PALESTRICA OF THE THIRD MILLENNIUM
CIVILIZATION AND SPORT

PALESTRICA MILENIULUI III
CIVILIZAŢIE ŞI SPORT

A quarterly of multidisciplinary study and research

A journal rated B+ by CNCS (Romanian National Research Council) since 2007,
certified by CMR (Romanian College of Physicians) since 2003
and CFR (College of Pharmacists of Romania) since 2015

A journal with a multidisciplinary approach in the fields of biomedical science, health, physical exercise, social sciences applied to physical education and sports activities

A journal indexed in international databases:
EBSCO, Academic Search Complete, USA;
Index Copernicus, Journals Master List, Poland;
DOAJ (Directory of Open Access Journals), Sweden

2

Vol. 16, No. 2, April-June 2015

Palestrica of the third millennium – Civilization and sport
Palestrica Mileniului III – Civilizaţie şi Sport
Vol. 16, no. 2, April-June 2015

Editorial Board
Comitetul editorial

Editorial Office of the Journal of
„Palestrica of the Third Millennium”
Civilization and Sport
Street: Clinicilor no. 1
400006, Cluj-Napoca
Telephone: 0264-598575
E-mail: palestrica@gmail.com

pISSN 1582-1943
eISSN 2247-7322
ISSN-L 1582-1943
www.pm3.ro

Contents

Cuprins

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 95–96

EDITORIAL

Contributions to the development of school sports in rural areas
Contribuţii la dezvoltarea sportului şcolar din mediul rural

Traian Bocu
"Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca
Editor-in-Chief of the Palestrica Mileniului III journal
Vice-President of the Romanian Medical Society of Physical Education and Sport
traian_bocu@yahoo.com

Few people know that Romania has 2854 communes including 12951 villages. Of these communes, 75 are on the territory of Cluj county, with a total of 356 villages (1). According to the 2011 census, Cluj county ranks third regarding the number of population, which follows the general decreasing trend. The top 6 counties with a stable population number, except for Bucharest Municipality (1.883 millions), are Iaşi (772,300), Prahova (762,900), Cluj (691,100), Constanţa (684,100), Timiş (683,500) and Dolj (660,500 people) (2).

As it is known, a large part of the population in Romania and Cluj county still lives in rural areas. Regarding the ratio between those who live in rural and urban environment, the balance shifts in favor of the latter, which represent 54% of all stable population.

Providing health care services is crucial for the population, including in rural areas. Health is also promoted and maintained by the practice of physical activities. Because physical activities included in the education curricula are insufficient, we agree with the policy of the Cluj County School Inspectorate to organize a number of events consisting of winter, spring and autumn competitions scheduled on weekends, for the middle school level (cross country skiing and cross country running). The aim of these events is to attract the participation of large numbers of pupils from rural areas in these extracurricular activities. For organizational reasons and for facilitation of attendance, the cross country events are held by county areas (at least two), in communes with higher numbers of school children, with stronger middle schools, with the support of the Cluj County School Inspectorate and of the Cluj County Authority for Sport and Youth, of the Local and County Council, as well as of the school management in the organizing locality, without restricting the participation of pupils from other county areas. Cross country skiing competitions are organized in larger communes, which are situated at altitudes over 600 m, up to 1000 m, where snow persists longer during the year. Alpine skiing competitions and Snow Festivals are usually held in the Băişoara mountain resort, at over 1400 m altitude.

In our opinion, the most indicated modality for organizing such sports activities is the workshop. As part of this form of organization, theoretical aspects related to the topic of the workshop can also be approached, provided these are kept within a time frame of 30-50 minutes. A second condition is that the theoretical presentation in front of the participants must be attractive and with application to the organized event. It has been found that some technical and tactical clarifications, as well as information related to the dosing of physical activity during cross country skiing and running races would be necessary. Some notions of how to manage stress/emotions before and during the race would also be of interest. The approached topics can also target the group of specialists, leaders of athletes from the participating localities.

All these sports events included in the competition calendar should be turned into projects with objectives and adequate activities for achieving these objectives. For each objective, there should be at least two activities. The sum of values for all activities allowing the achievement of the objectives of an event on the annual calendar corresponds to the structure of the budget required for the implementation of these projects in the territory. These projects should be designed and submitted within the deadline to the main organizing institution and to the partner institutions, so that all expenses necessary for the organization of the events can be estimated in the partners' budget.

* * *

Puţină lume ştie că România are 2854 comune, formate din 12951 sate. Din aceste comune, 75 sunt pe raza judeţului Cluj, cu un număr de 356 de sate (1). Conform recensământului din 2011, judeţul Cluj se situează pe locul 3 în ţară ca număr al populaţiei, în scădere conform trendului general. Primele 6 judeţe, cu excepţia Municipiului Bucureşti (1,883 milioane), ca număr de populaţie stabilă sunt Iaşi (772.300), Prahova (762.900), Cluj (691.100), Constanţa (684.100), Timiş (683.500) şi Dolj (660.500 persoane) (2).

După cum se constată, o mare parte a populaţiei din România, respectiv judeţul Cluj, trăieşte încă în mediul

rural. În privinţa raportului dintre cei care locuiesc la ţară şi cei care trăiesc la oraş, balanţa înclină în favoarea celor din urmă, care reprezintă 54% din totalul populaţiei stabile.

Asigurarea serviciilor de sănătate reprezintă o problemă primordială pentru populaţie, implicit pentru populaţia rurală. Sănătatea se promovează şi se menţine şi prin practicarea activităţilor fizice. Deoarece activităţile fizice cuprinse în planurile de învăţământ sunt insuficiente, suntem de acord cu politica Inspectoratului Şcolar Judeţean Cluj de a organiza o seamă de activităţi concretizate într-o succesiune de competiţii de iarnă, de primăvară şi de toamnă, programate la sfârşit de săptămână, pe palierul şcolilor generale (schi fond şi crosuri). Scopul acestor activităţi este angrenarea unui număr cât mai mare de elevi din mediul rural în aceste activităţi extracurriculare. Pentru operativitate şi simplificarea deplasării, crosurile se desfăşoară pe zone ale judeţului (minimum două), în comune cu populaţie şcolară mai numeroasă, cu şcoli generale mai puternice, cu implicarea Inspectoratului Şcolar Judeţean şi Direcţiei pentru Sport şi Tineret a Judeţului, Consiliului local şi Consiliului Judeţean, precum şi a conducerii şcolii din localitatea organizatoare, dar fără a îngrădi participarea elevilor din orice altă zonă a judeţului. Concursurile de schi fond se desfăşoară în comune mai mari, care sunt situate la peste 600 m altitudine, până al 1000 m, acolo unde zăpada rezistă ceva mai mult în timpul anului. Concursurile de schi alpin şi Serbările zăpezii se desfăşoară de obicei în staţiunea Băişoara, la peste 1400 m altitudine.

În opinia noastră, modalitatea cea mai indicată de organizare a unor astfel de activităţi sportive este workshopul. În cadrul acestei forme de organizare a unor manifestări sportive pot fi abordate şi aspecte teoretice legate de tematica workshopului, cu condiţia ca acestea să nu depăşească 30-50 minute. A doua condiţie este ca prezentarea teoretică făcută în faţa participanţilor să fie atractivă şi aplicată pe evenimentul organizat. S-a constatat că ar fi necesare unele precizări tehnice, tactice şi de dozare a efortului fizic în timpul curselor de schi fond şi cros. De asemenea, ar fi de interes noţiuni de gestionare a stresului/emoţiilor înainte şi în timpul competiţiilor. Tematica poate ţinti şi grupul de specialişti, conducători ai delegaţiilor de sportivi din localităţile participante.

Toate aceste evenimente sportive cuprinse în calendarul competiţional trebuie transformate în proiecte, cu obiective şi activităţi corespunzătoare îndeplinirii acestor obiective. Fiecărui obiectiv trebuie să-i corespundă minimum două activităţi de realizare a acestuia. Fiecărei activităţi de realizare trebuie să îi corespundă o anumită valoare. Suma valorilor pentru ansamblul activităţilor de realizare a obiectivelor unui eveniment din cadrul calendarului anual corespunde valoric cu structura bugetului necesar aplicării în teritoriu a acestor proiecte. Aceste proiecte trebuie concepute şi depuse în timp util la instituţia organizator principal şi instituţiile partenere, pentru ca toate cheltuielile necesare organizării evenimentelor să fie prevăzute în bugetele partenerilor.

References

(1) https://ro.wikipedia.org/wiki/List%C4%83_de_comune_din_jude%C8%9Bul_Cluj
(2) http://economie.hotnews.ro/stiri-finante_banci-15122357-recensamantul-populatiei.htm

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 97–101

ORIGINAL STUDIES
ARTICOLE ORIGINALE

Q10 coenzyme supplementation effect on heart weight in dysmetabolism and exercise (Note I)

Efectul suplimentării de CoQ10 asupra greutăţii inimii în condiţii de dismetabolism şi efort fizic (Nota I)

Bogdan Augustin Chiş [1], Natalia Giurgea [2], Remus Moldovan [2], Adriana Mureşan [2]
[1] *2nd Medical Clinic, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca*
[2] *Physiology Department, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca*

Abstract

Background. The paradoxical effect of exercise as a pro-oxidant at high intensities over short durations and as an anti-oxidant at moderate intensities over prolonged periods, as well as the influence of nutritional or non-nutritional antioxidant administration on the oxidant-antioxidant balance under exercise conditions are now known.

Aims. The beneficial effect of coenzyme Q10 (CoQ10) as a non-nutritional antioxidant on exercise capacity, its role in weight normalization and cardiovascular protection led us to study experimentally the effect of CoQ10 supplementation on body and heart weight in animals trained to exercise that were given a high calorie diet to achieve dysmetabolic syndrome.

Methods. The experiment was conducted on 12 groups (n = 10 animals/group) of adult male Wistar rats, with three types of food: four groups received a standard diet, four groups were fed a high-carbohydrate diet, four groups a high-fat diet; 6 groups were supplemented with CoQ10. 6 groups were subjected to daily physical exercise (by the swimming test) for 28 days, 60 minutes a day, the other 6 groups being sedentary. At the end of the experiment, the animals were sacrificed, and the body and heart weight was measured. Statistical analysis was performed using SPSS 20 and Excel 2010.

Results. The average daily weight gain was lower in the exercise trained groups, significantly in the groups supplemented with CoQ10. The relative weight of the heart was lower in the groups supplemented with CoQ10.

Conclusions. A normal calorie diet with additional CoQ10 limits weight gain in both sedentary and trained animals. A high calorie diet supplemented with CoQ10 leads to lower weight gain and limits cardiac hypertrophy both in trained and sedentary animals.

Keywords: exercise, dysmetabolism, weight, heart.

Rezumat

Premize. În prezent este binecunoscut efectul paradoxal al efortului fizic-prooxidant la intensităţi mari şi durată scurtă şi antioxidant la intensităţi moderate şi durată prelungită şi influenţa administrării unor antioxidanţi nutriţionali sau nenutriţionali asupra balanţei oxidanţi-antioxidanţi în condiţii de efort.

Obiective. Rolul benefic al coenzimei Q10 (CoQ10), ca antioxidant nenutriţional asupra capacităţii de efort, în normalizarea nivelului ponderal şi în prevenirea şi protecţia cardiovasculară, ne-a determinat să studiem experimental efectul suplimentării de CoQ10 asupra greutăţii organismului şi inimii la animale antrenate la efort, la care s-a administrat o dietă hipercalorică pentru obţinerea sindromului dismetabolic.

Metode. Experimentul s-a desfăşurat pe 12 loturi (n=10 animale/lot) şobolani rasa Wistar masculi adulţi, cu trei tipuri de alimentaţie: patru loturi cu alimentaţie standard, patru loturi cu alimentaţie hiperglucidică, patru loturi cu alimentaţie hiperlipidică; 6 loturi au fost suplimentate cu CoQ10. 6 loturi au fost supuse efortului fizic zilnic (prin proba de înot) timp de 28 zile, 60 minute pe zi, celelelte 6 loturi fiind sedentare. La sfârşitul experimentului, animalele au fost sacrificate, s-au măsurat greutatea corporală şi greutatea inimii. Analiza statistică a fost făcută utilizând programele SPSS 20 şi Excel 2010.

Rezultate. Câştigul ponderal mediu zilnic a fost mai redus la loturile antrenate, semnificativ la loturile suplimentate cu CoQ10. Greutatea relativă a inimii a fost mai scăzută la loturile suplimentate cu CoQ10.

Concluzii. O dieta normocalorică cu suplimentare de CoQ10 determină limitarea câştigului ponderal, atât la animalele sedentare, cât şi antrenate. O dietă hipercalorică şi suplimentare de CoQ10 duce la limitarea câştigului ponderal şi la limitarea hipertrofiei cardiace la animalele sedentare şi antrenate.

Cuvinte cheie: efort fizic, dismetabolism, greutate, inimă.

Received: 2015, April 25; *Accepted for publication:* 2015, May 25;
Address for correspondence: "Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca, 2nd Medical Clinic, 400006, 2nd-4th Clinicilor Street, Romania
E-mail: bogdan_a_chis@yahoo.com, chis.augustin@umfcluj.ro
Corresponding author: Bogdan Augustin Chis

Introduction

The paradoxical effect of exercise as a pro-oxidant at high intensities over short exercise and as an antioxidant at moderate intensities over long periods, as well as the influence of nutritional or non-nutritional antioxidant administration on the oxidant-antioxidant balance in effort are now known.

Macroscopic changes are often the starting point for some conclusions, but accompanied by histopathological studies they can lead to complex results of body responses. Anthropometry (weight, volume, length) was among the first studied, as access to these values was relatively easy, even before the development of laboratory medicine. Value standardization was a priority for research on human subjects as well as on animals. Simple experimental model studies have been conducted since the 19th century, with the focus of research on different food types (e.g. Mediterranean diet). Supplementation of certain specific items (carbohydrates, food subgroups) was used in simple standard diets, and body weight variations were observed (Palmisciano et al., 2015). Difficulties were encountered when classifying risk factors for some diseases; statistical research was limited and very few studies on large groups were available. The body mass index is still studied due to the increased prevalence of obesity, and obesity animal models induced genetically, by streptozotocin, etc. are used to study diabetes, obesity, in an attempt to find a predictive factor in adulthood (Leibowitz et al., 2007).

CoQ10 is a fat-soluble benzoquinone, involved in all cell breathing, especially in mitochondria, supporting energy generation by the production of ATP in mitochondria (Crane et al., 1989; Mataix J et al., 1997). It is stored in the heart, kidney, liver; the most important quantities in the animal kingdom are found in cattle (Aberg et al., 1992). Absorption takes place in the small intestine within maximum 4 hours postprandially (Bhagavan et al., 2006). There are researchers who maintain its indispensability in the human body, and the absence of CoQ10 can result in cell apoptosis or death of the whole body by blockage of the mitochondrial respiratory chain (Folkers et al., 1991). It is involved in the regeneration of other antioxidants (vitamin E) (Comes, 2001), cardiovascular protection (local anti-inflammatory effect, reduction of LDL-cholesterol, anti-atherogenic role, atherosclerotic plaque stabilization, ischemia-reperfusion injury prevention by maintaining ATP supplies, post-infarction ventricular dysfunction prevention) (Singh et al., 2003), thyroid hormone regulation (Mancini et al., 2005), increase of immunity (Bliynakov & Hunt, 1998; Lieberman & Bruning, 2005), mitochondrial membrane stabilization (Ciocoi-Pop & Tache, 2007).

Hypothesis

While the effects of CoQ10 supplementation on body weight and on exercise capacity are known, its myocardial protective effect, in reducing cardiac hypertrophy induced by exercise, particularly in metabolic syndrome, is not well known.

Objectives

The beneficial influence of CoQ10 as a non-nutritional antioxidant on exercise capacity, weight normalization, cardiovascular prevention and protection led us to study experimentally the effect of CoQ10 supplementation on body and heart weight in exercise trained animals receiving a high-calorie diet to induce metabolic syndrome.

Materials and methods

The study was approved by the Bioethics Committee of the University of Medicine and Pharmacy Cluj-Napoca No 401/5.10.2011. The research was conducted on 120 adult Wistar rats from the biobase of UMPh Cluj-Napoca. The animals were acclimated one week prior to the experiment to adequate vivarium conditions.

Research protocol

a) Period and place of the research

The experiment lasted for 28 days, during October-November 2012, and was carried out in the experimental laboratory of the Department of Physiology of UMPh Cluj-Napoca.

b) Subjects and groups

The following groups were included in the study:

Group I - control, standard diet, sedentary;

Group II - control, standard diet, exercise trained;

Group III - high-carbohydrate diet, sedentary;

Group IV - high-carbohydrate diet, exercise trained;

Group V - high-fat diet, sedentary;

Group VI - high-fat diet, exercise trained.

Group VII - control, standard diet, CoQ10 gavage, sedentary;

Group VIII - control, standard diet, CoQ10 gavage, exercise trained;

Group IX - high-carbohydrate diet, CoQ10 gavage, sedentary;

Group X - high-carbohydrate diet, CoQ10 gavage, exercise trained;

Group XI - high-fat diet, CoQ10 gavage, sedentary;

Group XII - high-fat diet, CoQ10 gavage, exercise trained.

At the end, all animals were euthanized and the heart was harvested according to goRENI standards (1).

The animals received three types of diet: standard diet (20 g/day/rat granulated fodder, Cantacuzino Institute, Bucharest, oropharyngeal gavage of 2 ml saline to simulate the stress of gavage), high-carbohydrate diet (standard diet + oropharyngeal gavage of 2 ml glucose syrup 75%) or high-fat diet (standard diet + gavage of 2 ml pork lard). The animals received water ad libitum. CoQ10 supplementation was done by oropharyngeal gavage of pure CoQ10 in suspension, delivered by Alevia Romania, at a dose of 100 mg/kg body weight.

c) Applied tests

The aerobic capacity was determined based on 60 minutes swimming in a pool with an open area larger than 1000 cm ^{2}, 40 cm water depth, to avoid interference of the animals with each other (Kregel, 2006).

The measured indicators were: absolute animal weight expressed in grams at the beginning (T0) and at the end of the experiment (T28), using a Kern Germany KB650-2NM electronic balance, relative heart weight in grams/100 g body weight using an electronic laboratory scale to 2 decimal places (MH-Series Pocket Scale/MH-100 100

g/0.01g).

d) Statistical processing

Statistical data analysis was performed using the SPSS.20 and Excel 2010 tools. Parametric tests were used for groups which were supposed to have a normal distribution, and those with a non-normal distribution were taken into account with their logarithmic values. Student t test, ANOVA, Pearson correlation coefficient were calculated.

Results

a) Average daily weight gain variation

We can see in Table I that both CoQ10 administration and physical exercise led to a decrease in daily weight gain compared to groups that did not receive CoQ10 and sedentary groups, respectively. Statistical tests (Student t) confirmed the statistical significance of this finding, p values being well below the 0.05 value considered statistically significant. The groups considered were the CoQ10 supplementation groups (VII-XII) compared to all groups without CoQ10 supplementation (I-VI), and the exercise trained groups (II, IV, VI, VIII, X, XII) compared to sedentary groups (I, III, V, VII, IX, XI). The greatest weight gain was obtained for sedentary groups and among them, those that had a high-calorie, high-fat diet, without being supplemented with CoQ10 (2.27 ± 0.87 g/day). Opposed to these were the animals in groups that were exercise trained or supplemented with CoQ10. The lowest weight gain was obtained in group VIII (exercise, standard diet with CoQ10 supplementation), 0.79 ± 0.29 g/day.

Table II shows that exercise lowers daily weight gain, CoQ10 also leads to its limitation, while a diet rich in calories leads to a higher average daily weight gain. The groups supplemented with CoQ10 had a lower weight gain than unsupplemented groups in all types of diet. The lowest values were obtained for the trained and CoQ10 supplemented groups.

In the standard diet, physical exercise groups (group II) had limited weight gain compared with sedentary groups (group I) (1.65 ± 0.31 g/day vs 1.25 ± 0.38 g/day). The administration of CoQ10 without exercise resulted in a more significant reduction (1.01 ± 0.16 g/day). In trained and CoQ10 supplemented groups, the decline was most significant (0.79 ± 0.29 g/day). Exercise in CoQ10 supplemented groups resulted in a borderline significant decrease ($p = 0.054$) (1.01 ± 0.16 vs 0.79 ± 0.29 g/day). The effect of CoQ10 supplementation is thus shown to limit weight gain and consequently to combat obesity. Exercise is effective only in the absence of CoQ10 supplementation, its effect being reduced by CoQ10 supplementation.

In the high-carbohydrate diet, the benefits are significant both for physical training (group IV) and CoQ10 supplementation (group IX).The effect is substantially the same in the sedentary groups (2.03 ± 0.27 to 1.32 ± 0.4 g/day in exercise training vs a decrease of 1.34 ± 0.17 g/day in the case of CoQ10 supplementation). CoQ10 administration in the trained group did not result in a significant decrease (1.32 ± 0.4 g/day to 1.02 ± 0.22 g/day, $p = 0.055$). Exercise training in the groups supplemented with CoQ10 had, however, an additional effect of decreasing weight gain (1.34 ± 0.17 vs 1.02 ± 0.22 g/day, $p = 0.003$).

In the high-fat diet, both CoQ10 supplementation and physical training led to a limitation of daily weight gain (2.27 ± 0.87 g/day in the sedentary group vs 1.57 ± 0.53 g/day in the trained group vs 1 47 ± 0.24 g/day in the CoQ10 supplemented group). Both CoQ10 administration in the trained group and exercise in the supplemented group, although leading to a greater reduction (up to 1.33± 0.13 g/day), were insignificant.

b) Relative heart weight

CoQ10 administration led to a relative weight loss both in sedentary and trained groups. The effect was more expressed in the latter.

Relative heart weight (Tables III, IV) changed both in the case of CoQ10 administration and physical exercise. There was an increase of 11.45% ($p < 0.001$) for exercise, while CoQ10 supplementation led to a 6.05% decrease, $p = 0.003$.

Table I

Comparison of average daily weight gain (in grams) by CoQ10 supplementation or physical activity.

Group A	Group B	Group A		Group B		Student t test
		Average	Standard deviation	Average	Standard deviation	
Without CoQ10	With CoQ10	1.689286	0.608665	1.166071	0.31327	<0.001
Sedentary	Trained	1.633929	0.585356	1.221429	0.42266	<0.001

Table II

Comparison of average daily weight gain (in grams) by diet, physical activity and CoQ10 supplementation.

Group A	Group B	Group A		Group B		Student t test
		Average	Standard deviation	Average	Standard deviation	
I	II	1.6536	0.31857	1.2571	0.38568	0.022
I	VII	1.6536	0.31857	1.0179	0.16603	<0.001
II	VIII	1.2571	0.38568	0.7964	0.29693	0.008
VII	VIII	1.0179	0.16603	0.7964	0.29693	0.054
III	IV	2.0393	0.27585	1.3286	0.40329	<0.001
III	IX	2.0393	0.27585	1.3393	0.17107	<0.001
IV	X	1.3286	0.40329	1.0286	0.22449	0.055
IX	X	1.3393	0.17107	1.0286	0.22449	0.003
V	VI	2.2786	0.87268	1.5786	0.53764	0.045
V	XI	2.2786	0.87268	1.475	0.24342	0.012
VI	XII	1.5786	0.53764	1.3393	0.13703	0.189
XI	XII	1.475	0.24342	1.3393	0.13703	0.142

Table III

Comparing relative heart weight (in grams/100 g body weight) based on CoQ10 supplementation or physical activity.

Group A	Group B	Group A		Group B		Student t test
		Average	Standard deviation	Average	Standard deviation	
Without CoQ10	With CoQ10	3.998329	0.394618	3.756755	0.466536	0.003
Sedentary	Trained	3.667623	0.347595	4.087461	0.438867	<0.001

Table IV

Comparison of relative heart weight (in grams/100 g body weight) depending on diet, physical exercise and CoQ10 supplementation.

Group A	Group B	Group A		Group B		Student t test
		Average	Standard deviation	Average	Standard deviation	
I	II	3.560629	0.172831	4.123771	0.268202	<0.001
I	VII	3.560629	0.172831	3.530799	0.577955	0.877
II	VIII	4.123771	0.268202	3.763843	0.731065	0.161
VII	VIII	3.530799	0.577955	3.763843	0.731065	0.439
III	IV	3.804417	0.137946	4.457563	0.312734	<0.001
III	IX	3.804417	0.137946	3.628009	0.316295	0.123
IV	X	4.457563	0.312734	3.890994	0.229686	<0.001
IX	X	3.628009	0.316295	3.890994	0.229686	0.047
V	VI	3.769030	0.303013	4.274563	0.246447	0.001
V	XI	3.769030	0.303013	3.712854	0.384071	0.721
VI	XII	4.274563	0.246447	4.014034	0.295205	0.046
XI	XII	3.712854	0.384071	4.014034	0.295205	0.065

In the standard diet, physical exercise led to a significant heart hypertrophy (a growth of 15.8%, $p < 0.001$). Exercise training and CoQ10 supplementation caused a lower growth, thus limiting the exercise-induced myocardial hypertrophy (a growth of 6.6%, $p = 0.439$). Also, CoQ10 supplementation in the exercise trained groups led to a decrease in the relative weight of the heart (a decrease of 8.7%, $p = 0.161$), but with no statistical impact.

In the high-carbohydrate diet, myocardial hypertrophy was important in the exercise trained group without CoQ10 supplementation (an increase of 17.16%, $p << 0.001$). Exercise induced hypertrophy in CoQ10 supplementation (group VIII), although statistically significant ($p = 0.047$), was less important than in the groups without CoQ10 supplementation (7.22%) (group IV). Antioxidant administration limits such exercise-induced myocardial hypertrophy.

In the high-fat diet, physical exercise induced myocardial hypertrophy (growth of 13.39%, $p < 0.001$) (group VI). CoQ10 supplementation (group XII) led to statistically insignificant hypertrophy (a growth of 8.1%, $p = 0.065$). CoQ10 supplementation in the exercise trained groups led to a decrease of 6.08% ($p = 0.046$) in relative heart weight.

Discussions

Average daily weight gain

ORAC (Oxygen Radical Absorbance Capacity) scale is a scale used alongside Trolox equivalents to measure the antioxidant capacity of biological elements (especially food). On that scale, the hypothesis has been discussed that a diet with a high ORAC (30,000 units) along with physical exercise may be beneficial in the management of obesity. Obesity is correlated with oxidative stress, which depends on general inflammation and atherosclerosis, high levels of TNF and IL-6 being found in obese patients (Higdon & Frei, 2003). Antioxidant supplementation, by lowering the antioxidant and inflammatory level, can improve intracellular mitochondrial energy use, speeding up metabolism. Weight reduction is also accompanied by a decrease of pro-inflammatory status (Ziccardi et al., 2002). The result supports the idea that a healthy diet is essential in maintaining optimum weight.

Relative heart weight

Myocardial hypertrophy is recognized as a result of physical training. Concentric left ventricular hypertrophy is a necessary consequence of increased cardiac output and increased afterload due to the contraction of skeletal muscles. Influencing this by various factors is an important study direction in sports medicine (Takemoto et al., 2001) (Choudhary et al., 2006), as this can spiral out of control in endurance athletes (obstructive hypertrophic cardiomyopathy, dilated cardiomyopathy, ischemic heart disease). Improving ventricular hypertrophy may be related to improving the local energy chain, with increased contractile force for the same myocardial perfusion, with increased exercise capacity. Some studies have shown that the combination of antioxidants with a high calorie diet is beneficial in reducing hypertrophy and slowing the development of heart failure (Chess et al., 2008). Exercise may influence the oxidant-antioxidant balance locally, by activating proteins that regulate gene transcription involved in encoding antioxidant activity (Muthusamy et al., 2012). It can be seen that CoQ10 supplementation has a favorable effect on exercise capacity, weight normalization and prevention of adverse effects of exercise on the heart.

Conclusions

1. CoQ10 supplementation leads to a decrease in average daily weight gain in both sedentary and exercise trained animals subjected to a normal calorie diet.
2. In sedentary animals with a high calorie diet, CoQ10 supplementation leads to the limitation of average daily weight gain.
3. In trained animals, a high calorie diet with CoQ10 supplementation reduces heart weight.

Conflicts of interest

There are no conflicts of interest.

Acknowledgments

This article uses partial results of the first author's personal research as part of his doctoral studies.

References

Aberg F, Appelkvist EL, Dallner G, Ernster L. Distribution and redox state of ubiquinones in rat and human tissues. Archives of biochemistry and biophysics. 1992;295(2):230-234.

Bhagavan HN, Chopra RK. Coenzyme Q_{10}: Absorption, tissue uptake, metabolism and pharmacokinetics. Free Radical Research 2006;40(5):445-453.

Bliznakov EG, Hunt GL. Nutrientul miracol-Coenzima Q10. Ed. Elit Comntator, Iaşi, 1998.

Chess DJ, Xu W, Khairralah R, O'Shea KM, Kop WJ. The antioxidant tempol attenuates pressure overload-induced cardiac hypertrophy and contractile dysfunction in mice fed a high-fructose diet. Am J Physiol Heart Circ Physiol, 2008;295(6):H2223-H2230. doi: 10.1152/ajpheart.00563.2008.

Choudhary R, Mishra KP, Subramanyam C. Preention of isoproterenol induced cardiac hypertrophy by eugenol, an antioxidant. Indian J Clin Biochem. 2006;21(2):107-113. doi: 10.1007/BF02912923

Ciocoi-Pop DR, Tache S. Coenzima Q10 şi capacitatea de efort. Palestrica Mileniului III-Civilizaţie şi sport, 2007, 30(4):235-241.

Comes L. Antioxidanţii în bolile cardiovasculare. În Dejica D (sub red.) Antioxidanţi şi terapie antioxidantă. Ed. Casa Cărţii de Stiinţă, Cluj-Napoca, 2001, cap 13, 420-423.

Crane FL, Hatefi Y, Lester RI. Isolation of a quinone from beef heart mitochondria. Biochim Biophys Acta, 1989;1000:362-363.

Folkers K, Yamagami T, Littarru GP. Eds. Biomedical and Clinical Aspects of Coenzyme Q. Vol. 6, Elsevier, Amsterdam, 1991,1-555.

Higdon J, Frei B. Obesity and oxidative stress. A direct link to CVD? Arterioscler, Thromb Vasc Biol. 2003;23(3):365-367. doi: 10.1161/01.ATV.0000063608.43095.E2.

Kregel KC. Exercise protocols using rats and mice In: American phisiology Society: Resource book for the design of animal exercise protocols. USA, Feb 2006, 23-57.

Leibowitz KL, Chang G-Q, Pamy PS, Hill JO, Gayles EC et al. Weight gain model in prepubertal rats: prediction and phenotyping of obesity-prone animals at normal body weight. Int J Obes (Lond) 2007;31(8):1210-1221.

Lieberman S, Bruning N. Biblia vitaminelor şi a mineralelor esenţiale. Ed Paralela 45. 2005, 255-268.

Mancini A, Bianchi A, Fusco A et al. Coenzyme Q10 evaluation in pituitary-adrenal axis disease: preliminary data. Biofactors 2005,25:197-199.

Mataix J, Manas M, Quiles J et al. Coenzyme Q content depends upon oxidative stress and dietary fat unsaturation. Mol Aspects Med. 1997. 18 suppl:S129-135.

Muthusamy VR, Kannan S, Sadhaasivam K, Gounder SS, Davidson CJ et al. Acute exercise stress activates Nrf2/ARE signaling and promotes antioxidant mechanisms in the myocardium. Free Radic Biol Med. 2012;52(2):366-376. doi: 10.1016/j.freeradbiomed.2011.10.440.

Palmisciano Bedê T, Pascoal AC, Hauaji Facó L, De Salvo Castro E, Mattoso Vel et al. Effect of the intake of liquids rich in polyphenols on blood pressure and fat liver deposition in rats submited to high-fat diet. Nutricion Hospitalaria. 2015;31(6):2539-2545.

Singh RB, Neki NS, Kartikey K, Pella D, Kumar A et al. Effect of coenzyme Q10 on risk of atherosclerosis in patients with recent myocardial infarction. Mol Cell Biochem. 2003;246(1-2):75-82.

Takemoto M, Node K, Nakagami H, Liao Y, Grimm M et al. Statins as antioxidant therapy for preventing cardiac myocyte hypertrophy. J Clin Invest. 2001;108(10):1429-1437.

Ziccardi P, Nappo F, Giugliano G, Esposito K, Marfella R, Cioffi M, D'Andrea F, Molinari AM, Giugliano D. Reduction of inflammatory cytokine concentrations and improvement of endothelial functions in obese women after weight loss over one year. Circulation. 2002;105(7):804-809.

Websites

(1) Revised guides for organ sampling and trimming in rats and mice. Available at: http://reni.item.fraunhofer.de/reni/trimming/index.php Accesed on 1st of april 2015

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 102–106

Q10 coenzyme supplementation effect on relative liver weight and density in dysmetabolism and exercise (Note II)

Efectul suplimentării de coenzimă Q10 asupra greutăţii ficatului în condiţii de dismetabolism şi efort fizic (Nota II)

Bogdan Augustin Chiş [1], Natalia Giurgea [2], Remus Moldovan [2], Adriana Mureşan [2]
[1] 2nd Medical Clinic, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca
[2] Physiology Department, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca

Abstract

Background. Data obtained on the administration of coenzyme Q10 (CoQ10) on heart weight in trained animals led us to study the effects of administration on relative weight and density of the liver.

Aims. We aimed to study the changes induced in liver weight and volume by exercise and CoQ10 supplementation in experimental dysmetabolic conditions.

Methods. The experiment was conducted on 12 groups (n = 10 animals/group) of adult male Wistar rats, with three types of diet: standard, high-carbohydrate, and high-fat, supplemented or not with CoQ10, sedentary or exercise trained. 6 groups were subjected to daily exercise (swimming) for one hour per day for 4 weeks, the other half were sedentary. At the end of the experiment, the animals were sacrificed, body weight and liver weight and volume were measured. Statistical analysis was performed using the SPSS 20 and Excel 2010 tools.

Results. The relative liver weight was significantly influenced only by physical training. Liver density was influenced by both physical training and CoQ10 supplementation.

Conclusions. In trained animals with a high calorie diet, a reduction of relative liver weight was observed, regardless of CoQ10 supplementation. Sedentary animals with CoQ10 supplementation had an increased liver density, regardless of the type of diet.

Keywords: exercise, dysmetabolism, relative liver weight, liver density

Rezumat

Premize. Datele obţinute experimental privind administrarea de coenzimă Q10 (CoQ10) asupra greutăţii inimii la animalele antrenate la efort, ne-au determinat să studiem şi efectul administrării acesteia asupra greutăţii relative şi densităţii ficatului.

Obiective. Ne-am propus să studiem modificările greutăţii şi volumului ficatului induse de efortul fizic şi de suplimentarea cu CoQ10 în condiţiile dismetabolismului experimental.

Metode. Experimentul s-a desfăşurat pe 12 loturi (n=10 animale/lot) de şobolani adulţi masculi rasa Wistar, cu trei tipuri de alimentaţie: standard, hiperglucidică şi hiperlipidică, in condiţii de suplimentare sau nu cu CoQ10, la animale sedentare sau antrenate la efort. 6 loturi au fost supuse efortului fizic zilnic (înot) timp de o oră zilnic pentru 4 săptămâni, cealaltă jumătate fiind sedentară. La sfârşitul experimentului, animalele au fost sacrificate, s-au măsurat masa corporală, greutatea hepatică, volumul hepatic. Analiza statistică a fost făcută utilizând programele SPSS 20 şi Excel 2010.

Rezultate. Greutatea relativă a ficatului a fost influenţată semnificativ doar de antrenamentul fizic. Densitatea hepatică a fost influenţată atât de antrenamentul fizic, cât şi de administrarea de CoQ10.

Concluzii. La animalele antrenate, cu dietă hipercalorică, s-a observat reducerea greutăţii relative a ficatului, indiferent de suplimentarea sau nu cu CoQ10. La animalele sedentare, suplimentarea de CoQ10 a dus la creşterea densităţii hepatice, indiferent de tipul de alimentaţie.

Cuvinte cheie: efort fizic, dismetabolism postprandial, greutate hepatică relativă, densitate hepatică.

Received: 2015, April 25; *Accepted for publication:* 2015, May 25;
Address for correspondence: "Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca, 2nd Medical Clinic, 400006, 2nd-4th Clinicilor Street, Romania
E-mail: bogdan_a_chis@yahoo.com, chis.augustin@umfcluj.ro
Corresponding author: Bogdan Augustin Chis

Introduction

Morphological changes are a most faithful witness to extrinsic aggressions on the body. Macroscopic changes are often preceded by microscopic ones, as they are preceded by molecular changes. The physical parameters of weight, volume, length were among the first studied, as their measurement is accessible to many laboratories. The development of laboratory medicine led to their high precision measurement, recent studies trying to standardize several parameters in animal species and humans. Although studies began to be conducted 200 years ago, the multitude of experimental parameters and conditions led to current studies in experimental models, adapted to current conditions. These investigate the effect of certain diets (Saraf Bank et al., 2015), different lifestyles (Bach et al., 2015) and supplementation with certain food constituents or toxic substances (Vitaglione et al., 2015; Tsirigoti et al, 2014).

Coenzyme Q10 (CoQ10) is a fat-soluble benzoquinone, whose major role is the production of ATP in the mitochondrial respiratory chain (Crane et al., 1989). The most important quantities have been found in the heart and liver, but its presence is felt in all animal cells, which could not function without it; its absence could even induce apoptosis (Aberg et al., 1992; Folkers et al., 1991). The level of fat solubility determines its absorbance in the small intestine (Bhagavan et al., 2006). In addition to the regeneration of other antioxidants (vitamin E) (Comes, 2001), it has roles in the cardiovascular system (local anti-inflammatory, reduction of LDL-cholesterol) (Singh et al., 2003; Bryce, 2013; Maidell, 1991).

Hypothesis

Experimental data obtained on the effect of CoQ10 on heart weight in physically trained animals subjected to a high-calorie diet to achieve metabolic syndrome and the role of the liver in CoQ10 synthesis, synthesis boosted by vitamin E and selenium, the importance of a balanced diet to ensure the necessary CoQ10 in the body led us to study the effect of CoQ10 supplementation on the relative weight and density of the liver.

Objectives

We experimentally studied the effect of CoQ10 supplementation on relative weight and density of the liver in trained animals, in whom metabolic syndrome was induced by high-calorie (high-carbohydrate and high-fat) diets.

Materials and methods

The study was approved by the Bioethics Committee of the University of Medicine and Pharmacy Cluj-Napoca No 401/5.10.2011. The research was conducted on 120 adult Wistar rats from the biobase of the Department of Physiology of UMPh Cluj-Napoca. The animals were acclimated one week prior to the experiment to adequate vivarium conditions.

Research protocol

a) Period and place of the research

The experiment lasted for 28 days, during October-November 2012, and was carried out in the experimental laboratory of the Department of Physiology of UMPh Cluj-Napoca.

b) Subjects and groups

The following groups were included in the study:

Group I - control, standard diet, sedentary;

Group II - control, standard diet, exercise trained;

Group III - high-carbohydrate diet, sedentary;

Group IV - high-carbohydrate diet, exercise trained;

Group V - high-fat diet, sedentary;

Group VI - high-fat diet, exercise trained.

Group VII - control, standard diet, CoQ10 gavage, sedentary;

Group VIII - control, standard diet, CoQ10 gavage, exercise trained;

Group IX - high-carbohydrate diet, CoQ10 gavage, sedentary;

Group X - high-carbohydrate diet, CoQ10 gavage, exercise trained;

Group XI - high-fat diet, CoQ10 gavage, sedentary;

Group XII - high-fat diet, CoQ10 gavage, exercise trained.

At the end, all animals were euthanized and the heart was harvested according to goRENI standards (1).

The animals received three types of diet: standard diet (20 g/day/rat granulated fodder, Cantacuzino Institute, Bucharest, oropharyngeal gavage of 2 ml saline to simulate the stress of gavage), high-carbohydrate diet (standard diet + oropharyngeal gavage of 2 ml glucose syrup 75%) or high-fat diet (standard diet + gavage of 2 ml pork lard). The animals received water ad libitum. CoQ10 supplementation was done by oropharyngeal gavage of pure CoQ10 in suspension, delivered by Alevia Romania, at a dose of 100 mg/kg body weight.

c) Applied tests

The aerobic capacity was determined based on 60 minutes swimming in a pool with an open area larger than 1000 cm^2, 40 cm water depth, to avoid interference of the animals with each other (Kregel, 2006).

The measured indicators were: absolute animal weight expressed in grams at the beginning (T0) and at the end of the experiment (T28), using a Kern Germany KB650-2NM electronic balance, relative liver weight in grams/100 g body weight using an electronic laboratory scale to 2 decimal places (MH-Series Pocket Scale/MH-100 100 g/0.01g).

d) Statistical processing

Statistical data analysis was performed using the SPSS.20 and Excel 2010 tools. Parametric tests were used for groups which were supposed to have a normal distribution, and those with a non-normal distribution were taken into account with their logarithmic values. Student t test, ANOVA, Pearson correlation coefficient were calculated.

Results

Relative liver weight

Table I shows a decrease in the relative weight of the liver both in the exercise trained and CoQ10 supplementation groups. Statistical significance was high in the trained group (a decrease of 7.71%, $p < 0.001$) compared to the CoQ10 supplemented group, where the magnitude of the

changes was of borderline significance (a decrease of 3.3%, p = 0.06) (Table I). The groups were considered sedentary and non-supplemented with CoQ10 (I, III, V), sedentary and supplemented with CoQ10 (VII, IX, XI) or trained without CoQ10 supplementation (II, IV, VI) or with CoQ10 supplementation (VIII, X, XII). There is a cumulative effect of exercise and CoQ10 supplementation on relative liver weight decrease, the groups trained and supplemented with CoQ10 having the lowest relative weight of the liver.

Table II shows an increase in relative liver weight with increased caloric intake. A decline was also observed when CoQ10 was administered. Sedentary groups had at the time of euthanasia a higher relative liver weight than the trained groups.

In the case of the standard diet (group I), the administration of CoQ10 (group VII) or exercise training (group II), although resulting in a decrease of relative weight, was not significant. The most important change was induced by administration of CoQ10 in the sedentary group (p = 0.076).

In the high-carbohydrate diet, exercise training only resulted in a significant decrease of relative liver weight. The changes were significant both for groups without CoQ10 supplementation (group IV vs group III, a 8.47% decrease, p = 0.036) and supplemented with Q10 (group X vs group IX, a 14.34% decrease, p = 0.025), where the most significant change was observed.

In the high-fat diet, exercise only had a statistically significant effect on relative liver weight, both for the groups without CoQ10 supplementation (group VI vs group V, a 7.26% decrease, p = 0.009) and in the case of CoQ10 supplementation (group XII vs group XI, a 5.75% change, p = 0.015). CoQ10 supplementation in sedentary animals did not lead to significant changes.

Liver density

Table III shows an increase of liver density both in the CQ10 supplemented and in the exercise trained groups. The most important changes occurred in the exercise trained groups supplemented with CoQ10.

Both exercise and CoQ10 supplementation resulted in significant liver density changes (an increase of 4.44%, p = 0.004 for exercise, an increase of 5.75%, p = 0.001 for CoQ10 supplementation).

In the standard diet, liver density was also significantly altered by the administration of CoQ10 in the sedentary group (group VII vs group I, an 8.62% increased density, p = 0.019). CoQ10 supplementation in the trained groups was also important, but of borderline significance (group VIII vs group II, a 5.97% increase, p = 0.058).

In the high-carbohydrate diet, there was an increase only in the sedentary group supplemented with CoQ10 (group IX vs group III, 7.02%, p = 0.013) and in the exercise trained group without CoQ10 supplementation (group IV vs group III, 22%, p = 0.006).

In the high-fat diet, liver density increased only in the sedentary group with CoQ10 supplementation (group XI vs group V, 7.02%, p = 0.013) or in the exercise trained group without CoQ10 (group VI vs group V, 6.22%, p = 0.006. CoQ10 supplementation in the trained groups did not induce significant changes (Table IV).

The analysis of the correlation between average daily weight gain and liver density showed a negative Pearson coefficient (-0.386) with a high statistical significance (p << 0.001). Thus, a greater weight gain is associated with decreased liver density.

Liver density is negatively correlated (Pearson coefficient = -0.204) with relative liver weight (p = 0.025). A high liver mass will be related to its low density.

The correlation between the relative weight of the liver and daily weight gain was significant (p = 0.017), the correlation is positive in this case. A greater weight gain will result in an increase of relative liver weight.

Discussions

Both CoQ10 administration and physical exercise decreased the relative weight of the liver. Statistical

Table I

Comparison of the effect of exercise or CoQ10 supplementation on relative liver weight (in grams liver/100 g body weight).

Group A	Group B	Group A		Group B		Student t test
		Average	Standard deviation	Average	Standard deviation	
Without CoQ10	With CoQ10	3.169748	0.265721	3.065261	0.333573	0.06
Sedentary	Trained	3.242730	0.282588	2.992278	0.275098	<0.001

Table II

Comparison of the relative liver weight (in grams liver/100 g body weight) depending on diet, physical training and CoQ10 supplementation.

Group A	Group B	Group A		Group B		Student t test
		Average	Standard deviation	Average	Standard deviation	
I	II	3.152082	0.096284	2.994298	0.301944	0.133
I	VII	3.152082	0.096284	3.012815	0.213548	0.076
II	VIII	2.994298	0.301944	2.860250	0.177023	0.242
VII	VIII	3.012815	0.213548	2.860250	0.177023	0.099
III	IV	3.295603	0.170015	3.016680	0.351265	0.036
III	IX	3.295603	0.170015	3.341573	0.495779	0.785
IV	X	3.016680	0.351265	2.862731	0.373326	0.355
IX	X	3.341573	0.495779	2.862731	0.373326	0.025
V	VI	3.403362	0.23965	3.156461	0.117000	0.009
V	XI	3.403362	0.23965	3.250947	0.161004	0.112
VI	XII	3.156461	0.117000	3.063248	0.151433	0.141
XI	XII	3.250947	0.161004	3.063248	0.151433	0.015

significance was high in the case of exercise training (a 7.71% decrease, $p < 0.001$) compared to CoQ10 supplementation, where the magnitude of the changes was of borderline significance (a 3.3% decrease, $p = 0.06$). Concerning liver density, both exercise and CoQ10 administration led to significant changes (a 4.44% increase, $p = 0.004$ in the case of exercise, a 5.75% increase, $p = 0.001$ in CoQ10 supplementation).

Standard diet

In the standard diet, administration of CoQ10 or physical exercise, though leading to a relative liver weight loss, was not significant. The most important change was induced by administration of CoQ10 to the sedentary group ($p = 0.076$). Hepatic density was significantly changed by administration of CoQ10 to the sedentary group (an 8.62% increased density, $p = 0.019$). CoQ10 supplementation in the trained groups was important, but of borderline significance (up to 5.97%, $p = 0.058$).

High-carbohydrate diet

In the high-carbohydrate diet, exercise training resulted in a significant decrease of relative liver weight. The changes were significant both for groups without CoQ10 (a decrease of 8.47%, $p = 0.036$) and for the groups supplemented with Q10 (a decrease of 14.34%, $p = 0.025$). Liver density increased only in sedentary groups with CoQ10 supplementation (7.02%, $p = 0.013$) and by physical training (6.22%, $p = 0.006$) without CoQ10. CoQ10 supplementation in the sedentary groups did not involve significant changes.

High-fat diet

In the high-fat diet, exercise training had a statistically significant effect on relative liver weight, both for the groups without CoQ10 (a decrease of 7.26%, $p = 0.009$) and in those supplemented with CoQ10 (5.75%, $p = 0.015$). The administration of CoQ10, unaccompanied by physical training, did not lead to significant changes. Hepatic density was influenced only in the sedentary groups, by CoQ10 administration (an increase of 7.76%, $p << 0,001$) and by physical training (an increase of 8.21%, $p = 0.002$). There is a slight difference in favor of exercise.

Correlation between weight gain, density and relative weight of the liver

There is a significant negative correlation between average daily weight gain and liver density. Thus, as daily weight gain increases, liver density decreases. Also, weight gain is positively correlated with relative liver weight increase. A more marked increase in weight gain is associated with a parallel increase in liver weight with the decrease of liver density. This change is consistent with the conclusion that an increased mass index is associated with an increased incidence and intensity of hepatic lipid load or the occurrence of hepatic steatosis. In this experiment, the increase in liver weight was also correlated with decreased liver density. Thus, in all groups, increased relative liver

Table III

Comparison of the effect of exercise or CoQ10 supplementation on liver density.

Group A	Group B	Group A		Group B		Student t test
		Average	Standard deviation	Average	Standard deviation	
Without CoQ10	With CoQ10	1.164105	0.078521	1.231191	0.110235	<0.001
Sedentary	Trained	1.171389	0.081670	1.223907	0.111952	0.004

Table IV

Comparison of liver density depending on diet, physical activity and CoQ10 supplementation.

Group A	Group B	Group A		Group B		Student t test
		Average	Standard deviation	Average	Standard deviation	
I	II	1.164260	0.098013	1.221144	0.088020	0.189
I	VII	1.164260	0.098013	1.259991	0.064010	0.019
II	VIII	1.221144	0.088020	1.294209	0.072963	0.058
VII	VIII	1.259991	0.064010	1.294209	0.072963	0.280
III	IV	1.124460	0.042699	1.194241	0.056358	0.006
III	IX	1.124460	0.042699	1.203956	0.080840	0.013
IV	X	1.194241	0.056358	1.238237	0.212031	0.534
IX	X	1.203956	0.080840	1.238237	0.212031	0.639
V	VI	1.095032	0.046097	1.185494	0.061323	0.002
V	XI	1.095032	0.046097	1.180633	0.023666	<0.001
VI	XII	1.185494	0.061323	1.210118	0.092956	0.493
XI	XII	1.180633	0.023666	1.210118	0.092956	0.344

Table V

Correlation of liver density, relative weight and weight gain.

The measured variable	Statistical test	Liver density	Average daily weight gain	Relative liver weight
Liver density	Pearson correlation	1	-.386**	-.204*
	Sig. (2-tailed)		.000	.025
Average daily weight gain	Pearson correlation	-.386**	1	.217*
	Sig. (2-tailed)	.000		.017
Relative liver weight	Pearson correlation	-.204*	.217*	1
	Sig. (2-tailed)	.025	.017	

** Correlation significant at the 0.01 level (2-tailed)

* Correlation significant at the 0.05 level (2-tailed)

weight can be seen as a consequence of hepatic steatosis.

CoQ10 supplementation has been shown to reduce oxidative stress and oxidative stress-related injuries in the liver (including hepatomegaly) in various animal models (Uboh et al., 2009; McNulty et al., 2008). Antioxidant supplementation has been shown to be useful in various types of hepatomegaly in humans (Stewart et al., 2007). The effect may be a consequence of the reduction of hepatic glutathione peroxidase activity and necroinflammatory activity associated with oxidative stress. It has been postulated that antioxidant supplementation may prevent liver ethanol related cirrhosis and hepatomegaly (steatosis) induced by a high-fat diet (Soylu et al., 2006). Thus, a high calorie diet could lead to a decreased hepatic synthesis of CoQ10, which would justify its supplementation in high-calorie diets, in obesity or metabolic syndrome.

Conclusions

1. CoQ10 supplementation leads to hepatic density increases in sedentary animals, in normal or high calorie diets.

2. CoQ10 supplementation does not induce changes in relative liver weight and density in trained animals receiving normal or high calorie diets.

3. Average daily weight gain is negatively correlated with liver density and positively correlated with relative liver weight.

4. Hepatic density is negatively correlated with relative liver weight.

Conflicts of interest

There are no conflicts of interest.

Acknowledgments

This article uses partial results of the first author's personal research as part of his doctoral studies.

References

Aberg F, Appelkvist EL, Dallner G, Ernster L. Distribution and redox state of ubiquinones in rat and human tissues. Archives of biochemistry and biophysics. 1992;295(2):230-234.

Bach CW, Brown AF, Kinsey AW, Ormsbee MJ. Anthropometric Characteristics and Performance Capabilities of Highly-Trained Motocross Athletes Compared to Physically Active Men. J Strength Cond Res. 2015 May 16. [Epub ahead of print]

Bhagavan HN, Chopra RK. Coenzyme Q_{10}: Absorption, tissue uptake, metabolism and pharmacokinetics. Free Radical Research 2006;40(5):445-453.

Bryce W. Antioxidanţii. Reţetă pentru viaţă. Ed Curtea Veche. Bucureşti, 2013,88-89.

Comes L: Antioxidanţii în bolile cardiovasculare. În Dejica D (sub red.) Antioxidanţi şi terapie antioxidantă. Ed. Casa Cărţii de Stiinţă, Cluj-Napoca, 2001, cap 13, 420-423

Crane FL, Hatefi Y, Lester RI. Isolation of a quinone from beef heart mitochondria. Biochim Biophys Acta, 1989,1000:362-363.

Folkers K, Yamagami T, Littarru GP. Eds. Biomedical and Clinical Aspects of Coenzyme Q. Vol. 6, Elsevier, Amsterdam, 1991,1-555.

Maidell E. Biblia Vitaminelor. Ed. Elit Bucureşti, 2006, 246.

McNulty H, Jacob RF, Mason RP. Biological activity of carotenoids related to distinct membrane physiochemical interactions. Am. J. Cardiol. 2008;101(10A):20D-29D. doi: 10.1016/j.amjcard.2008.02.004.

Singh RB, Neki NS, Kartikey K, Pella D, Kumar A et al. Effect of coenzyme Q10 on risk of atherosclerosis in patients with recent myocardial infarction. Mol Cell Biochem. 2003;246(1-2):75-82.

Saraf-Bank S, Esmaillzadeh A, Faghihimani E, Azadbakht L. Effects of Legume-Enriched Diet on Cardiometabolic Risk Factors among Individuals at Risk for Diabetes: A Crossover Study. J Am Coll Nutr. 2015 Mar 11:1-10. [Epub ahead of print]

Soylu AR, Altaner S, Aydodu N, Basaran US, Tarcin O et al. Effects of vitamins E and C supplementation on hepatic glutathione peroxidase activity and tissue injury associated with ethanol ingestion in malnourished rats. Curr Ther Res Clin Exp. 2006;67(2):118-137.

Stewart S, Prince M, Bassendine M, Hudson M, James O, Jones D et al. A randomized trial of antioxidant therapy alone or with corticosteroids in acute alcoholic hepatitis. J Hepatol 2007;47(2):277-283.

Tsirigoti L, Kontogianni MD, Darema M, Iatridi V, Altanis N et al. Exploring associations between anthropometric indices and graft function in patients receiving renal transplant. J Hum Nutr Diet. 2014 Dec 18. doi: 10.1111/jhn.12289. [Epub ahead of print]

Uboh FE, Ebong PE, Umoh IB. Comparative hepatoprotective effect of vitamins A and E against gasoline vapor toxicity in male and female rats. Gastroenterol Res, 2009;2(5):295-302.

Vitaglione P, Mennella I, Ferracane R, Rivellese AA, Giacco R et al. Whole-grain wheat consumption reduces inflammation in a randomized controlled trial on overweight and obese subjects with unhealthy dietary and lifestyle behaviors: role of polyphenols bound to cereal dietary fiber. Am J Clin Nutr. 2015;101(2):251-261. doi: 10.3945/ajcn.114.088120.

Websites

(1) Revised guides for organ sampling and trimming in rats and mice. Available at: http://reni.item.fraunhofer.de/reni/trimming/index.php accessed on 1 April 2015

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 107–112

Arguments for a unified psycho-neuro-motor approach in Human Performance training

Argumente pentru o abordare unitară, psiho-neuro-motorie, în antrenarea Performanţei Umane

Călin Marin [1], Pierre Joseph de Hillerin [1,2,3], Mihaela Marin [1], Cristian Vizitiu [1], Alexandru Nistorescu [1], Andreea Vizitiu [1]

[1] *Institute of Space Science, Bucharest, Romania*
[2] *Faculty of Physical Education and Sport, University of Pitesti, Romania*
[3] *Center for Human Performance Development, Bucharest, Romania*

Abstract

Background. The purpose of this paper is to demonstrate the psycho-neuro-motor approach in order to understand, develop, and especially to strengthen the Human Performance (Human Performance – HUP – a concept developed in a holistic vision by Hillerin, Văleanu & Dop in 2003).

Objectives. The research was initiated with the aim of introducing a psychological component in neuro-motor training to analyze and identify changes in human behavior under different conditions (environments or in response to stimuli) and to recover/improve human performance.

Methods. We used a specific training methodology and technology on human subjects, namely: Computer Assisted Information Orthotics (CASINOR), which basically consists of placing the subject in a feedback loop with an information device that offers him real-time visual feedback on the executed movements (Văleanu 2003), a neuromuscular control device and a helmet that acquires EEG signals which are processed (using specific software) to obtain an indicative brain mapping.

Results. By comparing the study's results under various neuromuscular testing conditions (with or without visual feedback and mental training), using brain mapping technology, major differences of the electrical impulses propagation in certain directions of the cortex, depending on the protocol chosen by the methodologist were observed.

Conclusions. From these results, the interdependence of the three components (psycho-neuro-motor) was demonstrated, as well as the importance of their unified approach for assessment, improvement and recovery, in other words human performance training with applications in elderly or disabled assistance, sports performance, training for demanding activities (firefighters, military personnel) and preparing the human crew for prolonged space flight.

Keywords: psycho-neuro-motor, training, Human Performance.

Rezumat

Premize. Scopul acestei lucrari este de a demonstra necesitatea abordării psiho-neuro-motrice pentru înţelegerea, dezvoltarea şi mai ales pentru consolidarea Performanţei Umane (conceptul Human Performance -HUP- elaborat într-o viziune holistă de către Hillerin, Văleanu şi Dop în 2003).

Obiective. Cercetarea a fost iniţiată cu scopul introducerii componentei psihologice în antrenamentul neuro-motor, de a analiza şi identifica modificările comportamentului uman în diferite condiţii (medii sau ca răspuns la stimuli), în vederea recuperării/îmbunătăţirii performanţei umane.

Metode. S-a folosit metodologia şi tehnologia de antrenament specific, cu subiect uman, şi anume: ortezarea informaţională asistată de calculator (CASINOR - Computer ASsisted INformational ORthotics), ce are ca principiu introducerea subiectului într-o buclă de reacţie informaţională cu un dispozitiv ce îi oferă acestuia un feedback vizual asupra mişcărilor executate în timp real, un dispozitiv de control neuromuscular şi o cască ce achiziţionează semnale EEG care, cu ajutorul unui soft specific, sunt procesate în vederea obţinerii unui mapping cerebral orientativ.

Rezultate. Prin compararea rezultatelor studiilor efectuate în diferite condiţii ale antrenamentului neuro-muscular (cu feedback vizual, fără feedback şi antrenament mental), s-au constatat cu ajutorul mapping-ului cerebral, diferenţe majore de propagare a impulsurilor electrice pe anumite direcţii ale cortexului în funcţie de protocolul ales de metodolog.

Concluzii. În urma acestor rezultate, s-a demonstrat interdependenţa celor trei componente: psiho-neuro-motric, dar şi importanţa abordării unitare a acestora pentru evaluarea, perfecţionarea şi recuperarea, cu alte cuvinte, antrenarea performanţei umane cu aplicaţii pentru asistarea şi recuperarea persoanelor în vârstă sau cu dizabilităţi, performanţă sportivă, antrenarea pentru activităţi solicitante (pompieri, personal militar) şi în pregătirea echipajului uman în vederea zborului spaţial prelungit.

Cuvinte cheie: psiho-neuro-motric, antrenament, performanţă umană.

Received: 2015, March 20; *Accepted for publication:* 2015, April 16;
Address for correspondence: Institute of Space Science, Computer Assisted and Information Feedback Training for Human Spaceflight Support - Starwalker, Magurele City, Atomistilor Street, no. 409, Ilfov County, Romania
E-mail: karin3ti@yahoo.com
Corresponding author: Călin Marin

Introduction

The interest in the human performance concept, as defined by Hillerin, Văleanu and Dop in 2003 (Hillerin, 2003), of the group of authors, involving institutions with common research objectives, led to an exploratory experimental approach regarding the connections between cortical excitation and movement, which can be evidenced by EEG and brain mapping.

The advantage of this approach is dictated by the fact that in terms of human performance required for long-term space flights (no gravity, isolation, stress) and also in sports (effort at the limit of tolerance, coordination, time restrictions) or motor recovery programs (readjustment difficulties and mobility restrictions), conditioning the dynamics of results depends on the contribution of several factors, among which, in our opinion, motor, psychological and neural components play a decisive role. In developing human performance, an important role is played by the dynamic balance between stress and recovery in cycles of adaptation (Loehr, 2012) in all areas where stress and recovery are present as the basis for adjustments to keep the human being within acceptable health limits.

Hypothesis

The starting hypothesis states that both the quantity and quality of the information available to a subject, when achieving a certain movement, significantly and mutually affect both cortical activity functioning and the quality of mechanical results of the required exercise.

Methods and technologies

We mention that the research protocol was approved by the management board of the STARWALKER Competence Center, Space Applications for Safety and Health Laboratory at the Institute of Space Sciences, being consistent with legal provisions on the protection of individuals, and technological and ethical standards comply with the requirements of the European Union.

The research protocol:

a) *Time and place of the research*

The study was conducted between December 2014 - March 2015, at the Institute of Space Science, Space Applications for Health and Safety Laboratory, Măgurele, Ilfov.

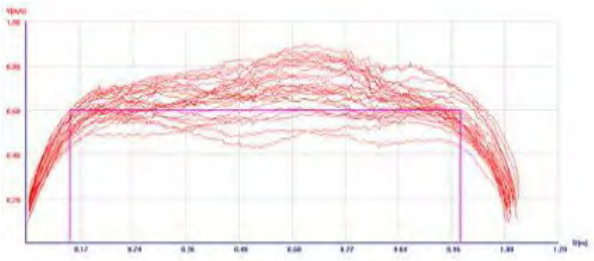
b) *Subjects*

Considering the fact that this was an exploratory approach, tests were performed on two volunteer subjects from the laboratory personnel, who knew and agreed on the experimental protocol and dissemination of results.

c) *Applied tests*

For the studies, we used the CASINOR concept methodology - Figure 1 (Computer ASsisted INformational ORthotics, computer-aided orthotics information), which is basically introducing the subject in an information feedback loop with a device (computer) that offers him real-time visual feedback of the mechanical results of the performed movements.

a.



b.

Fig. 1 a,b – Computer assisted informational orthotics – CASINOR®.

The device used in the experiments was the in-house designed Move1Du type which uses know-how and technological solutions that fall within the CASINOR® concept (1), ”principles to achieve motion simulators” (Hillerin, 1983) and ”use of computer-assisted instrumentation to drive motor and volitional capacities” (Văleanu, 2003). The device is designed to perform neuromuscular control exercises for the upper limbs, for the training of the overall capacity of psycho-neuro-muscular control, neuro-motor recovery and/or enhancement of the subject’s mental control. The methodological principle consists of movements carried out by the subject under low resistance movement conditions, of inertia-gravity type (weight), with speed control load so that the subject has to maintain a value close to a predefined constant, displayed on the computer.

In parallel, we used an Emotiv wireless EEG headset (14 channels + 2 reference channels), which provides an optimal spatial positioning, of sufficient resolution for the current state of our experimental studies (2). This equipment, along with the Emotiv 3D Brain Map Premium software (3), acquires EEG signals and provides a real-time electrical activity intensity map of the cortex in four significant frequency bands of brain waves (delta, theta, alpha and beta).

The experiment was divided in three stages:

1. In the first stage, the subject performed neuromuscular control exercises with eyes closed. A reference was given, namely that he had to overcome a resistance (gravity and inertial mass) of about 2 kg and that movement had to be carried out at a constant speed throughout its amplitude: V (velocity) = 0.4 m/s, in 25 repetitions. We will further refer to this type of exercise as „without visual feedback.”

2. In the second stage, the subject was able to verify the accuracy of the performed movements against the model, by viewing the graphic image of the speed-position relations in the phase space, in real time. The movement was the same as described above, and the model parameters were: V (velocity) = 0.4 m/s in D (position) = 1.2 m, in 50 repetitions. Such exercises will be referred as „with visual feedback".

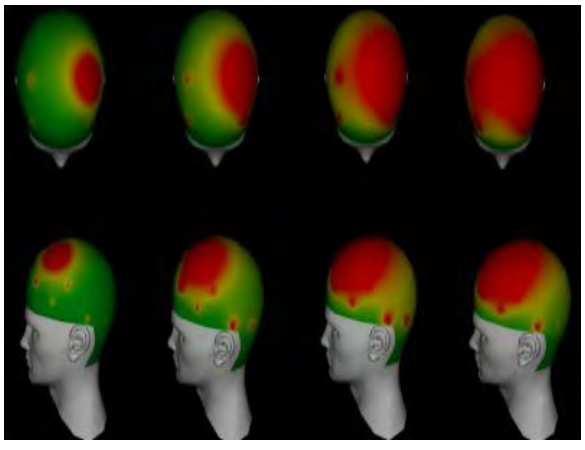
3. In the third stage, the subject performed the exercise only mentally, with sound and visual isolation. The subject was asked to imagine the movement, such as that of the previous exercise, for a total of 20 repetitions.

Results

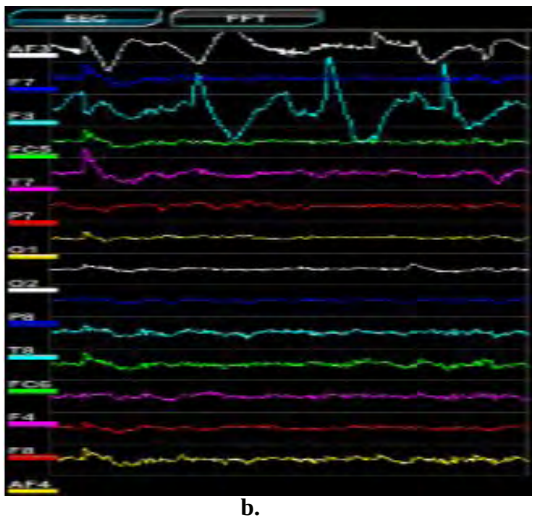
The central nervous system is generally seen as being organized in three hierarchical levels (Scott 2004), namely: cortex, brainstem and spinal cord. The first level is the spinal cord including motor neurons (the final pathway for conducting voluntary motor impulses) and interneurons (which integrate/provide feedback sensations in muscles, joints and skin). On the second level (intermediate level), there is the brainstem with a role in homeostasis, in conducting, selecting and increasing electrical impulses from the spinal cord, as well as in opposite direction, from higher nerve centers. Associating the intermediate level with some areas of the cortex (Rodier 2002) improves both postural and fine control, and may vary depending on the speed and quality of locomotion patterns. The last level is the cerebral cortex, involved in cognitive, perceptual and executive processes, connecting them through a variety of circuits or entry, exit and re-entry loops of collected and processed information (4). This includes in terms of motor behavior the planning and execution of motion, depending on requirements/conditions.

Discussion

Stage 1. The acquisition data obtained and processed for the visualization of brain mapping (Figure 2) while performing neuromuscular control exercises with the eyes closed, using the Epoc EEG headset together with the 3D Brain Map Premium software, suggest a pronounced involvement of the left hemisphere, which is responsible, in VELCOPAL's opinion, for: logic/reasoning (Vengopal, 2012), control of the right side of the body, mathematical calculations, analytical thinking, grammar/vocabulary, reading, writing, understanding language, science, sequential thinking, objectivity and other functions.



a.



b.

Fig. 2 a,b – Brain mapping and EEG signal recording during neuromuscular control exercises without visual feedback.

Brain areas activated during exercises:

- The prefrontal cortex (association area: voluntary motion planning).
- Premotor cortex involved in the preparation/planning, coordination and execution of movement.
- The sensory parietal area is the area of integration of peripheral sensory information, in our case it receives signals from cutaneous and kinesthetic analyzers (5).
- The motor cortex is where movement is initiated.
- Basal ganglia have functions such as: motion control, development of motor skills, learning or acquisition of habits.
- The cerebellum is responsible for the coordination of voluntary movements, motion learning, balance, postural reflex learning, sequential learning.
- The brainstem has the role of conducting, selecting and increasing the impulses sent to the spinal cord (motor neurons => muscle).

The indicative route of electrical impulses in the cortex during the execution of neuromuscular control movements without visual feedback can be seen in Figure 3.

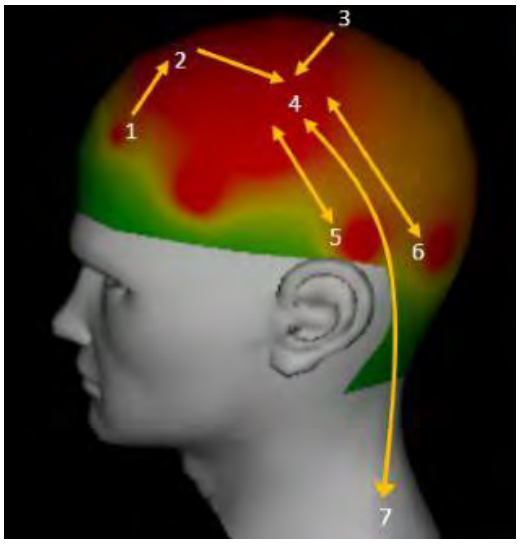


Fig. 3 – 1. Prefrontal cortex, 2. Premotor cortex, 3. Parietal cortex, 4. Motor cortex, 5. Basal ganglia, 6. Cerebellum, 7. Descending pathway – motor cortex - brainstem - spinal cord.

On the Move1Du/Motrix application, there is a mismatch between the requested task (to perform a movement at a constant speed) and the execution of movements by the subject in the given conditions – Figure 4.

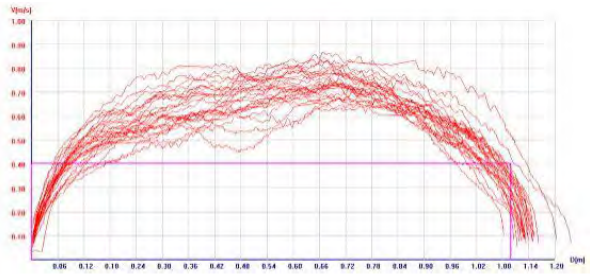
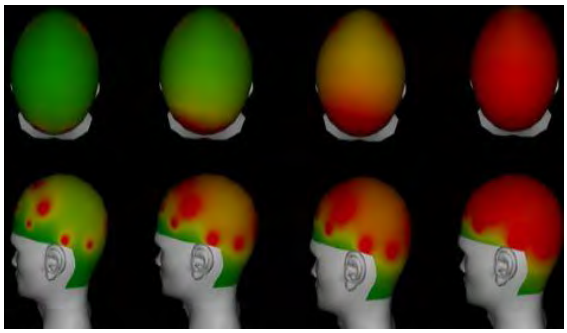


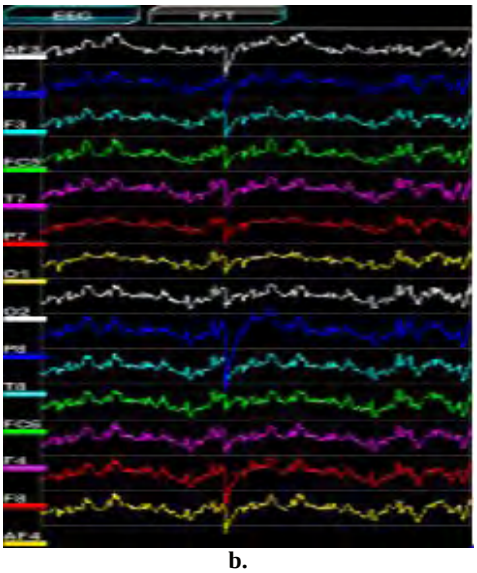
Fig. 4 – Graphical representation of acquisitions during neuromuscular control exercises without visual feedback.

Stage 2. Neuromuscular control exercises were performed with visual feedback as previously described.

The brain mapping recorded (Figure 5) in this stage indicated an approximately equal dispersion of electrical impulses on the surface of both hemispheres, with considerable dynamic changes in the electrical impulse directions (different from the previous stage).



a.



b.

Fig. 5 a, b – The brain mapping and EEG signal recording during neuromuscular control exercises with visual feedback.

Brain areas activated during exercises (Figure 6):

- The primary visual cortex that receives and processes impulses through the optic nerve.
- Impulses are then directed to the parietal somatosensory association area that receives information from the three sensory systems: visual, auditory, somatosensory (receiving sensations from muscle and skin). This area plays an important role in building the image of the body and its segments, the environmental image (Trimble 2007), while having the function to plan/adjust the movement depending on environmental conditions in which it takes place, according to the applied methodology.
- Next is the activation of the premotor cortex area (involved in preparation/planning and execution of movement, imitation, learning), which simultaneously receives impulses from the prefrontal area (involved in planning, reasoning and judgment). The impulses are then directed to the primary motor cortex which has the role to coordinate and initiate movement for each body segment, represented on its surface.
- A concomitant exchange of information occurs between the motor cortex and basal ganglia.
- In the descending pathway, an exchange of information occurs between the motor cortex and the cerebellum (Scott 2004), followed by transmission of impulses through the brainstem to the spinal cord and effectors (motor neurons-> muscle).

The indicative route of electrical impulses in the cortex during the execution of neuromuscular control movements with visual feedback can be observed in Figure 6.

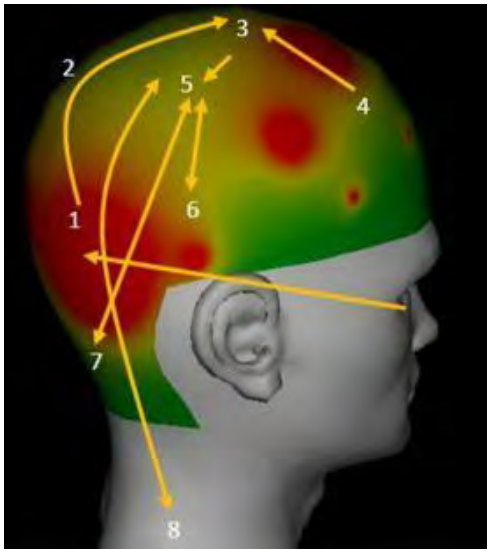


Fig. 6 – 1. Visual cortex, 2. Associative parietal-premotor circuit, 3. Premotor cortex. 4. Prefrontal cortex, 5. Motor cortex, 6. Basal ganglia, 7. Cerebellum, 8. Motor cortex - brainstem - spinal cord circuit.

Neuro-motor behavior considerably improved (Figure 7) as a result of using visual feedback. Integrating the whole somatosensory association system, the subjects managed to come closer to the graphical model.

The grades assigned to subjects during executions (Figure 8) in stages 1 and 2, from the point of view of movement precision, indicate the effectiveness of neuromuscular control exercises with visual feedback and its impact on the development of motor skills.

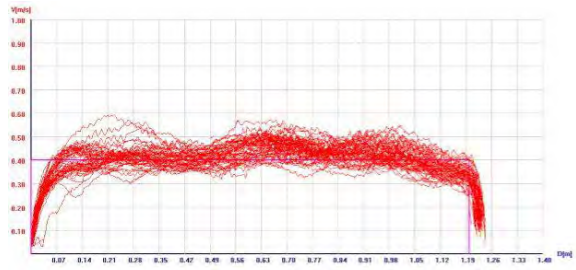


Fig. 7 – Graphical representation of acquisitions during neuromuscular control exercises with visual feedback.

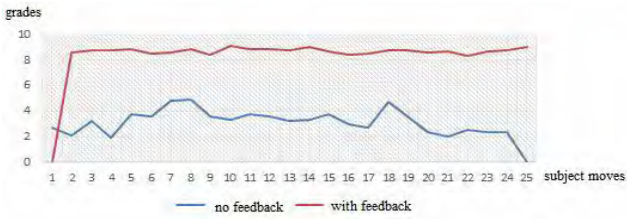
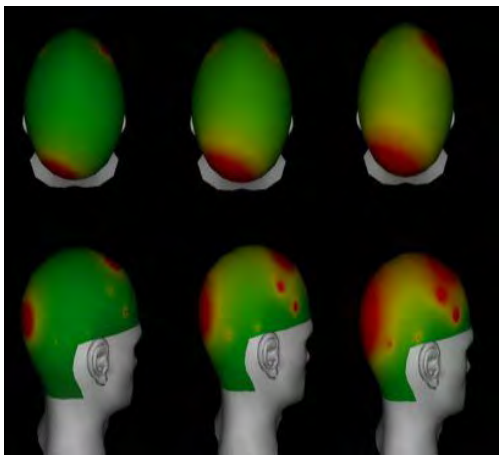


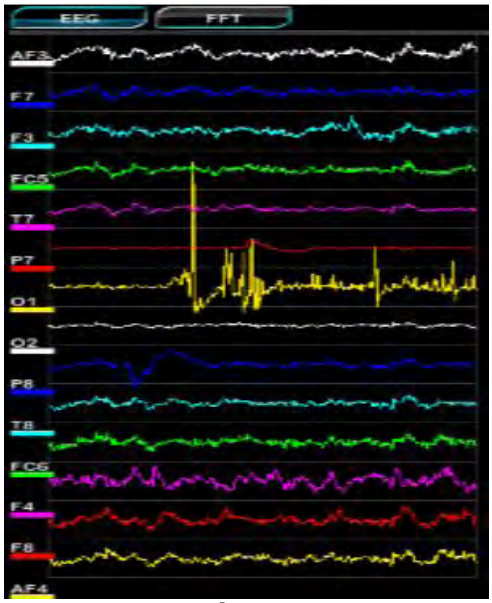
Fig. 8 – The graphs of grades resulting from the evaluation of movements corresponding to the type of exercise (with feedback/ without feedback).

Stage 3. In this stage, the subject was requested only to imagine, with no sound or visual feedback, the movements related to the neuromuscular control exercises executed in the previous stages.

Brain mapping (Figure 9) in the case of mentally simulated exercises showed a different distribution of electrical impulses and increased activity of the right hemisphere. Thus, circuits are formed which link the prefrontal cortex (representing the creation of new behavioral patterns) with the parietal-temporal-occipital association cortex, which has an important role in certain aspects of visual memory (Axmacher, 2008), mental mathematics, three-dimensional awareness of the body, construction of the mental image of the proposed exercise. According to Buckner (2008), the imagination network is involved in building dynamic mental simulation based on past personal experiences, by remembering previous movements (with visual feedback), realizing based on thought, on imagination, the prospect of a movement/ execution (in our case, during mental exercises).



a.



b.

Fig. 9 a, b – Brain mapping and EEG signal recording in mental neuromuscular exercise simulation.

Conclusions

1. The behaviors observed in the subject performing the exercises are due to neuromuscular and mental-volitional control mechanisms.

2. Based on these results, the interdependence of the three components (psycho-neuro-motor) was demonstrated, as well as the importance of their unitary approach for evaluation, improvement and recovery, in other words, human performance training, with applications in the assistance and recovery of elderly or disabled people, in sports performance, in training for demanding activities (firefighters, military personnel) and in preparing the human crew for prolonged space flight. The results open the perspective of using brain mapping for the real-time monitoring of training to achieve human performance aspects specifically targeted on the training objectives.

Conflicts of interest

In this experimental article, there are no conflicts of interest.

Acknowledgements

The authors would like to thank all participants in this experimental study and the entire team of researchers at the Competence Center in Countermeasures for the Adverse Effects of Human Space Flight – STARWALKER.

References

Axmacher N, Schmitz DP, Wagner T, Elger CE, Fell J. Interactions between medial temporal lobe, prefrontal cortex, and inferior temporal regions during visual working memory: a combined intracranial EEG and functional magnetic resonance imaging study. J Neurosci. 2008;28(29):7304-7312. doi: 10.1523/JNEUROSCI.1778-08.2008.

Buckner RL, Andrews-Hanna JR, Schacter DL. The brain's default network: anatomy, function, and relevance to

disease. Ann N Y Acad Sci. 2008;1124:1-38. doi: 10.1196/annals.1440.011.

Hillerin PJ, Shor V, Stupineanu I. Basic principles for motion simulators implementation. 1983. Available online at: http://www.casinor.ro/documente/princip1_eng.pdf Accessed on January 15, 2015

Hillerin P J, Văleanu V, Dop R. Conceptul HUP . 2003. Available online at http://www.casinor.ro/documente/conceptul%20hup.pdf . Accessed on January 15, 2015

Loehr J. High Performance Requires Balance. Available online at: http://www.clomedia.com/articles/high-performance-requires-balance, 2012. Accessed on January 15, 2015

Rodier PM. Converging evidence for brain stem injury in autism. Dev Psychopathol. 2002;14(3):537-57.

Scott SH. Optimal feedback control and the neural basis of volitional motor control. Nat Rev Neurosci 2004;5:532-546. doi:10.1038/nrn1427.

Trimble M. Body image and the parietal lobes. CNS Spectr. 2007;12(7):540-544.

Văleanu VM. Utilizarea Instrumentației Asistate de Calculator pentru Antrenarea Capacităților Motrice și Volitive. 2003. Available online at http://www.casinor.ro/documente/cincs1.pps. Accessed on January 15, 2015

Vengopal K. Styles of Learning and Thinking: Hemisphericity Functions. Encyclopedia of the Sciences of Learning. 2012; doi: 10.1007/978-1-4419-1428-6.

Websites

(1) http://www.donnamaria.ro/suport/Aplic/Move1Du/Manual_MOVE1D_ro.pdf ., Accessed on January 15, 2015

(2) http://www.emotiv.com/store/product_75.html., Accessed on January 15, 2015

(3) http://www.emotiv.com/quickstart-guides/QuickStartGuide2014.pdf., Accessed on January 15, 2015

(4) http://www.psihiatrie-timisoara.ro/material/cortexul.pdf. Accessed on January 15, 2015(5)

(5) http://www.medicinasportiva.ro/dr.drosescu/curs/Anatomie%20IFR.pdf. Accessed on January 15, 2015

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 113–117

Preliminary study of the mechanical properties of striated muscle in humans

Elemente preliminare în studiul proprietăţilor mecanice ale musculaturii striate la om

Pierre de Hillerin [1,3,4], Andra Băltoiu [1,2], Cristina Botezatu [2], Cristina Ciurea [2], Alexandru Nistorescu [1], Vlad Văleanu [1]

[1] *Institute of Space Science, Bucharest, Romania*
[2] *National Institute of Sport Science, Bucharest, Romania*
[3] *Faculty of Physical Education and Sport, University of Pitesti, Romania*
[4] *Center for Human Performance Development, Bucharest, Romania*

Abstract

Background. During prolonged space flights, where microgravity or the lack of gravity affects the physiology and biomechanics of the human body, one of the most important challenges in order to keep the astronauts' capacity, both in terms of health and working capacity throughout the mission, is to preserve the muscle tone and, in general, the mechanical properties of skeletal muscle as a factor in maintaining the psycho-neuro-motor control and bone consistency.

Aims. Our purpose was to investigate the mechanical response of the muscles using their response in acceleration and highlighting the spatial anisotropy response.

Methods. Accelerometers embedded in EMGS active electrodes (TRINGO system) were used, placed on the surface of the femoral biceps in an orderly arrangement around a point where a moderate short mechanical shock, similar to a Dirac delta impulse was produced. The acceleration responses in a perpendicular direction to the plane from two accelerometers were recorded: one placed along the muscle fiber and one located lateral to the first accelerometer and to the mechanical impact point.

Results. The data were used to model a transfer function with characteristics similar to a response dependent on the mutual ratio between the mechanical qualities - tone, elasticity and damping. By comparing the raw acceleration data to the associated mathematical model data, a high level of predictability of the mathematical model and also a possibility to identify the above mentioned mechanical qualities both in wave propagation along the fiber and in highlighting the propagation anisotropy on lateral directions ensued.

Conclusions. Addressing the skeletal muscle mechanical qualities in non-invasive conditions, in-vivo, ensures the possibility of monitoring their progress in special conditions for astronauts, athletes or patients with myopathic disorders.

Keywords: muscle tone, elasticity, damping, accelerometers, modeling.

Rezumat

Premize. În zborurile spaţiale de lungă durată, unde microgravitaţia sau lipsa gravitaţiei afectează fiziologia şi biomecanica fiinţei umane, unul dintre elementele de maximă importanţă pentru păstrarea capacităţilor astronauţilor, atât din perspectiva propriei sănătăţi, cât şi a posibilităţii de a-şi păstra capacitatea de muncă pe tot parcursul misiunilor, este nivelul de conservare a tonusului muscular şi, în general, a proprietăţilor mecanice ale musculaturii striate, ca factor de menţinere atât a controlului psiho-neuro-motor, cât şi a consistenţei osoase.

Obiective. Ne-am propus realizarea unor investigaţii asupra calităţilor mecanice ale musculaturii folosind răspunsul în acceleraţie a muşchiului şi evidenţierea anizotropiei spaţiale a acestui răspuns.

Metode. Au fost folosite accelerometrele înglobate în electrozii activi de EMGS ai sistemului TRINGO, plasate pe suprafaţa bicepsului femural, într-o dispunere ordonată în jurul unui punct în care a fost produs un şoc mecanic moderat, scurt, asimilabil cu un impuls delta Dirac. S-au înregistrat răspunsurile în acceleraţie pe direcţia perpendiculară pe plan, la un accelerometru plasat în lungul fibrei musculare şi la unul aflat lateral faţă de aceasta şi faţă de locul de impact mecanic.

Rezultate. Datele au fost utilizate pentru modelarea unei funcţii de transfer cu caracteristici asimilabile unui răspuns dependent de raportul reciproc între calităţile mecanice de: tonus, elasticitate şi capacitate de amortizare. Compararea datelor brute de acceleraţie cu cele din modelul matematic asociat a arătat nivelul ridicat de predictibilitate a modelului matematic, respectiv o posibilitate de identificare a calităţilor mecanice menţionate, atât în propagarea undelor în lungul fibrei, cât şi în

Received: 2015, March 20; *Accepted for publication:* 2015, April 16;
Address for correspondence: Institute of Space Science, Computer Assisted and Information Feedback Training for Human Spaceflight Support - Starwalker, Magurele City, Atomistilor Street, no. 409, Ilfov County, Romania
E-mail: andra.baltoiu@gmail.com
Corresponding author: Andra Băltoiu

evidenţierea anizotropiei de propagare pe direcţii laterale.

Concluzii. Abordarea calităţilor mecanice ale musculaturii striate în condiţii neinvazive, in vivo, asigură posibilitatea monitorizării evoluţiei acestora în condiţii speciale, atât pentru astronauţi, cât şi pentru sportivi sau pacienţi cu afecţiuni miopatice.

Cuvinte cheie: tonus muscular, elasticitate, amortizare, accelerometrie, modelare.

Introduction

During prolonged space flights, where microgravity or the lack of gravity affects the physiology and biomechanics of the human body, one of the most important challenges in order to maintain the astronauts' health and working capacity throughout the mission is to preserve the muscle tone and, in general, the mechanical properties of skeletal muscle as a factor in maintaining adequate psycho-neuro-motor control and bone consistency. This leads to the need for assessing muscular health before, during and after missions, in order to prevent and countermeasure the effects of microgravity.

Our aim is to develop a non-invasive device and method operational in microgravity, for the comprehensive analysis of muscular properties. We present here a preliminary study that was carried out with the purpose of testing the viability of our proposed method, which consists of the analysis of the acceleration response propagation pattern within a muscle bundle upon the application of a mechanical impulse.

State of the art

Muscular characteristics have been widely studied by several approaches, both invasive and non-invasive. From phenomenological approaches extracted from tests developed in sport (Bosco et al., 1983) and subjective investigations used in physical therapy and chiropractic (Conable et al., 2005; Conable et al., 2011), to biological signal energy analysis (Mariūnas & Kojelyte, 2006; Hoang et al., 2009), electromyographic analysis (Cifrek et al., 2009) and electrical impedance analysis (Rutkove, 2009), or to the biochemical perspective of the differentiated metabolism of muscle fiber types (Pesta, 2010), only to name a few references from thousands of attempts recorded in the literature since Faraday, mechanical, biochemical and electrical properties have drawn the attention of researchers in various fields of science. There was even a Nobel Prize awarded for the study of the heat generating properties of muscle contraction to researchers Hill and Meyerhof (***, 1922).

Due to the nature of our areas of interest, only non-invasive techniques have been taken into consideration for this study. Two such approaches are of special interest for us, as their findings have revealed structural and dynamic properties of muscular tissue that can be used for the assessment of muscular health in sports and space applications. The first, electric impedance myography (EIM), is based on the observation that the electrical response of a muscle that is stimulated with a high-frequency electrical current depends on the microscopic structure of the tissue ("Monitoring Muscle | MIT Technology Review," n.d.). EIM has revealed anisotropic electrical properties of muscle tissue that have proven useful in clinical applications (Chin et al., 2008).

The second approach measures elastic properties of the muscle by applying a mechanical impulse on the surface of the skin and recording the acceleration components of response. This method, termed myotonometric measurement of muscular properties, has been studied amongst others by Li-ling Chuang et al., who have developed a method for assessing different muscular properties, such as compliance (increase of tension during elongation), stiffness (magnitude of force that causes displacement), tone (resistance to passive stretching) (Chuang et al., 2011). Moreover, the Myoton myometer (Müomeetria AS, Tallinn, Estonia) was developed for the objective determination of the above properties ("Myoton muscle diagnostics - Myoton" n.d.). Myotonometric measurements have proven useful in both clinical and space applications (Schneider et al., 2015).

Hypothesis

This preliminary study is based on the premises that the mechanical properties of muscle can be identified by mapping the muscle response after applying a mechanical impulse in different longitudinal regions of the tissue. The differences between the regions indicate not only structural heterogeneities and viscoelastic constraints on the normal axis, but also irregularities and changes in the expected physiological behavior.

Materials and methods

Research protocol

The experiment was developed after obtaining the approval of the Ethics Committee and the subjects' informed consent to participate in the research.

As mentioned earlier, valuable information about the mechanical properties (tone, elasticity and dissipative capacity of mechanical energy) of a muscular system can be obtained through non-invasive monitoring by classic myotonometric measurements or by more advanced methods (as proposed by this project).

a) Place and period of the research

The experiment was performed in the Competence Center for Space Technology in support for Human Spaceflight – Starwalker laboratory of the Institute of Space Science, Magurele between 1 September 2014 and 30 September 2014.

b) Subjects

We used data obtained from the investigation of the propagation of transverse accelerations, following a moderate mechanical shock in a single volunteer human subject, on the femoral biceps muscle of his left leg.

c) Applied tests

The experiments were developed using a Trigno™ Wireless EMG electromyograph with accelerometer sensors applied on the skin surface and a short and moderate mechanical impulse (excitation). The accelerometer sensors were placed in a pattern that follows as much as

possible the muscle bundle limits. The muscle used in the experiment was the femoral biceps (biceps femoris) of the left leg. A mechanical impulse was applied in the center of the explored area of the measured muscle and the values of the normal acceleration components were recorded for each of the sensors placed on the skin surface. The normal acceleration component was taken into consideration, as it is supposed to provide the most information on the amplitude of response. The same measurements were performed in order to characterize the dynamic muscular response in two circumstances:

1. the muscle was relaxed;
2. the muscle was contracted.

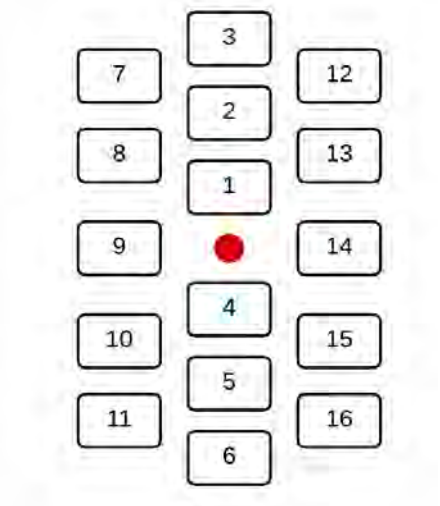


Fig. 1 – Accelerometer sensor placement in relation to the impulse application point.

d) Statistical processing

Since the experiment was purely exploratory and the aim was to see if meaningful results could be obtained in order to verify the hypothesis and to communicate the obtained data as quickly as possible, there was no mathematical processing of the experimental results, only qualitative observations were made.

Results

Our preliminary experimental results revealed that in the response to excitation through a moderate mechanical impulse, there were elements of anisotropy of the muscle mechanical response and, also, variations in the mechanical perturbation signal (wave) propagation speed along the muscle fiber in a monotonous manner with respect to the distance from the excitation impact.

Results revealed three different muscle activity dynamics, occurring successively after the application of the mechanical impulse. In what follows, we present the results obtained in the part of the experiment where impulse was applied on the relaxed muscle. Further work is necessary for the interpretation of the differences occurring in the cases of relaxed and contracted muscle.

The first type of muscular response, occurring within 15 milliseconds, is characterized by a large amplitude. Propagation along and across muscle fibers both in terms of time delay and amplitude size is observed. The shape of the response is consistent with the findings of Chuang et al. (2011).

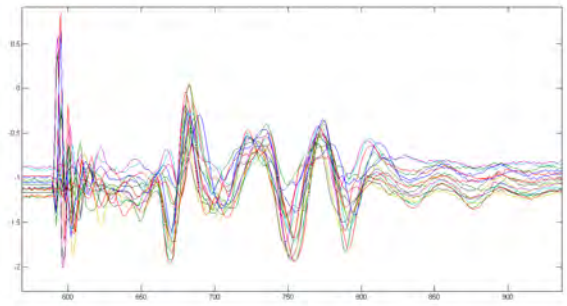


Fig. 2 – Raw signal of the 16 accelerometers, recorded upon the application of impulse on relaxed muscle.

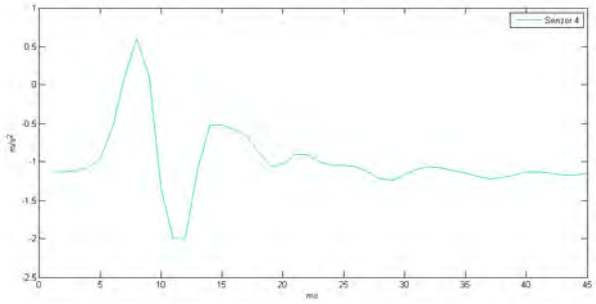


Fig 3 – Recorded acceleration signal for sensor 4 (below the impact region, along and across the muscle fiber).

The second type of response is unsynchronized in relation to the different locations where acceleration was measured. Moreover, in the range of 45 milliseconds of this phase, some muscle areas exhibit an amplification of the dumping tendency from the previous phase. Our interpretation, which needs further experimentation, is that this stage corresponds to a medullary response which superimposes on the muscular reaction to the mechanical impulse.

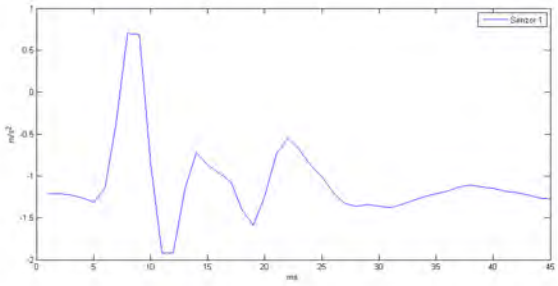


Fig. 4 – Response dumping, followed by amplification in the case of sensor 1 (above the impact region, along the muscle fiber).

The third stage is the most visible at the first application of impulse, suggesting a CNS command, which is dependent on the novelty of the stimulus. It contains highly synchronized muscular activity along and across fibers. This stage lasts for approximately 250 milliseconds and occurs 60 milliseconds after the impulse.

As stated before, the aim of the research is to offer in-depth characterization of muscular health by examining the propagation of the response to mechanical impulse through the whole muscle bundle, along and across fibers. We developed a method of analysis based on estimating the transfer function of the muscle system that produces the measured output. The method investigates the differences in the transfer function parameters obtained from the 16 accelerometers. However, further work is needed for the determination of the relationship between different propa-gation dynamics and muscle properties. Here we present only a few propagation patterns, for illustration purposes.

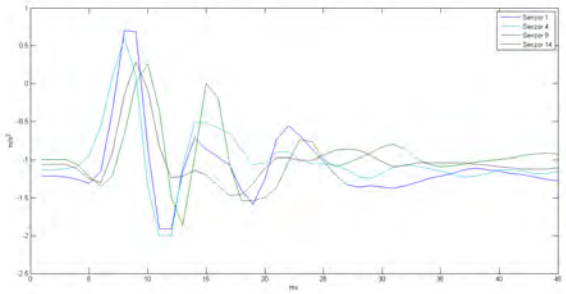


Fig. 5 – Acceleration response recorded by the closest sensors to the impact area (along fibers: sensors 1 and 4; across fibers: sensors 9 and 14).

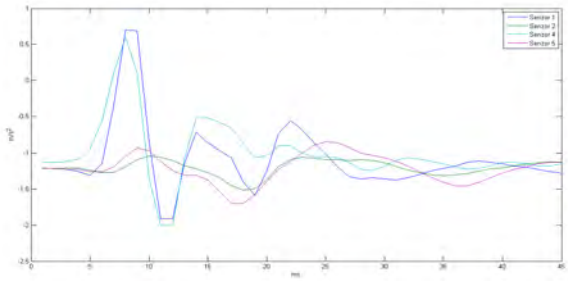


Fig. 6 – Acceleration response recorded by sensors along the impacted fiber.

The figure above shows amplitude dependence on distance from the impact region along the muscle fiber that received the impulse. For clarity reasons, we omitted signals recorded from the farthest sensors. The signals can also be compared with propagation dynamics across fibers, presented in figures 7a and 7b. Although not illustrated here, a delay is recorded in the case of these responses. Moreover, lateral asymmetry can be observed.

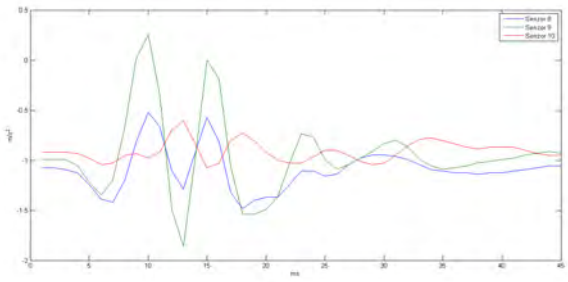


Fig. 7a – Acceleration response recorded by sensors across the impacted fiber (left side).

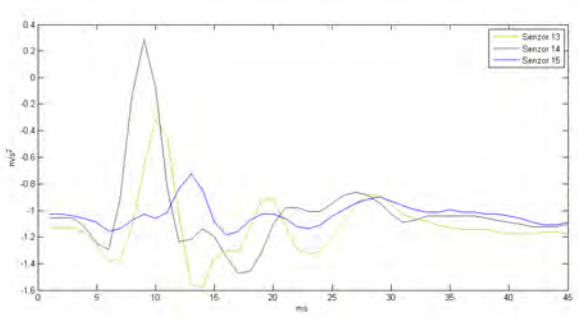


Fig. 7b – Acceleration response recorded by sensors across the impacted fiber (right side).

Discussions

Muscle response to mechanical impulse contains valuable information on the tissue's health, functional and structural characteristics. We propose a method for investigating muscle properties that takes into account the dynamic complexity of the muscle, with the aim of providing a detailed, objective description of these characteristics. So far we have tested the hypothesis that the propagation of the acceleration response to a mechanical impulse within a muscle fiber can be used for the assessment of the health of striated muscle.

Results are consistent with the state of the art and in addition, they reveal promising new information, which makes the research a useful approach to the problem of testing muscular capabilities for space applications. Further work is needed for the development of a device that applies the impulse and reads the response from several sensors arranged in a specific geometrical distribution, in order to capture information on muscular anisotropy. Moreover, future work will include establishing the analysis methodology, both in terms of transfer function parameter identification and mapping, and physiological interpretation of the results.

The present results as well as the intended in-depth investigations are encouraging for the use of the method for the astronauts' protection in space flight, because according to current knowledge the anatomical, physiological and biomechanical interaction between muscles and bones is very tight. In this respect, the studies of Sundeep Khosla (2012) evidence a link between muscle growth and bone mass increase. Cianferotti et al. (2014) stated that the endocrine properties of muscle and bone may serve to sense and transduce biomechanical signals such as loading, unloading or exercise, or systemic hormonal stimuli into biochemical signals. Under these circumstances, we consider that a mechanical characterization of the muscle would bring valuable information about the evolution of muscles and bones in microgravity.

Conclusions

1. The results are consistent with current research and reveal promising new information, which makes this study a useful approach to the problem of testing muscle capabilities for space applications.

2. Future research is necessary in order to develop a device that applies an impulse and reads the response from

several sensors placed in a controlled geometry with the main purpose of acquiring information about muscular anisotropy.

3. Future work will aim to establish the analysis methodology, in terms of identifying and mapping transfer function parameters, as well as in terms of physiological interpretation of the results.

Conflict of interest

There are no conflicts of interest regarding the experiment protocol or the result dissemination.

Acknowledgments

The authors thank all participants and the managers of the four institutions involved for understanding and agreeing to participate in this preliminary experiment.

References

Bosco C, Luhtanen P, Komi PV. A Simple Method for Measurement of Mechanical Power in Jumping. Eur J Appl Physiol. 1983;50:273-282.

Chin AB, Garmirian LP, Nie R, Rutkove SB. Optimizing measurement of the electrical anisotropy of muscle. Muscle & Nerve, 2008;37(5):560-565. doi:10.1002/mus.20981.

Chuang L, Wu C, Lin K. Myotonometric Measurement of Muscular Properties of Hemiparetic Arms in Stroke Patients. 2011. Available online at:http://cdn.intechopen.com/pdfs-wm/37903.pdf Accessed on: 15 march 2015

Cianferotti L, Brandi ML. Muscle-bone interactions: basic and clinical aspects. Endocrine. 2014;45(2):165-177. doi: 10.1007/s12020-013-0026-8.

Cifrek M, Medved V, Tonković S, Ostojić S. Surface EMG based muscle fatigue evaluation in biomechanics. Cl Biomech. 2009;24(4):327-340.

Conable KM, Cornea J, Hambrick T, Marquina N, Zhang J. Investigation of Methods and Styles of Manual Muscle Testing by AK Practitioners. Private practice of chiropractic. J Chiropr Med. 2005; 4(1):1-10. doi: 10.1016/S0899-3467(07)60106-2.

Conable KM, Rosner AL. A narrative review of manual muscle testing and implications for muscle testing research. J Chiropr Med. 2011;10(3):157-165. doi: 10.1016/j.jcm.2011.04.001.

Hoang P, Saboisky JP, Gandevia SC, Herbert R.D. Passive mechanical properties of gastrocnemius in people with multiple sclerosis. Cl Biomech 2009;24(3):291-298.

Mariūnas M, Kojelyte K. Investigation of the Relationship of Muscle Mechanical Characteristics with Biosignal Energ. Solid State Phenomena, 2006;113:151-156. 10.4028/www.scientific.net/SSP.113.151.

Pesta D. Non-Invasive Methods of Muscle Fibre Type Determination. VDM Verlag Dr. Müller GmbH & Co. Saarbrücken, Germany, 2010.

Rutkove SB. Electrical Impedance Myography: Background, Current State, and Future Directions. Muscle Nerve. 2009;40(6):936-946

Schneider S, Peipsi A, Stokes M, Knicker A, Abeln V. Feasibility of monitoring muscle health in microgravity environments using Myoton technology. Medical & Biological Engineering & Computing, 2015;53(1):57-66. doi:10.1007/s11517-014-1211-5.

Sundeep Khosla, 2012, Determinants of Peak Bone and Muscle Mass. In ASBMR topical meeting: Bone and Skeletal Muscle Interactions. July 17–18, 2012, Kansas City, Missouri, USA Available online at: https://www.youtube.com/watch?v=pfvxp3W9VR0#t=40, Accessed on March 16, 2015.

Vain A. Method and a device for recording mechanical oscillations in soft biological tissues. US Patent No.6132385 A, 2000

***. The Nobel Prize in Physiology or Medicine 1922. Avaible online at: http://www.nobelprize.org/nobel_prizes/medicine/laureates/1922/ Accessed on 14 march 2015

Websites

Monitoring Muscle. MIT Technology Review. (n.d.). Available online at: http://www.technologyreview.com/news/412955/monitoring-muscle/ Accessed on March 18, 2015

Technology - MyotoPRO Digital Palpation Device. Avaible online at http://www.myoton.com/en/Technology, Acesed on March 18, 2015

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 118–124

The structural equation model of brand identity and attitudinal and behavioral loyalty of Iranian Football League's fans

Modelul ecuaţiei structurale privind relaţia dintre identitatea de brand și loialitatea atitudinală și comportamentală a fanilor Ligii Iraniene de Fotbal

Mohammadrasoul Khodadadi [1], Mohammad Pourranjbar [2], Abolfazl Bejani [3], Roghayeh Sarlab [4]
[1] *University of Tabriz, Iran*
[2] *Physical Education Department and Physiology Research Center Kerman, Iran*
[3] *Allameh Tabataba'i University, Tehran, Iran*
[4] *Tabriz University, Tabriz, Iran*

Abstract

Background. Identity is a key element in branding and the core element of a successful brand is to perceive how the brand identity is created and developed.

Aims. This research tackles the modeling of structural equation of brand identity dimensions and attitudinal and behavioral loyalty in Iranian Super League's fans.

Methods. The present study is descriptive-analytical and completed as a survey. The statistical population included the 13 Iranian league clubs and 690 people were chosen using the Q-Cochran formula and stratified random and cluster sampling methods. The author developed a Fan Based Brand Equity (FBBE) instrument based on Kapffer's model in brand identity and Meller and Hansan's model of attitudinal and behavioral loyalty. The first section included demographic characteristics and the second section consisted of items covering all variables by Likert's seven item scale. Content reliability was CVI=0.87 and internal validity was investigated in a pilot study by two methods of test-retest and Cronbach's Alpha (0.75) SPSS 20 used for descriptive statistics of variables and data normality and AMOS20 used for structural equation modeling.

Results. The results showed that brand identity had a significant positive effect on the loyalty to the brand. Tangible identity had a significant positive effect on behavioral loyalty but no significant effect on the attitudinal loyalty of Iranian Super League fans.

Conclusions. Reinforcement of the football brands' intangible identity has an impressing effect on the brand. Brand identity could duplicate the power of attracting fans.

Keywords: brand identity, brand loyalty, fans, football.

Rezumat

Premize. Identitatea este un element cheie în branding. Elementul central al unui brand de succes este de a percepe modul în care a fost creată şi dezvoltată identitatea brandului.

Obiective. Această cercetare are ca obiective abordarea modelării ecuaţiei structurale a indentităţii de brand. Din acest motiv a fost luată în considerare atitudinea şi comportamentul fanilor Super Ligii Iraniene.

Metode. Studiul de faţă este o anchetă şi se bazează pe metoda descriptiv-analitică. Populaţia folosită în cercetare pentru analiză statistică a cuprins 13 cluburi din liga iraniană şi 690 de persoane, care au fost alese folosind formula Q-Cochran şi metodele de prelevare de probe aleatorii şi grupuri stratificate. Autorul a construit un instrument de măsurare Fan Based Brand Equity (FBBE) pe baza modelului Kapffer, pentru realizarea identităţii de brand şi modelului Meller şi Hansan pentru măsurarea loialităţii atitudinale şi comportamentale. Prima secţiune a inclus caracteristicile demografice şi a doua secţiune a constat din elemente care să acopere toate variabilele de şapte elemente pe scara Likert.

Fiabilitatea testului a fost CVI = 0,87 şi validitatea internă a fost investigată într-un studiu pilot, prin două metode de testare-retestare şi Alpha Cronbach (0,75) SPSS 20, utilizând pentru statisticile descriptive ale variabilelor şi date de normalitate. De asemenea a mai fost utilizat programul AMOS20 pentru modelarea ecuaţiei structurale.

Rezultate. Rezultatele au arătat că identitatea de brand a avut un efect pozitiv semnificativ în loialitatea de brand. Identi-

Received: 2014, December 25; *Accepted for publication:* 2015, January 20;
Address for correspondence: Physical Education and Sport Sciences Department, University of Tabriz, 29 Bahman Sq., Tabriz, Iran, Postal Cod: 5166616471
E-mail: rm_kh85@yahoo.com
Corresponding author: Mohammadrasoul Khodadadi

tatea corporală a avut un efect pozitiv semnificativ în loialitatea comportamentală, dar nici un efect semnificativ în loialitatea atitudinală a fanilor iranieni ai Super Ligii.

Concluzii. Consolidarea în fotbal a brandurilor de identitate necorporale a imprimat efectul asupra brandului. Identitatea de brand ar putea fi dublată ca putere de atragere a fanilor.

Cuvinte cheie: identitate de brand, loialitate de brand, fani, fotbal.

Introduction

Marketers argue that brands are important on a number of levels. First, brands make a financial contribution to firms. Up to 70 percent of a firm's earnings can be attributed to brands (Perrier, 1997). Brands did not use to be mentioned in financial statements, but their value is increasingly recognized among the "intangible assets" of firms. Second, customers build loyalty to strong brands. Finally, brands now provide the guiding principles for market oriented organizations. Over time, research attention has shifted from a focus on brand image to the creation of brand identity (Kapferer, 1997; Harris & de Chernatonay, 2001).

The sporting world has long recognized the fervent loyalty of fans to particular sporting stars and teams. Sport is a significant sector in economic, social, and management terms. Globally, the market alone is estimated to be worth around $12 billion per annum (Ozanian, 2005). Football is one of the most globally significant sports. While many sports have appeal and commercial success within particular regions, such as baseball, few appeal to fans in all regions of the world. Even the mention of brand in conjunction with football is likely to raise the hackles of many football fans (Bridgewater, 2010). For these reasons, considering football clubs and other football organizations as brands - and seeing what insights can be gained from doing so - may be a useful exercise even for those who deplore the commercialization of football. Sports marketing theory argues strongly that football and other sports clubs should be considered as brands. These arguments focus on a number of attributes of sports clubs that make this appropriate. First, the media interest in sports clubs means that they have an increasing awareness of image. Certainly, sports attract loyal, even fanatical support. Within sports marketing literature there is a growing volume of work in the areas of "fan identification," or the relationships that fans have with clubs and with loyalty to particular teams or sports personalities (Sutton et al, 1997). The growing commercial importance of sport means that clubs are increasingly concerned with raising revenue in order to successfully meet their sporting aims. For a football club, this may be how it might attract greater numbers of fans in attendance at matches or events. For a football body, this might be to provide a better service to members of the association, or otherwise help the football body to meet the needs of its members. Sports theory also explores why fans support a specific club or sports star, what influences the choices they make, and what would prompt them to participate more in particular sports (Bridgewater, 2010).

On the other hand, in traditional economic literature, labor, capital, and land are three fundamental production elements and are regarded as the main sources of wealth and value creation; however, it cannot explain how a product with the same efficiency, quality, and features is sold at the price three times the competitors products. New marketing approaches explain this phenomenon by the identity that different brands provide for their customers. In numerous markets, brand creates a unique identity for a product and connects it to a specific group of target population. In psychological perspective, this type of products, in addition to their apparent applications, positively affects customer self-esteem and dignity. For this reason, a customer would prefer to pay higher prices (Shirazi et al., 2013). Thus, brand loyalty plays a critical role in creating long-term benefits for the organization. Sen & Bhattacharya (2001) argue that customers reflect and reinforce their identities through brand identification and the relationships that are built along with it. Therefore, when customers highly value the quality of a brand and competitors can easily imitate and copy the firm products, the necessity of creating a strong brand identity to gain brand equity seems highly important and desirable (Geuens et al., 2009). According to De Chernatony & McDonald (1994), the purpose of branding is to facilitate the circumstances for gaining loyal consumers and retaining them with acceptable cost with the goal of accelerating return on investment. Aaker (1991) defines brand loyalty as customer attachment to the brand. In research on brand loyalty, the main challenge is to define the brand loyalty concept and to measure it, because repurchasing is not only a voluntary reaction, but it is due to mental, emotional, and normative factors (Meller & Hansan, 2006).

Identity is a key element in branding and the core element of a successful brand is to perceive how the brand identity is created and developed (Laforet, 2010). Geuens et al. (2009) define brand identity as a concept of a brand designed and presented by an organization. The identity of each brand is its quintessence and originality. So, if an organization wants to create a sustainable image in its customers' minds, it needs to create its brand identity first. A brand provides an attractive and strong identity when its identity is more distinctive and prestigious in comparison with other brands (Bhattacharya & Sen, 2003; Dutton et al., 1994). Therefore, when the role of brands is distinguishing products by creating value for the brand owners, brand distinction is regarded as an underlying and critical concept in contemporary competitive markets (Lu et al., 2008; Vignoles et al., 2000). A distinctive brand identity enables the consumers to fulfill their self-definition needs for being unique (Berger & Heath, 2007; Ruvio, 2008). Hansen et al. (2008) suggest that corporate reputation has a positive relationship with perceived value. In addition, there is a positive relationship between brand identity and customer satisfaction, because brand identity gives specific prestige to consumers and it is able to fulfil the customers' needs for uniqueness and self-enhancement. Geçti & Zengin (2013) indicate that there is a positive relation between

brand trust and brand affect. Brand trust is also positively related to both attitudinal loyalty and behavioral loyalty. Despite expectations, brand affect showed no significant impact on behavioral loyalty. According to the research of Moshabaki et al. (2013) on the brand identity of sports design industry in Iran, dimensions of brand identity in Iranian Football League include football success (0.97), delivery (0.92), local area teams (0.89), star players (0.88), logo, fans, history, traditional rivals (0.87), tradition (0.85), team performance (0.82), stadium (0.72) and non-player personnel (0.51). Therefore, it is necessary to evaluate football brand identity based on real fans. Finally, the question is raised: What are the effects of fan based tangible and intangible brand identity on attitudinal and behavioral loyalty?

Hypothesis

Tangible identity has a significant effect on attitudinal loyalty of Iranian Football Super League fans

Tangible identity has a significant effect on behavioral loyalty of Iranian Football Super League fans

Intangible identity has a significant effect on attitudinal loyalty of Iranian Football Super League fans

Intangible identity has a significant effect on behavioral loyalty of Iranian Football Super League fans

Material and methods

Research protocol

a) Period and place of the research

This study is a descriptive survey study, examining the structural equation model of brand identity and attitudinal and behavioral loyalty of Iranian Football Super League fans in 2013.

b) Subjects and groups

The statistical population was represented by football club (Esteghlal, Persepolis, Sepahan, Foolad and Mes) fans of 13 Football Super League clubs and the sample population consisted of 690 people chosen from seven clubs using the Q-Cochran formula and random category and clustering methods.

c) Tests applied

The instrument was the author-made FBBE questionnaire based on Kapferr's model (2008) for brand identification and Meller & Hansan's model (2006) on attitudinal and behavioral loyalty. The questionnaire had two segments of demographic characteristics and 54 questions of Likert 7 switched spectrum covering all related variables. Whole reliability was (CVI=0.87) and validity was surveyed by 2 pilot methods of test-retest and Chronbach that showed a score higher than 0.75 for 47 questions and lower than 0.75 for 2 questions, which were finally eliminated from the questionnaire.

d) Statistical processing

A total of 1000 questionnaires were distributed among fans in five stadiums and 690 were returned and used in the final analysis. First, data were analyzed for descriptive of mean, standard frequencies, percentiles and charts, then descriptive statistics was evaluated for all variables. Using KS showed that distribution was normal, and SPSS 20 was used for exploratory and confirmatory factor analysis. SPSS 20 software was used for descriptive statistics of all variables and determination of normality of distribution, and AMOS 20 was used for structural equation modeling.

Results

Table I reports demographic characteristics such as mean, standard deviation, minimum and maximum, and Table II shows the descriptive index of brand identity and loyalty on brand variables

To test the impact of brand identity on attitudinal and behavioral brand loyalty in Iranian Super League fans, the structural equation model was used. The calculations were performed with the AMOS software. First, the overall fit of the model was evaluated and then, the hypotheses were tested. For the overall fit of the model, two indicators of absolute, comparative and parsimonious fit were investigated. The statistical value of chi-square was 576.53 and the significance level was 0.059 due to the significant level of chi-square, being higher than 0.05; it results that the collected data stand in line with the theorical model of research. The goodness of fit index (GFI) was 0.975, which is considered as a desired amount for GF. The root mean square error of approximation (RMSEA) was 0.04, less than 0.07, which is desired and confirms the research model. Also, the Tucker-Lewis index (TLI) was 0.932; the comparative fit index (CFI) was 0.907 and PNFI was

Table I

Descriptive index of demographic variables.

Index Variable	Mean	SD	Minimum	Maximum
Age	32.45	7.305	20	63
Fandom history	9.18	4.413	3	22
Number of attendances in desired team's matches	7.41	3.024	1	18

Table II

Descriptive index of brand identity and loyalty on brand variables.

Index / Variable	N	Mean	SD	Kurtosis	Skewness	Minimum	Maximum
Brand Identity	690	4.9954	1.14709	-.425	-.183	2.35	7.00
Tangible identity	690	5.1940	1.05432	-.295	-.234	2.67	7.00
Intangible Identity	690	4.7417	1.39075	-.505	-.247	1.83	7.00
Brand Loyalty	690	5.2390	1.06105	-.160	-.403	2.75	7.00
Attitudinal loyalty	690	5.1830	.90405	-.451	.111	3.50	7.00
Behavioral loyalty	690	4.7912	1.31984	-.381	-.234	2.00	7.00

0.637, all of which indicate a desired level and confirm the research model. Therefore, generally, the model is valid for arguing the relation between the variables (Table III).

The modeling results are shown in Table IV. The results show that tangible identity had a significant positive effect on the attitudinal loyalty of Iranian Football Super League fans - with an estimated coefficient 0.672, a standard estimated coefficient 0.642, critical ratio 13.45, and significance 0.001. Tangible identity had a significant positive effect on the behavioral loyalty of Iranian Football Super League fans - with an estimated coefficient 0.703, a standard estimated coefficient 0.613, critical ratio 13.20, and significance 0.001.

Intangible identity had a significant positive effect on the behavioral loyalty of Iranian Football Super League fans - with an estimated coefficient 0.207, a standard estimated coefficient 0.241; critical ratio 6.67, and significance 0.001. Intangible identity did not have a significant effect on the attitudinal loyalty of Iranian Football Super League fans - with an estimated coefficient 0.051, a standard estimated coefficient 0.065, critical ratio 1.80, and significance 0.072.

A structural equation model was developed for the effect of brand identity on loyalty to brand in Iranian Super League fans. The statistical value of chi-square was 3.65 and the significance level was 0.061, due to the significant level of chi-square, being more than 0.05; it results that the collected data stand in line with the theorical model of research. The goodness of fit index (GFI) was 0.986, which is considered as a desired amount for GF. The root mean square error of approximation (RMSEA) was 0.051, less than 0.07, which is desired and confirms the research model. Also, the Tucker-Lewis index (TLI) was 0.91; the comparative fit index (CFI) was 0.985 and PNFI was 0.564, all of which indicate a desired level and confirm the research model. Therefore, generally, the model is valid for arguing the relation between variables (Table V).

Table VI shows the results of model analysis. The results show that brand identity had a significant positive effect on loyalty to brand - with an estimated coefficient 0.571, a standard estimated coefficient 0.748, critical ratio 14.17, and significance 0.001. Also, based on the significant positive effect of brand identity on the behavioral loyalty of Iranian Super League fans - estimated coefficient 0.672 and standard estimated coefficient of identity factors and loyalty factors higher than 0.4 - it can be concluded that the aforementioned factors can explain the total score of identity and loyalty.

Discussions

The results showed that brand identity had a significant

Table III

Structural equation model fit indexes.

Model fit index		Rate	Criterion	Interpretation
Absolute	x^2	165 with 576.53 df		
	p value	0.059	Higher than 0.05	Good fit
	Goodness-of-fit index	0.975	Higher than 0.90	Good fit
Comparative	Tucker-Lewis index	0.932	Higher than 0.90	Good fit
	Comparative fit index	0.907	Higher than 0.90	Good fit
Parsimonious	Root mean square error of approximation	0.04	Lower than 0.07	Good fit
	Parsimonious normal fit index	0.637	Higher than 0.50	Good fit

Table IV

Regression estimation and significance tests.

Independent variable		Dependent variable	Estimate	S.E.	C.R.	P	Standard estimate
Tangible identity	--->	Attitudinal loyalty	.672	.050	13.450	.001	.642
Tangible identity	--->	Behavioral loyalty	.703	.053	13.201	.001	.613
Intangible identity	--->	Behavioral loyalty	.207	.031	6.667	.001	.241
Intangible identity	--->	Attitudinal loyalty	.051	.028	1.799	.072	.065

Table V

Structural equation model fit indexes for all scores.

Model fit index		Rate	Criterion	Interpretation
Absolute	x^2	3.65 with 1 df		
	p value	0.061	Higher than 0.05	Good fit
	Goodness-of-fit index	0.986	Higher than 0.90	Good fit
Comparative	Tucker-Lewis index	0.910	Higher than 0.90	Good fit
	Comparative fit index	0.985	Higher than 0.90	Good fit
Parsimonious	Root mean square error of approximation	0.051	Lower than 0.07	Good fit
	Parsimonious normal fit index	0.564	Higher than 0.50	Good fit

Table VI

Regression estimation and significant tests for total scores

Independent variable		Dependent variable	Estimate	S.E.	C.R.	P	Standard estimate
Identity	--->	Loyalty	.571	.040	14.170	.001	.748
	--->		1.000				.844
Tangible identity	--->	Identity	.690	.042	16.282	.001	.648
	--->		1.000				.784
Behavioral loyalty	--->	Loyalty	1.450	.061	23.698	.001	.980

positive effect on the loyalty of Iranian Football Super League fans. These results suggest that with enforcement of brand identity, brand loyalty will increase significantly. The amount of the total standardized effect of the brand identity factor on brand loyalty was 0.748. In other words, for one unit change in the standard deviation of the brand identity factor, the loyalty amount changes into 0.748. This is in line with the results of Javaheri Kamel & Kosarneshan (2011); Dehdashti Shahrokh et al. (2012); Gladden & Funk (2002); Bauer et al. (2005); Alexandris et al. (2008); Koo (2009), and Schade & Burmann (2010). Moshabbaki et al. (2013) in the research "Planning brand identity pattern of Iran's sport industry; case study of football super league" state that football is an industry for which branding and brand identity have an extraordinary importance, in which developed football countries have special brand patterns. In this research, the author presents a pattern of brand identity factors of Iranian Football Super League teams in relation to new brand identity theories and patterns of some developed football countries; Germany, Spain, France and South Korea, along with comments and viewpoints of experts and fans, and finally, ten dimensions determined for Iranian Football Super League. All these dimensions were expressed more widely by Gladden & Funk (2002). The result of this study is not in line with that of Moshabbaki et al. (2013), who neglected Kapferer's (2008) comprehensive brand identity model that considered identity in two dimensions of being tangible and intangible.

The results showed that tangible identity had a significant positive effect on the fans' attitudinal loyalty (estimated coefficient 0.672, standardized estimated coefficient 13.45 and significance level 0.001) and behavioral loyalty (estimated coefficient 0.703, standardized estimated coefficient 0.613, critical ratio 13.20, and significance level 0.001). Tangible identity involves subscales of appearance, relation and reflection. According to the results, if apparent traits, gestures and objective schemes are reinforced in a way that leads to a continuous and positive attitude toward the football brand and have a positive distinction in relation to the brand, so that the brand is used again by the person who finally transforms into an active and loyal fan, successful brand management takes place. These results are in line with the following studies: Jamali Nejad (2007); Gylaninia & Mousavian (2010); Dehdashti Shahrokh et al. (2012); Javaheri Kamel & Kosarneshan (2011); Shah Hoseyni et al. (2011); Ebrahimi et al. (2012), and Moshabbaki et al. (2012) in Iran, and Gladden & Funk (2001); Gwinner & Swanson (2003); Gwinner & Bennett (2008); Anonymous (2009); Koo (2009); Broadbent et al. (2010); Schade & Burmann (2010); Cui (2011).

The evaluated intangible identity effect on the Iranian Football Super League fans' behavioral loyalty was positively significant (estimated coefficient 0.207, standardized estimated coefficient 0.241, critical ratio 6.67, and significance level 0.001), but the effect of intangible identity on attitudinal loyalty was not significant (estimated coefficient 0.051, standardized estimated coefficient 0.065, critical ratio 1.80, and significance level 0.072). Intangible identity includes subscales of personality, culture and self-image. Acquainted personality by football brand, brand culture between public and football brand self-expression could create an intangible identity between fans in this research and it would lead to continuous participation and real loyalty of fans. This result is not in line with the results of Moshabbaki et al. (2013), but favors the results of Jamali Nejad (2007); Gylaninia & Mousavian (2010); Dehdashti Shahrokh et al. (2012); Javaheri Kamel & Kosarneshan (2011); Shah Hoseyni et al. (2011) and Moshabbaki et al. (2013) in Iran, and Gladden & Funk (2002); Gwinner & Swanson (2003); Gwinner & Bennett (2008); Anonymous (2009); Koo (2009); Broadbent et al. (2010); Schade & Burmann (2010); Cui (2011).

Dehdashti Shahrokh et al. (2013) consider brands with a strong identity as a formula for long term relations between customer and corporation, resulting in loyalty. Unlike other brand management approaches, the conceptualization and transformation of the identity approach takes place with managers and executive agents, which means that the development of this approach increasingly depends on functional experiences gained from using the brand concept as a management instrument (Khodadad Hosseini & Rezvani, 2012).

Ross (2006) considers that all concepts of the branding area are based on tangible and handmade goods, while sport services are intangible and decaying. Berry (2000) believes that sport services are intangible, not packaged and have no label, so that brand relies on organization instead of a relation with the product. Most of the authors believe that consumers who strongly relate to a brand need less advertisement (Khodadad Hosseini & Rezvani, 2012).

Conclusions

1. Brand identity is the explanation and description of brand and consists of a name, brand visual traits – logo, color, font, etc. In brand identity, it is determined that clients should have a certain feeling toward the brand. Due to this, brand identity is an instrument to identify clients and demonstrate the brand differentiation aspect. Brand identity is an indicator of brand association and company tendencies to formulate this identity in the mind of clients.

2. Brand identity is formulated by corporate managers, while brand image is an indicator of the customer's brand perception. The aim of management is to equalize brand identity and brand image. In this respect, a high level of brand awareness and a positive brand image have a special role in price setting and developing advertisement activities so that a positive image enables the brand to gain more intangible profit and enhance flexibility and resistance against price increase. Fans with a strong attitude toward sport brand tend to pay more for the brand. On the other hand, brand loyalty is the ultimate purpose of corporations which possess a product with a special brand. The fans' priority of participating in sport events of their desired club is named sport brand loyalty. Fans must perceive that their desired football club's brand offers them a plan and combination of safe service containing levels of qualities with appropriate price. This perception is the basis of repeated attendance by fans. At the beginning, fans may show themselves as the club's fans and then the satisfaction with being fans makes them repeat attendance and tend to continue loyalty.

3. Brand identity refers to the quality and properties

of a brand; neglecting its subscales in football may bear damage to the club, although it may not affect financial balance or the loyalty of fans. Brand identity structure becomes more relevant day by day in brand management, because it potentially has the ability to enforce competitive strength. Nowadays, many corporations create and manage identity in order to make sure that brand identity presents a precise set of values, abilities and exclusive suggestions. Brand identity can be tangible and intangible. Tangible identity includes appearance, relation, reflection subscales, and intangible identity includes personality, culture and self-image subscales.

4. Tangible identity has internal approaches to surveying identity. From the internal aspect, identity derives all its dimensions of strategic decision such as relations, brand development, brand architecture, association. Thus, football club management must spend considerable time developing tangible brand identity. With this explanation, the reinforcement and evolution of Iranian football clubs with the support of loyal fans is ascending and at least leads to the improvement of Iranian sport industry management marketing activities. It means that in the sport area, the club's name and reputation has an effect on the consumer and the consumer's perception, and from the customer's viewpoint, the club's reputation indicates the quality of its services.

5. Reinforcement of the football brand intangible identity has an impressing effect on the brand. A famous and familiar football brand could submit its brand right to another corporation for use on their products. Brand identity could duplicate the power of attracting fans.

Conflicts of interest

There are no conflicts of interest.

References

Aaker DA. Managing brand equity: Capitalizing on the value of a brand name. NY: The Free Press,1991.

Alexandris K, Douka S, Papadopoulos P, Kaltsatou A. Testing the Role of Service Quality on the Development of Brand Associations and Brand Loyalty. Managing Service Quality, 2008;18(3): 239-255.

Anonymous F. Fan loyalty measured; a study by Dentsu Sports, A division of Dentsu, says there are four factors that help people decide team loyalties: Energy (PE), Human factor (HF); Performance and Engagement. Business Today, 2009.

Bauer HH, Stokburger-Sauer NE, Exler S. Brand. Image and Brand Loyalty in Professional Team Sport: A Refined Model and. Empirical Assessment. J Sport Manag, 2008;22(2):206-226.

Berger J, Heath C. Where consumers diverge from others: Identity signaling and product domains. J Consumer Res, 2007;34(2):121-134.

Bhattacharya CB, Sen S. Consumer-company identification: A framework for understanding consumers' relationships with companies. J Marketing, 2003;67(2):76-88.

Bridgewater S. Football Brands. Warwick Business School, University of Warwick, UK. Printed and bound in Great Britain by CPI Antony Rowe, Chippenham and Eastbourne, 2010.

Broadbent S, Bridson K, Ferkins Lesley, Rentschler R. Brand Love, Brand Image and Loyalty in Australian Elite Sport. J Internat Market, 2010;17(3):71-86.

Broadbent S. Bridson K. Ferkins L. Rentschler R. Brand Love, Brand Image and Loyalty in Australian Elite Sport. J Internat Market, 2010;17(3):71-86.

Cui W. Creating Consumer-Based Brand Equity in the Chinese Sports Shoes Market: Measurement, challenges and opportunities. A thesis submitted for the degree of Master of Science in International Marketing, Aalborg University; 2011.

De Chernatony L, McDonald MHB. Creating powerful brands. Oxford: Butterworth-Heinemann Ltd, 1994.

Dehdashti Shahrokh Z, Jafarzadeh Kanari M, Bakhshizadeh Alizadeh. Viewpoints their social identity and its role in developing brand loyalty (Case Study: hat company producing dairy products). New Market Res, 2013;2 (2):87-105.

Dutton JE, Dukerich JM, Harquail CV. Organizational images and member identification. Admin Sci Quart, 1994;39:239-263.

Ebrahimi A, Khalifeh M, Samizadeh M. A survey on effect of brand identity's psychological processes and brand personality on brand loyalty. Comm Manag Sport J, 2012; 12:189-208.

Geçti F, Zengin H. The Relationship between Brand Trust, Brand Affect, Attitudinal Loyalty and Behavioral Loyalty: A Field Study towards Sports Shoe Consumers in Turkey. Int J Market Stud, 2013; 5(2):111-119.

Geuens M, Weijters B, Wulf K. A new measure of brand personality. Int J Res Market, 2009; 26:97-107.

Gladden JM, Funk DC. Developing an Understanding of Brand Associations in Team Sport: Empirical Evidence from Consumers of Professional Sport. J Sport Manag, 2002;16 (1):54-81.

Gladden JM, Funk DC. Understanding brand loyalty in professional sport: Examining the link between brand associations and brand loyalty. Int J Sports Market & Sponsorship, 2001;3(2):67-94.

Gwinner K, Bennett G. The impact of brand cohesiveness and sport identification on brand fit in a sponsorship context. J Sport Manag, 2008;22(4):410-426.

Gwinner K, Swanson SR. A model of fan identification: Antecedents and sponsorship outcomes. J Serv Market, 2003;17(3):275-294. doi:10.1108/08876040310474828.

Gylaninia S, Mousavian SJ. The effect of brand loyalty and brand equity of the bank card from the customer perspective letter. Industr Manag, 2010; 5 (14):Ss103-119.

Hansen H, Samuelsen BM, Silseth PR. Customer perceived value in B-2-B service relationships: Investigating the importance of corporate reputation. Industr Market Manag, 2008; 37(2):206-217.

Harris F, de Chernatonay L. Corporate branding and corporate brand performance. Eur J Market, 2001;35(3/4):441-456.

Jamali Nejad. S. reviewing existing RabthY and how the product involvement on the brand loyalty in mobile GvshyHay MsrfKnndgan, 2007. Proceedings of the international conference held in Tehran, 2007, Tehran.

Javaheri Kamel M, Kosarneshan MR. Brand identity check backgrounds and consequences (Case Study: Brand Hacoupian), Proceedings of the Sixth International Conference held in Tehran, 2011, Tehran.

Kapferer JN. Strategic brand management: creating and sustaining brand equity long term. (2nd) Ed. Kogan Page Limited, London, 1997.

Kapferer JN. The new strategic brand management. 4th edition London: Kogan Page, 2008.

Khodadad Hosseini SH, Rezvani M. Brand Management, schools, evaluation and development of national brand, Publications Office of Cultural Research, Printing, Tehran, 2012, 52-77.

Koo JJ. Brand Management Strategy for Korean Professional Football : A Model for Understanding the Relationships between Team Brand Identity, Fans' Identification with Football Teams, and Team Brand Loyalty Teams. A thesis submitted for the degree of Doctor of Philosophy, School of Engineering and Design, Brunel University, 2009.

Laforet S. Managing brands: A contemporary perspective. McGraw-Hill Education, London, 2010.

Lu J, Kadan J, Boatwright P. The dirt on bikes: An illustration of CART models for brand differentiation. J Product & Brand Manag, 2008;17(5):317-326.

Meller JJ, Hansan T. An empirical examination of brand loyalty. J Product & Brand Manag, 2006; 15(7):442-449.

Moshabbaki Esfahani, A., Vahdati. H., KhodadaHosseini, S., Ehsani, M., (2013). Planning brand identity model of Iran sport industry (), Management studies journal (Case study: Iranian Footbal Super League), period 17, vol. 4, pp 201-220.

Ozanian MK. The business of soccer. Forbes, 2005;4:25-34.

Perrier R. Brand Valuation. Premier Books, London, 1997.

Ross SD. A conceptual framework for understanding spectator-based brand equity. J Sport Manag, 2006;20(1):22-38.

Ruvio A. Unique like everybody else? The dual role of consumers' need for uniqueness. Psychol Market, 2008;25(5):444-464.

Schade M, Burmann C. The brand image of professional sport teams - an analysis of relevant brand benefits and the relevance of brand personality. Research Paper Submitted to The Thought Leaders International Conference on Brand Management Lugano, 2010,18-20th April.

Sen S, Bhattacharya CB. Does doing good always lead to doing better? Consumer reactions to corporate social responsibility. J Mark Res, 2001;38(2):225-243.

Shah Hoseyni MA, Ekhlasi A, Rahmani K. Service brand equity and customer purchase behavior. Market Res, 2011;1(3):Ss63-77.

Shirazi A, Lorestani HZ, Mazidi AK. Investigating the Effects of Brand Identity on Customer Loyalty from Social Identity Perspective. Ir J Man St (IJMS), 2013; 6(2):153-178.

Sutton WA, McDonald MA, Milne GR, Cimperman J. Creating and fostering fan identification in professional sports. Sport Market Quarterly, 1997;6(1):15-22.

Vignoles VL, Chryssochoou X, Breakwell GM. The distinctiveness principle: Identity, meaning, and the bounds of cultural relativity. Personal Soc Psychol Rev, 2000;4(4):337-354.

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 125–131

The relationship between the school principals' collaborative leadership style and teachers' self-efficacy

Relaţia dintre stilul de leadership colaborativ al directorilor de şcoală şi eficacitatea de sine a profesorilor

Abdolhamid Arbabi, Vali Mehdinezhad
University of Sistan and Baluchestan Zahedan, Faculty of Education and Psychology, Iran

Abstract

Background. Collaborative leadership is one of the leadership styles which promote and develop organizations. Collaborative leadership is defined as the participation of employees in different levels in the organization to identify problems, analyze situations and achieve solutions, so that they can assist their managers and headquarters in solving problems.

Aims. The purpose of this study was to determine the relationship between the school principals' collaborative leadership style and teachers' self-efficacy.

Method. In this study, the descriptive method was used. 196 subjects (82 female and 114 male) were selected by using Korjeci and Morgan's (1970) sample size table. Sampling was stratified and simple. The Tschannen-Moran and Woolfolk Hoy (2002) self-efficacy questionnaire and Washington University Turning Point Collaborative Leadership Questionnaires (2012) were used to gather data. Frequency, mean, standard deviation, correlation and regression were used to analyze data.

Results. The findings showed a significant correlation between the school principals' collaborative leadership style and teachers' self-efficacy. There was a significant correlation between other dimensions of collaborative leadership including training environment, clarity, reliance, power sharing and teachers' self-efficacy. The results also show that reliance has a positive and predictable effect on the teachers' self-efficacy; in fact increasing reliance leads to the teachers' self-efficacy increment.

Conclusions. The use of situations and leadership style preference is recommended to increase assessing the environment. It is recommended to broadcast the results to managers, because this is an important step to promote the quality of organization and managers' motivation toward consulting leadership.

Keywords: collaborative leadership, self-efficacy, teachers.

Rezumat

Premize. Colaborarea în leadership este unul dintre stilurile de conducere, care promovează şi dezvoltă organizaţii. Acest stil de conducere este definit de către angajaţi ca fiind o modalitate de intervenţie pe diferite niveluri pentru a identifica problemele şi pentru a analiza situaţia dând anumite soluţii, astfel încât angajaţii să-şi poată ajuta managerii în vederea rezolvării de probleme.

Obiective. Scopul acestui studiu a fost de a determina relaţia dintre "stilul" de conducere al directorilor de şcoli şi auto-eficacitatea cadrelor didactice.

Metode. În acest studiu a fost utilizată metoda descriptivă. Au fost selecţionaţi 196 subiecţi (82 femei şi 114 bărbaţi), folosind Korjeci dimensiunea de masă (1970) şi proba Morgan. Eşantionarea a fost stratificată şi simplă. Chestionarul de auto-eficacitate Tschannen-Moran şi Woolfolk Hoy (2002), de la Universitatea Washington Turning Point (2012) a fost folosit pentru a aduna datele. Pentru analiza datelor au fost utilizate: frecvenţa, abaterea medie standard, corelaţia şi regresia.

Rezultate. Au arătat o corelaţie semnificativă între "stilul de conducere de colaborare a directorilor de şcoli şi auto-eficacitatea cadrelor didactice. Nu s-a constatat o corelaţie semnificativă între alte dimensiuni ale leadership-ului de colaborare, inclusiv mediul de formare, claritatea, încrederea, împărţirea puterii şi auto-eficacitatea profesorilor. De asemenea, rezultatele au arătat că dependenţa are un efect pozitiv şi previzibil asupra auto-eficacităţii profesorilor, de fapt, creşterea dependenţei duce la auto-eficacitatea profesorilor.

Concluzii. Se recomandă utilizarea situațiilor și preferințelor stilului de conducere pentru a creşte evaluarea mediului. Se recomandă să se disemineze rezultatele managerilor, deoarece acesta este un pas important pentru a promova calitatea de organizare și motivația managerilor pentru o conducere consultativă.

Cuvinte cheie: conducere în colaborare, auto-eficacitate, profesori.

Received: 2015, March 16; *Accepted for publication:* 2015, April 10;
Address for correspondence: Faculty of Education and Psychology, University of Sistan and Baluchestan, University Boulevard, P.O. Box 98155-987, Iran
E-mail: h2arbabi@yahoo.com & valmeh@ped.usb.ac.ir
Corresponding author: Vali Mehdinezhad

Introduction

Collaborative leadership is one of the leadership styles which promote and develop organizations. Collaborative leadership is defined as the participation of employees in different levels in the organization to identify problems, analyze situations and achieve solutions, so that they can assist their managers and headquarters in solving problems. In recent years, the human factor has become central in organizations. In the current world, traditional thought turns to new arenas and human collaboration is focused. Studies on organizational leadership show that organizations that move toward promoting human forces and human collaboration have a better development compared to other organizations. In addition, changes in the new world regardless of their nature are most important issues. On the other hand, society is increasingly changing, the increase of population, inventions, exploration, communication ways and individual knowledge lead to environmental evolution. Physical education and exercise lead to knowledge and science development and have created a lot of changes.

Such changes have influenced organizational procedures regarding physical education and exercise. Therefore, under these circumstances, managers try to prepare organizations to deal with environmental reactions. Arranging goals and improving procedures are needed for the survival of organizations. Organizations cannot survive in the absence of change, so creativity and innovation are required. In 1947, Kurt Lewin was the first to apply the cooperative system as a scientific method to individual nutrition in the US. He encouraged people to actively work together to change the procedure, to overcome their resistance against changes and move toward a consistent way (quoted in Marrow, 1969). This study investigated effective resources of future teachers. Most of the organizations use a cooperative leadership style, employee-oriented methods and problem solving to protect productivity against changes. Jackson (1983) conducted a study entitled "Effect of cooperation on decision-making and decreasing job pressure" and showed that cooperation has a negative effect on confliction and individual participation in decision-making is determinant of job pressure. The results of Fine's study (1986) evidence that employee participation is one of the ways to deal with changes. Also, Miller & Mange (1986) show that cooperative leadership increases satisfaction, decision-making and performance improvement, but this is not common.

Hoy et al. (2006) maintain that employee engagement in cooperative decisions lead to an increase in the quality of decision acceptance. According to Rice (1995), cooperation plays an important role in accepting changes and technological evolution.

Mirkamali (1997) shows that teachers' cooperation in school decreases absence, ignoring work, and resistance against changes. Also, teachers' cooperation increases their motivation. Clark (1997) shows that acceptance capacity and resistance against change do not reflect each other and there is no correlation between acceptance and resistance against changes and organization efficiency. Taghvaei (1996) evidences a significant correlation between resistance against changes and organizational culture components such as encouragement and rewarding, cooperation, coherence and control. According to Baker's results quoted by SarAbadani (2007), employee cooperation is important for the organization's work quality. In addition, supervision on programs by employees increases communication and is positive, so their motivation is also increased.

Roshandel (2003) reports that employee motivation is increased by the development of cooperative leadership in the organization. Habibi (2004) maintains that increasing cooperative leadership in the organization leads to higher organizational commitment and lower resistance against changes. Sheikhlo-Aghdam (2004) evidences a positive correlation between cooperative culture and strategic planning, so that by increasing employee's participation in strategic planning, coherent programs would be formed and individual commitment to these programs would increase. Nazari-Komishani (2005) shows that increasing cooperative leadership in the organization results in a decrease of decision-making focus and complexity in the organization.

According to Parnet (2006), cooperation plays an important role in the work environment and is related to consistency and adaptability. O'Brien (2002) shows in a study entitled "Key cooperation to successful changes" that employee cooperation and engagement play a key role in accepting changes. Based on available articles and study results, cooperative leadership is an approach that meets human needs regarding respect and equality. Human resource development is caused by a cooperation process. Increasing employee cooperation facilitates coping with environmental changes and improves decision-making; finally, human communication between employees and leaders is improved. The importance of training efficiency and its understanding by teachers should be studied.

Given the importance of self-efficacy for future teachers, this study investigated effective resources of future teachers. Starting from the four Bandura resources related to efficacy, including performance and skill, intentional experience, social and verbal satiation and physiological situation, the author studied other resources influencing teachers' efficacy. Ghasemi (2009) conducted a study in Melli Bank - Alborz to investigate the correlation between leadership style and employee efficacy. The results of the study show a significant correlation between all three leadership styles including evolutional, exchange and cooperative style and self-efficacy, of level 0.01.

Nazari-Komishani (2005) shows that increasing cooperative leadership in the organization leads to decreasing decision-making focus, formality and complexity in the organization. In this regard, according to Habibi (2004), increasing cooperative leadership in the organization increases organizational commitment and decreases employee resistance against changes. Sheikhlo-Aghdam (2004) evidences a positive correlation between cooperative culture and strategic planning, so that increasing employee cooperation leads to an improvement of strategic planning. Mirkamali (1996) shows that teachers' cooperation in school decreases absence, ignoring work and resistance against changes. Also, teachers' cooperation in decision-making increases motivation. Fallahi (1995) studied informal and cooperative leadership

style in relation to mental health in employees working in an industrial institution in Shiraz. He concluded that employee participation in job related affairs increased employee motivation.

Hassani (1994) studied job relations, job satisfaction, organizational commitment, the tendency to stay in the job and job performance, concluding that teachers should be satisfied and increase their commitment to stay in their job. On the other hand, job satisfaction, organizational commitment and effective return in the job and education should be broadcasted by school decision-making, and financial reward and educational facilites should be provided. Rice (1995) studied the role of cooperation in accepting change in a textile company. Clark (1997) evidenced a significant correlation between acceptance of and resistance against change and organizational components such as rewarding, coherence, and cooperation and control (Taghvaei, 1996).

Shin (1991) studied the job satisfaction and job commitment of teachers in the United States and concluded that job satisfaction and job commitment are different and job satisfaction prevails over job commitment. This study shows that managers should provide job satisfaction first and then create commitment in the organization for employees.

Hypothesis

The purpose of this study is to determine the correlation between a cooperative leadership style in school principals and teacher efficacy to use instructional strategies, classroom management and student engagement. In this regard, there are some hypotheses.

- There is a significant correlation between the assessing the environment dimension of the principals' collaborative leadership style and teachers' self-efficacy (instructional strategies, classroom management, and student engagement).
- There is a significant correlation between the creating clarity dimension of the principals' collaborative leadership style and teachers' self-efficacy (instructional strategies, classroom management, and student engagement).
- There is a significant correlation between the building trust dimension of principals' collaborative leadership and teachers' self-efficacy (instructional strategies, classroom management, and student engagement).
- There is a significant correlation between the sharing power and influence dimension of the principals' collaborative leadership style and teachers' self-efficacy (instructional strategies, classroom management, and student engagement).
- There is a significant correlation between the developing people dimension of the principals' collaborative leadership style and teachers' self-efficacy (instructional strategies, classroom management, and student engagement).
- There is a significant correlation between the self-reflection dimension of the principals' collaborative leadership style and teachers' self-efficacy (instructional strategies, classroom management, and student engagement).
- Principals' collaborative leadership styles can predict teachers' self-efficacy.

Materials and methods

The research protocol

a) Period and location of the research

The research was conducted between February and May 2014, among primary school teachers in Fenoj, Iran. We should mention that this research was formally approved by the Ethics Commission of the Department of Education. Also, for studies conducted on human subjects, the informed consent of each of the subjects involved in the research was obtained.

b) Subjects and groups

In this study, the descriptive method was used. The target population of this study was represented by primary school teachers in Fenoj, Iran. There were 360 teachers including 151 females and 209 males. Korjeci and Morgan tables (1970) were used to determine the sample size, so 196 subjects were selected, of which 82 female and 114 male. Simple sampling was used. Table I shows the teachers' status according to sex, age, academic degree, and job experience.

Table I
Details of the sample (N=196)

Variable	Group	N
Sex	Male	114
	Female	82
Age	-35	80
	35 - 45	72
	+45	44
Academic degree	Associate degree	59
	Bachelor's degree	100
	Master's degree	37
Job experience	-10	107
	10-15	56
	+10	33

c) Tests applied

The Tschannen-Moran & Woolfolk (2002) self-efficacy questionnaire and Washington University Turning Point Collaborative Leadership Questionnaires (2012) were used to gather data. The first section of the questionnaire includes general questions such as age, sex, work experience and education level. The first questionnaire includes 24 items in three components, using instructional strategies, classroom management and student engagement. The second questionnaire includes 64 items in six aspects: assessing the environment, creating clarity, building trust, sharing power and influence, developing people and self-reflection with items 10, 11, 11, 11, 11 and 10. They were arranged in five Likert points from very low = 1 to very high = 5. Cronbach's alpha results are presented in Table II.

Table II
Reliability coefficient of research questionnaires.

Questionnaire	Dimension	α
Teacher self-efficacy	Instructional Strategies	0.7I
	Classroom Management	0.71
	Student Engagement	0.80
	Total	0.88
Cooperative leadership questionnaire	Assessing the Environment	0.70
	Creating Clarity	0.67
	Building Trust	0.78
	Sharing Power and Influence	0.83
	Developing People	0.79
	Self-Reflection	0.68
	Total	0.84

d) Statistical processing

Frequency, average, standard error, the correlation coefficient test and regression were used to analyze data using SPSS software version 20.

Results

Is there a correlation between the principals' collaborative leadership style and teachers' self-efficacy? (Table III).

The table III shows the correlation coefficient test and results evidence a significant correlation between the school principals' collaborative leadership style and teachers' self-efficacy. Value r is (r = 0.248) and is significant at alpha level 0.05. Also, the direction of the correlation is positive and direct. It means that a highly collaborative style leads to high teachers' self-efficacy.

Table III

Pearson correlative index test between the collaborative leadership style and teachers' self-efficacy (N=196).

Variables		Teachers' self-efficacy
Collaborative leadership	r	0.248
	Sig.	.001

Is there a correlation between the principals' collaborative leadership style and teachers' self-efficacy using instructional strategies, classroom management, and student engagement? (Table IV).

The table IV shows the correlation coefficient test and results evidence a significant correlation between the school principals' collaborative leadership style and teachers' self-efficacy in the assessing the environment dimension. Value r is significant at alpha level 0.05. Also, the direction of the correlation is positive and direct. It means that a highly collaborative style leads to high teachers' self-efficacy. However, there is no significant correlation between the school principals' collaborative leadership style in the assessing the environment dimension and the influence of instructional strategies (Table IV).

Is there a correlation between the principals' collaborative leadership style and teachers' self-efficacy in the creating clarity dimension using instructional strategies, classroom management, and student engagement? (Table V).

The table V shows the correlation coefficient test and results evidence a significant correlation between the school principals' collaborative leadership style and teachers' self-efficacy in the creating clarity dimension. Value r is 0.144 and is significant at alpha level 0.05. Also, the direction of the correlation is positive and direct. It means that a highly collaborative style leads to high teachers' self-efficacy in the creating clarity dimension.

Is there a correlation between the principals' collaborative leadership style and teachers' self-efficacy in the reliance dimension using instructional strategies, classroom management, and student engagement? (Table VI)

The table VI shows the correlation coefficient test and results evidence a significant correlation between the school principals' collaborative leadership style and teachers' self-efficacy in the building trust dimension. Value r is significant at alpha level 0.05. Also, the direction of the correlation is positive and direct. It means that a highly collaborative style leads to high teachers' self-efficacy in the building trust dimension. However, there is no correlation with the influence of instructional strategies.

Is there a correlation between the principals' collaborative leadership style and teachers' self-efficacy in the power sharing dimension using instructional strategies, classroom management, and student engagement? (Table VII)

The table VII shows the correlation coefficient test and results evidence a significant correlation between the school principals' collaborative leadership style and teachers' self-efficacy in the sharing power and influence dimension. Value r is significant at alpha level 0.05. Also, the direction of the correlation is positive and direct. It means that a highly collaborative style leads to high

Table IV

Pearson correlative index test between the collaborative leadership style in assessing the environment dimension and teachers' self-efficacy (N=196).

Effect on self-efficacy (total)	Student engagement	Classroom management	Instructional strategies		Variable
0.194	0.142	0.175	0.113	r	Assessing the
0.007	0.047	0.014	0.116	Sig.	Environment

Table V

Pearson correlative index test between the collaborative leadership style in the creating clarity dimension and teachers' self-efficacy (N=196)

Effect on self-efficacy (total)	Student engagement	Classroom management	Instructional strategies		Variable
0.172	0.144	0.117	0.117	r	Creating Clarity
0.016	0.044	0.102	0.102	Sig.	

Table VI

Pearson correlative index test between the collaborative leadership style in the building trust dimension and teachers' self-efficacy (N=196)

Effect on self-efficacy (total)	Student engagement	Classroom management	Instructional strategies		Variable
0.224	0.205	0.199	0.100	r	Building Trust
0.002	0.004	0.005	0.161	Sig.	

teachers' self-efficacy in the sharing power and influence dimension. However, there is no correlation with the influence of classroom management.

Is there a correlation between the principals' collaborative leadership style and teachers' self-efficacy in the professional development dimension using instructional strategies, classroom management, and student engagement? (Table VIII)

The table VIII shows the correlation coefficient test and results evidence no significant correlation between the school principals' collaborative leadership style and teachers' self-efficacy in the developing people dimension. Value r is not significant at alpha level 0.05.

Is there a correlation between the principals' collaborative leadership style and teachers' self-efficacy in the self-reflection dimension using instructional strategies, classroom management, and student engagement? (Table IX)

The table IX shows the correlation coefficient test and results evidence no significant correlation between the school principals' collaborative leadership style and teachers' self-efficacy in the self-reflection dimension. Value r is not significant at alpha level 0.05. In conclusion, there is no correlation between the principals' collaborative leadership style and teachers' self-efficacy in the self-reflection dimension using instructional strategies, classroom management, and student engagement.

Which one of the principals' collaborative leadership styles can predict teachers' self-efficacy? (Table X)

The beta table X shows the final results of regression and using the table, a regression line equation is drawn: (Building Trust), 85.60 + 0.379 = teachers' self efficacy.

The results of the above table show that building trust has a predictable and significant effect on teachers' self-efficacy. Also, based on the beta value, by increasing building trust by one unit, teachers' self-efficacy is increased by 0.224. So, it is concluded that the effect on teachers' self-efficacy is high, while other dimensions have a low effect and were removed from the regression model (Tables X, XI).

Teachers' self-efficacy= 85.60 + 0.379 (Building Trust)

Discussions

The results of the study show a significant positive correlation between the collaborative leadership style of school principals and teachers' self-efficacy. This means that a highly collaborative style leads to an improvement of teachers' self-efficacy. This study is consistent with the studies of Ghasemi (2009), Moran and Hoy (2001), Mirkamali (1996), Hoy et al. (2006) and Fallahi (1995).

In fact, self-effective teachers have a high power to manage the classroom, they have creative skills to teach

Table VII

Pearson correlative index test between the collaborative leadership style in the sharing power and influence dimension and teachers' self-efficacy (N=196)

Effect on self-efficacy (total)	Student engagement	Classroom management	Instructional strategies		Variable
0.198	0.167	0.134	0.148	r	Sharing Power and Influence
0.005	0.019	0.060	0.039	Sig.	

Table VIII

Pearson correlative index test between the collaborative leadership style in the developing people dimension and teachers' self-efficacy (N=1).

Effect on self-efficacy (total)	Student engagement	Classroom management	Instructional strategies		Variable
-0.053	-0.033	0. 021	-0.0116	r	Developing People
0.462	0.643	0.072	0.011	Sig.	

Table IX

Pearson correlative index test between the collaborative leadership style in the self-reflection dimension and teachers' self-efficacy (N=196).

Effect on self-efficacy (total)	Student engagement	Classroom management	Instructional strategies		Variable
0.111	0.095	0.030	0.0101	r	Self-reflection
0.122	0.185	0.677	0.157	Sig.	

Table X

Multiple correlation coefficient (N=196).

Variable	R	R^2	Adj. R^2	df	F	Sig.
Building Trust	.224	.050	.045	1, 194	10.251	.002

Table XI

Standard and non-standard coefficients. Self-efficacy predicted by predictor variables in a stepwise manner (N=196).

Sig	t	Standard beta Beta	Abnormal beta Standard error	B	Regression model
0.001	15.81	-	5.41	85.60	Building Trust
0.002	3.20	0.225	0.118	0.379	

and in other words, such teachers increase education promotion among students. According to the studies of Poddel & Soodak (1993), Wolters & Daugherty (2007), the teacher plays an important role in successful education promotion in students. Martin & Marsh (2006) believe that motivation increases the energy level and activities in individuals, so they move toward a specific purpose and carry out specific activities. In fact, identifying the motivation concept and different incentives as well as their effects on the learning process helps teachers to apply better strategies and styles in their teaching. The results of studies performed by Anderson and Betz in 2001 show that teachers' confidence and power influence teachers' efficacy and increase self-efficacy beliefs. In fact, teachers who have decision-making power to achieve solutions and consult with their managers are highly effective (quoted by Tovvins, 2007). Based on studies, teachers' self-efficacy is correlated with performance results. Teachers who have a high self-efficacy provide reactive techniques in their classroom (Smylie, 1989) and achieve new ideas and innovations (Stein & Wang, 1988). Teachers with a higher self-efficacy communicate with students using all kinds of models (individual, group and team models) to respond to the students' requirements. Increasing self-efficacy improves performance and productivity (Bandura, 1997).

It seems that self-efficacy is directly related to the image in the individual's mind and reinforcing this image increases self-efficacy. Ashton & Webb (1986) report that teachers with a high self-efficacy have good skills to organize training, questioning, explanation, appropriate feedback to students, shortly, to improve student education promotion. The self-efficacy theory is useful for work environment. Based on this theory, individual motivation and performance could be increased by increasing teachers' self-efficacy. Bandura (1994) discussed about self-efficacy and increasing it from easy to difficult. Schools could apply this system to increase self-efficacy. Successful experience of teachers improves self-efficacy.

Conclusions

1. Today, schools need managers who provide training goals to increase motivation. Leadership includes change and effect, and this means how leaders can influence their followers. Effect is a critical component of leadership and schools are responsible for creating humans. Education of students who are society's future should be done by schools. Therefore, understanding self-efficacy and leadership and using a cooperative leadership style dramatically increase the teachers' self-efficacy as well as performance. Teachers' cooperation to control and supervise organizational affairs allows to inform teachers about weaknesses and to solve them, if changing is needed. When teachers participate in value determination, they could refer key and sensitive matters and accept changing.

2. Team work and cooperative leadership implementation allows to explore talents and decrease autocratic leadership. This leadership system is an effective and desirable system in theoretical and practical terms and at the moment has an appropriate situation in developing countries. Cooperative leadership plays a positive role, so it is necessary to implement it in organizations in order to solve problems and dysfunctions and continuously improve organizational activities. Since teachers' self-efficacy plays an important role in education, increasing motivation and education promotion in students, self-efficacy assessment when employing teachers is required. Given the teacher's role in managing the classroom, self-efficacy training courses for teachers need to be designed. The cooperative leadership style is useful, so it is necessary to employ managers who have good decision-making power and determine preference. The kind of leadership style is also assessed.

3. The use of situations and leadership style preference is recommended to increase assessing the environment. It is recommended to broadcast the results to managers, because this is an important step to promote the quality of organization and managers' motivation toward consulting leadership.

Conflicts of interests.
Nothing to declare

Acknowledgments
The article is based on the partial results of the first author's master thesis, presented at the University of Sistan and Baluchestan, in 2014.

References

Anderson SL, Betz NE. Sources of social self-efficacy expectations: Their measurement and relation to career development. J Vocat Behav, 2001;58(1):198-117.

Ashton PT, Webb RB. Making a Difference: Teachers' Sense of Efficacy and Student Achievement. New York: Longman, 1986.

Bandura A. Self-Efficacy. Encyclop Human Behav, 1994;4(1):71-81.

Bandura A. Self Efficacy: The Exercise of Control. New York: Freeman. 1997, 120-190.

Clark C. Discipline In Schools. British J Educat Stud, 1997;46(3):289-301.

Fallahi V. Comparative Study of Correlation Between Informal and Cooperative Leadership Styles and Mental Health in the Employees Who Are Working in High schools and Other Industries at Shiraz. MA Thesis, Tehran University, Psychological and Educational Science College, 1995, 83-102.

Fine SF. Technological Innovation Diffusion and Resistance: A Historical Perspective. J Libr Administr, 1986;7(1):83-97

Ghasemi SA. Civil Society, Civil Culture, Summary of Civil Society Congress in the Islamic Evolution, February, Tehran, Islamic Evolution School and Document Organization, Islamic Culture Ministry, 2009,128-148.

Habibi L. Analysis of Correlation between Cooperative Leadership (With Emphasize on Recommendation System) and Employees Efficiency in Headquarters of Supervision on Good and Service Distribution, MA Thesis, Tehran University, 2004, 32-45.

Hassani D. Study Job Motivation, Job Satisfaction and Organizational Commitment to Stay in the Job, Gilan Education Study, 1994, 54-60.

Hoy WK, Gage C, Tarter CJ. School Mindfulness And Faculty Trust: Necessary Conditions For Each Other? Educat

Administr Quarterly, 2006;42(2):425-446.
Jackson E. Participation in Decision Making as a Strategy for Reducing Job Related Strain. J Appl Psychol. 1983;68(1):3-19.
Krejcie RV, Morgan DW. Determining sample sizes for research activities. Educat Psychol Measur, 1970;30:607-610.
Marrow AJ. The Practical theorist: The Life and Work of Kurt Lewin, Teachers College Press, New York, 1969.
Martin A, Marsh H. Academic resilience and its psychological and educational correlates: A construct validity approach. Psychol Schools, 2006;43(3):267-281.
Miller K, Mange ER. Participation, satisfaction, and productivity: A meta-analytic review. Acad Manag J, 1986; 29(4):727-753.
Mirkamali M. Changing in the Organization, Culture and resistance, Tehran, Iran Leadership Association,1997.
Mirkamali M. Human Relationship in the School, Leadership J Educat, 1996;16:91-104.
Moran M, Hoy A. Teacher Efficacy: Capturing and Elusive Construct. Teaching & Teacher Educat, 2001;17(1):783-805.
Nazari-Komishani H. Study the Correlation between Organizational Structure and Cooperative Leadership in Fars Industrial Group, MA Thesis, Tehran University, 2005, 54-79.
O'Brien G. Participation as the Key to Successful Change: A Public Sector Case Study. Leadership & Organization Develop J, 2002;23(8):442-455.
Parnet, JD. Individual Adaptation to the Changing Workplace: Causes, Consequences and Outcomes, University Of Massachusetts Amherst, AAT, 2006.
Poddel D, Soodak, L. Teacher Efficacy and Bias In Special Education Referrals. J Educat Res, 1993;86(3):247-253.
Rice AK. Productivity And Social Organization in Indian Wearing Shed. Human Relation, 1995;6(1):27-97.
Roshandel T. Study And Evaluate the Correlation between Cooperative Leadership and Employees Efficiency of Cooperation Ministry. MA Thesis, Tehran University, 2003,18-79.
SarAbadani H. Study the Correlation between Leadership Style and Motivation of Experts in Physical Education Organization. MA Thesis, University, 2007, 100-112
Sheikhlo-Aghdam R. Study the Formation of Cooperative Culture and Strategic Planning in the Municipality of Region 17, Tehran, MA Thesis, Tehran University, 2004,98-120.
Shin H. Teacher Commitment and Job Satisfaction: Which Cues First Paper Presented at the American Educational Research Association, 1991, 30.
Smylie MA. Teachers' Views of the Effectiveness Of Sources Of Learning To Teach. Elem School J, 1989;89(4):543-558.
Stein MK, Wang MC. Teacher Development And School Improvement: The Process of Teacher Change. Teaching & Teacher Educat, 1988;4(1):141-187.
Taghvaei M. Relationship between Culture and Resistance Against Changing and Comparison in Public and Private High schools in Region 6 of Mashhad. MA Thesis, Ferdosi University, Mashhad, 1996, 21-60.
Tovvins P. Comparative Pokitics: Notes And Redings. Calfornia: Wads Warth, Inc. 2007
Tschannen-Moran M, Woolfolk A. The Influence of Resources and Support on Teachers' Efficacy Beliefs. Annual Meeting of The American Educational Research Association, New Orleans, LA, 2002.
Turning Point National Program Office. Collaborative Leadership Self-Assessment Questionnaires, School Of Public Health and Community Medicine, University Of Washington, 2012
Wolters CA, Daugherty SG.. Goal Structures and Teachers' Sense of Efficacy: Their Relation and Association to Teaching Experience and Academic Level. J Educat Psychol, 2007;99(1):151-193.

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 132–137

Psychomotricity development in visually impaired children through synchronous group dance - work strategy
Dezvoltarea psihomotricităţii copilului deficient de vedere prin dansul sincron de grup-strategie de lucru

Georgiana-Alexandra Penescu
Faculty of Psychology and Educational Sciences, Bucharest University, Romania

Abstract

Background. It is well known that the level of physical development in children with visual impairments has a slight difference from normal due to reduced motions or to lack of movement, which cannot contribute to the development of weight, size, muscle mass, strength and endurance adequate for chronological age. Young visually impaired children manifest sharp disorders of spatial behavior, mainly targeting spatial orientation, spatial relations between objects, movement coordination in general and in limited space (referring especially to the space for reading and writing). The visually impaired and blind children's knowledge of body features includes manifestations such as not knowing various parts of the body, confusion or inability to name them correctly, the most common situations being related to paired organs; reduced ability to correctly identify the partner's body schema or correctly identify it in pictures.

Aims. Synchronous group dance performed by visually impaired children is aimed at training and developing general motor skills and coordination of movements; formation and development of the organizational capacity of the body scheme; formation and development of perceptual-motor structure shape, size and color; formation and development of perceptual-motor spatial structure; formation and development of perceptual-motor temporal structure.

Methods. This article is intended as a presentation of dance teaching techniques for the visually impaired and blind and a recognition of the positive effects of dance on developing their psychomotor abilities.

Conclusions. We believe that using synchronous group dance for children with visual impairments improves their orientation and mobility characteristics both in large spaces and smaller areas. Benefits are body knowledge, effective use of movements and educating the real sense and meaning of beauty.

Keywords: visually impaired, psychomotricity, synchronous group dance, blind.

Rezumat

Premize. Este binecunoscut faptul că la nivelul dezvoltării fizice, în cazul copilului cu deficienţă de vedere, se constată o uşoară diferenţă faţă de normal, datorită lipsei mişcării sau mişcării reduse, care nu poate contribui în mod corect la dezvoltarea greutăţii, taliei, masei musculare, forţei şi rezistenţei în mod corespunzător vârstei cronologice. În cazul deficienţilor de vedere la vârste mici, apar dereglări accentuate ale comportamentului spaţial, în principal fiind vizate orientarea în spaţiu, raporturile spaţiale dintre obiecte, coordonarea mişcărilor în spaţiul larg şi restrâns (mai ales în spaţiul destinat scris-citităului). Somatognozia la ambliopi şi nevăzători se manifestă prin particularităţi precum necunoaşterea diferitelor părţi ale corpului, confuzia acestora sau incapacitatea de a le denumi corect, cele mai des întâlnite situaţii fiind legate de organele pereche; capacitatea redusă de a identifica corect schema corporală a altcuiva sau de a o identifica corect în imagini.

Obiective. Obiectivul central al studiului a fost îmbunătăţirea psihomotricităţii, atenţiei şi memoriei auditive. Dansul sincron de grup realizat cu copiii cu deficienţe de vedere vizează formarea şi dezvoltarea motricităţii generale şi a coordonării mişcărilor; formarea şi dezvoltarea capacităţii de organizare a schemei corporale; formarea şi dezvoltarea structurii perceptiv-motrice de formă, mărime şi culoare; formarea şi dezvoltarea structurii perceptiv-motrice spaţiale; formarea şi dezvoltarea structurii perceptiv-motrice temporale.

Metode. Acest articol se doreşte a fi atât o prezentare a tehnicilor de predare a dansului la nevăzători, cât şi o recunoaştere a efectelor pozitive pe care acesta le poate avea asupra psihomotricităţii deficientului de vedere.

Concluzii. Considerăm că prin utilizarea dansului sincron de grup la copiii cu deficienţe de vedere se pot îmbunătăţi caracteristicile de orientare şi mobilitate, atât în spaţiu larg, cât şi în spaţiu restrâns ale acestora, beneficiile vizând cunoaşterea corpului, utilizarea mişcărilor în mod eficient şi educarea simţului pentru frumos.

Cuvinte cheie: deficient de vedere, psihomotricitate, dans sincron de grup, ambliop, nevăzător.

Received: 2015, March 19; *Accepted for publication:* 2015, April 15;
Address for correspondence: Universitatea din Bucureşti,Facultatea de Psihologie şi Ştiinţele Educaţiei, Şcoala Doctorală, Şos. Panduri nr. 90, Romania
E-mail: georgianabalaceanu@yahoo.com
Corresponding author: Georgiana-Alexandra Penescu

Introduction

Visual impairment has various degrees, depending on the deterioration of vision, the limits being amblyopia and absolute blindness (congenital). Amblyopia is the reduction of visual capabilities in various degrees, regardless of etiology and severity, which is maintained after appropriate correction and involves a decrease of visual acuity to less than half.

In 1912, the leading forerunner of Romanian Special Education, Dimitrie Rusticeanu, gave the following definition: *in a scientific sense, blind is the eye that does not feel the light at all, so it is not able to observe day and night. Blind in a practical sense is an individual whose power of seeing in both eyes is forever damaged and is not curable, so he cannot go alone on foreign roads. So, blind is the one who at a distance of one meter is unable to count the fingers of the moving hand. Suitable to be admitted to the institute for blind are children who possess an ability to see so insignificant that no eyeglasses can help them see the alphabet letters, therefore they cannot take part in education, as well as those adults who, because of acquired myopia, cannot meet the call that claims competence of vision* (Stănică et al., 1997).

In terms of educational definitions, visual impairments are interpreted according to the type of education that can be achieved by the visually impaired person. So in educational terms, amblyopic subjects are those who because of deficient vision cannot attend regular school without prejudice to their eyesight or their educational development, but can be trained by special methods involving sight. A blind person is one that has no vision or whose eyesight is so diminished that it requires educational methods that do not involve vision (Miller quoted by Stănică et al., 1997).

In young visually impaired children, sharp disorders of spatial behavior occur, mainly targeting spatial orientation, spatial relations between objects, coordination of movements in general and in limited space (for reading and writing).

The body image can be fragmented and disturbed (Koch, 2008).

Child motor and mental stimulation should begin at birth by the influence of family stimuli (Albu et al., 2008). Also, we need to emphasize that blind children and those with more complex needs may need additional support for activities involving movement along circles, for games involving change of position or in writing activities (Bowen, 2010).

In special schools for the visually impaired, sporting activities, specific orientation and mobility therapies are carried out. However there is a need for optional activities such as sports and recreational games, arts and Sports for All activities (ex. dance). The curriculum does not contain such optional subjects. These disciplines would cover the effects on both harmonious physical and mental development.

When a child discovers new alternative ways of interaction, self-transformation and rapid improvement in self-image is guaranteed (Cucu-Ciuhan & Vasile, 2010).

The therapeutic effects of these activities are not yet fully investigated.

I often think it is a shame that the therapeutic role of Arts is not recognized in the mainstream school curriculum (Comte, 2009).

Dance itself has been attributed a curative power, due to which dance (and movement) therapy has been developed in recent decades and follows a specific therapeutic approach. It is believed to have a positive impact on the welfare of people with social, physical or psychological disabilities (Kiepe et al., 2012). Importantly, regardless of the learning theory, we must emphasize that learning is always situational depending on the personal characteristics of the individual. Learning is constantly related to the previous learning experiences and current energy level of the person (Kivijärvi, 2012).

However, in some states, after the morning routine, students participate in academic programs and special classes such as art and music for a period of two hours (Butler et al., 2010).

We consider psychomotor counseling important, whose main objectives are studying individual motor capabilities compared to standard motor possibilities of age, sex and social status, as well as transfer opportunities in order to improve the quality of life, establishing the most effective means of prevention and intervention (Dumitrescu et al., 2013).

Therefore, many experts address physical, mental and motor development in all its complexity, as these processes can occur simultaneously (Albu et al., 2008).

To reduce these characteristics, a very popular activity among visually impaired children can be used, synchronous group dance. In addition to being a beautiful activity, it also has the advantage of stimulating and involving throughout the artistic act all body segments, also educating the psychomotor component of the student.

The way in which teachers use postural movements along the space in relation to children determines the feeling of reassurance of the latter. However, there is no formula for the construction of a safe area. Children respond differently at different times in different spatial configurations, all depending on their history, their temperament, their condition and other factors (Betty, 2013).

Objectives

The reference objectives of this strategy are consistent with the 2008 curriculum of educational activities, the Psychomotor Education chapter, and are the following: formation and development of general motor skills and coordination of movements; formation and development of the body scheme organizational capacity; formation and development of the perceptual-motor structure of shape, size and color; formation and development of the perceptual-motor spatial structure; formation and development of the perceptual-motor temporal structure.

We believe that all these objectives can be achieved through synchronous group dance, involving staged exercises that are in line with these objectives.

Hypothesis

Synchronous group dance for children with visual

impairments can improve their psychomotor development level.

Material and methods

We mention that, in agreement with the Declaration of Helsinki, the Amsterdam Protocol and Directive 86/609/EEC, the study case procedure was approved by an ethics commission within the Special School for the Visually Impaired, Buzău, Romania, and that we obtained the written consent of the legal guardian of the subjects.

The research protocol

a) Period and place of the research

The study was conducted at the Special School for the Visually Impaired in Buzău, over a period of 2 years, between September 2012-September 2014.

b) Subjects and groups

This research included 30 children with amblyopia, aged 14-16 years, both boys and girls. Of the 30 subjects, 18 were girls and 12 boys.

c) Tests applied

In the initial and final testing we applied the Bender-Santucci perceptual-motor test (Vlad, 2000) and the Attention and visual memory test, author Anca Rozorea (Vlad, 2000). Quantitative analysis of efficiency in the Bender-Santucci perceptual-motor test was aimed at comparing the total score obtained by the subject to the average performance (the standard) of the subject's age group. Based on this reference, different levels of success can be established: a high level 40-50 p; a medium level 25-40 p; a low level 10-25 p.

The Attention and visual memory test evaluates visual attention, visual memory, the sign-object association ability, the speed of execution of a task that involves visual function. The task is to find and note the sign-object correspondence, for the first two rows using the model, and for the next four rows without a model. Working time is 3 minutes. Scoring is based on the number of correct and wrong answers on each row. The maximum number of points that can be accumulated is 72.

Thus, depending on the number of correct responses, subjects fall into 3 categories: good visual memory 50-72 p; average visual memory 30-50 p; poor visual memory 0-30 p. After applying the initial tests (TI), following the scores obtained, we conducted the intervention period involving the students' participation in dance activities, then final testing (TF) was performed. Activities were carried out once a week as part of the afternoon program, and lasted 60-90 minutes.

Presentation of the work plan with visually impaired children

In teaching synchronous group dance to children with visual impairments, it is necessary to consider structuring the process into three main areas: a) Arrangement of the dance space; b) Teaching-learning of dance figures; c) Encouraging artistic expression through dance

a) Arrangement of the dance space

Like in the case of normally sighted subjects, the strategy of setting the stage for children with visual impairments must meet a set of rules; the children's dance space must be organized depending on characteristics such as: type of deficiency and its degree, height, existing motor skills.

Regarding the first feature, a number of explanations are required for a better understanding of organizational strategies in the dance space.

In the strategy of setting the stage for dance for visually impaired children, organization must take into account the specifics of each child. Thus, we consider as adequate the placement of blind students in the middle of the group or according to the shape of the dance space, right in front of their peers with residual vision (amblyopia) or interspersed with amblyopic children.

Because of the lack of vision, the blind child does not have the risk of attention disruption due to visual stimuli, which is common in amblyopic children. Consequently, the blind child represents the pillar of the group, not being disturbed by visual stimuli such as people, scenery or repositioning of the group during the dance.

A blind child who has correctly acquired the specific motor structure of dancing figures in multiple dance schemes can be positioned in the center of the group. Furthermore, he can be a visual landmark and support for amblyopic peers who can rely on him for orientation during the dance or can have an immediate control of movements when a disturbing stimulus occurs and recover position by watching the blind peer.

As a rule, the blind, using their attention and memory during any activity, manage to correctly acquire the scheme of each motor structure taught by the teacher. Difficulties are encountered, however, in understanding and executing the figures, but not regarding the order in which they should be executed.

It is considered necessary to put the scheme of the dance group arrangement on paper, showing the shape of the group in the dance space.

It is to the students' advantage to use for dance group arrangements geometric shapes such as triangles or circles, or shapes which can be easily constructed from geometric circles representing the students. Large circles represent blind students and small circles represent amblyopic students.

So, for amblyopic students, a bolded or highly colored drawing is recommended, which must indicate the precise position of each child, each position being represented as a circle in the visual space on paper. This material, specially designed for tactile identification (in relief) and magnified, can be used for the students' mental organization of their own and the other students' positions throughout the dance.

To effectively educate children with residual vision, each child is asked to recognize their position on the paper drawing; the circle representing the child can be colored in the case of amblyopic children. It is recommended to use the same color for two students who are in a symmetrical position relative to the pawn of the group, which is usually blind. If the group is larger, multiple colors can be used. Also, the child can be asked to identify the children before and behind him, all children on the same row, on his left or right. This is how children will know their own and the other children's positions throughout the dance, practicing the left-right and front-rear orientation, in relation to their

body schema and to the central landmark of the group, the blind child.

In order to develop and educate the orientation and mobility of the blind in the space dance, these are asked to perform the same exercise by identifying their position in relation to that of the other children and to the whole stage area.

The blind child's position will be highlighted for:

- Amblyopic children, by coloring the contour of the circles representing them with black and by larger size circles, which are the most easy to perceive.

- Blind children, by highlighting the circles that represent them using the Piaf device, with larger dimensions of the circles compared to those representing amblyopic children.

Also, the amblyopic children's position can be better highlighted for:

- Amblyopic children, by drawing circles with black contour or coloring the contour with strong colors, or by coloring the entire surface of the circle with black.

- Blind children, by highlighting smaller size circles than those representing children with blindness, or by writing the peers' initials in Braille on the circle surface, or by covering the surface of the circles with materials of different textures, each pair of children including the students from both sides of the pawn being assigned a certain texture (e.g. rough, smooth).

Along with this exercise, all dancers in the dance space will be identified by identifying their positions in the group. Each child will be handed an augmented Braille written copy to be used at anytime.

b) Teaching of dance figures

Phase 1

In the case of the blind child

Teaching all movements and motor schemes at this stage will be done without music, the purpose of this phase being the understanding and proper execution of dance figures, thus involving technical aspects of execution.

For a better understanding of the figures, the teacher should face the student, performing the dance figure while verbalizing every movement with details about the limb used, its position (ex. vertical/ horizontal/oblique), its distance from the body, the movement direction. The student is encouraged to touch each body segment of the teacher. This phase lasts until the student is able to reproduce verbally the movement structure, even if this cannot be reproduced in motor terms.

In the case of the amblyopic child

The teacher will face the student, performing movements in the mirror, verbalizing the actions. The teacher can stand on either side of the child, which is dictated by the child's eye that has the best residual vision, and if necessary, the dance figures can be executed by the teacher with his/ her back to the student. This procedure allows to practice hand-eye coordination, hand-foot coordination, opposite hand-foot coordination, etc.

The support given by the adult to amblyopic children should be predominantly visual and verbal; physical support should be used only in certain cases in order to keep active the principles of perceptual visual learning. According to these principles, the use of residual vision should be maximized in all learning situations, considering that amblyopic children tend to imitate blind subjects in orienting themselves using auditory and tactile stimuli, although they are not blind. So, eye-motor coordination and the visual control of movements should be encouraged during the dance. Amblyopic children suffering from a degenerative disorder who have a risk of loss of eyesight will benefit from all modalities for the stimulation of the senses.

Phase 2

The teacher faces the student during the execution of the dance figure, while verbalization of movements is maintained along with physical support provided to the student, the teacher manipulating the child's limbs. We believe that each dance figure should be decomposed in stages, and each movement should be practiced until the whole dance figure is understood by the student and even more, reproduced.

It is recommended that the teacher handle each segment of the child's body involved in the structure of figures, for a better understanding of these. Gradually, physical help from the teacher should diminish from grasping and manipulating the body segments with all fingers to using a single finger, initially for directing the limb and its movement, subsequently with a reassuring or positive feedback role.

Phase 3

After the motor structure of the dance figure has been understood and reproduced by the child, its execution with music, according to the rhythmic structure of a chosen melody can be initiated. Now is the time to highlight the artistic component of dancing. Rhythm in music refers to an organized sequence of sounds (Popovici & Matei, 2005). The execution of this phase requires dividing the melody in dance beats.

The student is invited to listen to the music, focusing on the musical instrument that creates rhythm, percussion, and the sounds of the instrument are counted. Thus, percussion beats are counted in groups of eight until the end of the melody. Usually a figure dance should last one beat.

For a better understanding of how to listen to percussion, children are asked to clap their hands whenever they hear the sound of this instrument, which can develop phonemic hearing, responsible for the correct discrimination of sounds. After the whole group of children has managed to clap in rhythm, they can move on to the next stage, clapping while counting the sounds of percussion in groups of eight.

After this step has been performed, the teacher will encourage students to execute dance figures, still keeping up the rhythm and counting the percussion beats.

The teacher will continue to stand in front of the blind child and in front or to the side of the amblyopic child, this time providing verbal support in the rhythm of the music, counting the beats and encouraging the children's artistic expression. Motor schemes will be executed faster than during their performance without music, when the teacher's attention was focused on their understanding and proper execution by the child.

If all steps have been efficiently completed, it can be said that the purpose of the work has been achieved, the children being able to execute the dance figures in the

Table I
Mean percentage increase.

P value		Medium		Accentuated		Critical	
Visual Memory	Bender	Visual Memory	Bender	Visual Memory	Bender	Visual Memory	Bender
0.00182	1.00321	0.02	0.07	0.07	0.28	0.02	0.27

rhythm of the melody, following the previously practiced motor schemes, and at the same time, to link them together.

c) Encouraging artistic expression through dance

Once the students have learned to move and coordinate their entire body in the rhythm of music, as dictated by the motor structure of the dance figures, it is time for students to create their own motor structures, this time dictated by emotions and feelings derived from the musical harmony and rhythm of the melody.

Children are invited to move as they feel like moving and verbalize if possible the sensations they feel when dancing in one way or another. The child must be assured that there are no wrong or right figures, but only movements.

"Talk to me", I asked my body. "I am finally listening". "Dance me this moment", the body replied (Lussier-Ley, 2010).

Once at this level, we can use motor dance schemes designed by children to continue the already learned choreographic structure, thereby helping the visually impaired to show their talent, creativity and grace, some of them demonstrating to be the exception that proves the rule.

"When people are relaxed and feel accepted and loved, they will take risks, try new things, discover new things about themselves" (Gordon, 2014).

d) Statistical processing

For data processing, we used Microsoft Office Excel 2007.

Results

According to deficiency grades as they appear in individual records for classification of the degree, we divided the subjects into Medium, Accentuated and Critical. Following data analysis, there was a mean percentage increase of 0.4% in the visual memory test score obtained at FT compared to IT, and a mean percentage increase of 0.42% in the Bender-Santucci test.

We also determined the mean percentage scores in the two tests, depending on the degree of deficiency, which showed an increasing trend, especially in the case of the Bender-Santucci perceptual-motor test (Table I).

An increase in the attention and visual memory test score as well as in the Bender-Santucci perceptual-motor test score was found. This is due to the vision deficiency which involves a certain degree of residual vision allowing the successful achievement of the test tasks. However, magnified copies of the test records were used to meet the children's needs. Thus, the results obtained show that psychomotricity depends on the degree and type of visual impairment.

Discussions

Once they have acquired the language of movement, children can create and develop their own dance figures, enriching their vocabulary of movements, which can make their own dance compositions unique. This newfound language enables them to clearly express their ideas in composition, performance and appreciation. If the movement idea can be explained to the teacher, a reference point for assessing the students' work has already been established. Also, a range of movement concepts can be passed on from year to year to build up a profile of dance knowledge derived from the students' experience, just as with other topics (1).

We consider that the impact of dance on the development of psychomotricity in visually impaired children, on the development of visual memory, on well-being and nervous relaxation could be a strong argument in favor of including this type of activity on the list of specific therapies in special education schools.

Conclusions

1. The results of the attention and visual memory test evidence an increase in the performance achieved by students, regardless of their degree of visual impairment, indicating a constant need for visually impaired subjects to use their residual vision.

2. The results of the Bender-Santucci perceptual-motor test reveal a significant increase in motricity, which is a constant problem of the visually impaired. Motor stimulation following synchronous dance sessions represents an important gain for the child, manifesting itself both in gross movements and fine movements that are involved in the graphic act.

Conflicts of interests

Nothing to declare.

Acknowledgements

This article uses partial results from the author's PhD thesis that is in progress.

References

Albu C, Albu A, Vişan A. Universul de mişcare a copilului mic. Ed. Polirom Iaşi, 2008; 89:8.

Betty A. Taming Tidal Waves: A Dance/Movement Therapy Approach to Supporting Emotion Regulation in Maltreated Children. Am J Dance Ther 2013;35(1):39-59. doi:10.1007/s10465-013-9152-3.

Bowen J. Visual impairment and self-esteem. What makes a difference? British J Visual Impair, 2010;28(3):235-243. doi:10.1177/0264619610375504.

Butler LS, Boivina NE, Campbella EJ. Non-classroom special education effectiveness for students with severe developmental, emotional and behavioral disorders. Proced Soc Behav Sci, 2010;2(2):1680-1686. doi:10.1016/j.sbspro.2010.03.965.

Butler LS, Boivina NE, Campbella EJ. Non-classroom special education effectiveness for students with severe developmental, emotional and behavioral disorders.

Proced Soc Behav Sci, 2010;2:1680-1686. doi:10.1016/j.sbspro.2010.03.965

Comte M. Don't hang your dreams in a closet: Sing them, paint them, dance them, act them. Austral J Music Educ, 2009;(2):58-66.

Cucu-Ciuhan G, Vasile AS. Efficiency of experiential psychotherapy in the treatment of children with attention deficit hyperactivity disorder. Proced Soc Behav Sci, 2010;5:922-925.

Dumitrescu R, Aducovschi D. The psychomotor guidance centre's strategy for promoting a healthy lifestyle through diversified and individualized free time programs. Palestrica of the third millennium - civilization and sport, 2013;14(3):228-233.

Gordon AJ. Focusing on Positive Affect in Dance/Movement Therapy: A Qualitative Study. Am J Dance Ther 2014; 36(1):60-76. DOI 10.1007/s10465-014-9165-6.

Kiepe MS, Stockigt B, Keil T. Effects of dance therapy and ballroom dances on physical and mental illnesses: A systematic review. Arts Psychother, 2012;39:404-411. doi: 10.1016/j.aip.2012.06.001.

Kivijärvi S. Project Disabled People as Musicians: A Systemic Approach. Proced Soc Behav Sci, 2012;45:416-427. doi:10.1016/j.sbspro.2012.06.578.

Koch SC. Dance/Movement Therapy with Clergy in Crisis: A (Group) Case Study. Am J Dance Ther, 2008;30(2):71-83. DOI: 10.1007/s10465-008-9053-z.

Lussier-Ley C. Dialoguing with Body: A Self Study in Relational Pedagogy through Embodiment and the Therapeutic Relationship. The Qualitative Report, 2010;15(1):197-214. Retrieved from http://www.nova.edu/ssss/QR/QR15-1/lussierley.pdf, 2010.

Popovici DV, Matei RS. Terapie ocupaţională pentru persoane cu deficienţe. Constanţa, Ed. Muntenia, 2005, 140.

Stănică I, Popa M, Popovici D, Rozorea A, Mușu I. Psihopedagogie specială. Deficienţe senzoriale. Ed. Pro Humanitate, Bucureşti, 1997, 192, 194.

Vlad E. Evaluarea în actul educaţional-terapeutic. Ed. ProHumanitate, Bucureşti, 2000, 155-171, 175-176.

Web-sites

(1) Language of Dance Centre, Course Handbook Available online at www.lodc.org/.../LOD_Course_Handbook.pdf, 4 Accesed on 2015, February the 1st.

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 138–143

Exploring the infrastructure and community programs accessed by medical students when being physically active
Explorarea infrastructurii şi a programelor comunitare accesate de studenţii medicinişti pentru practicarea activităţilor fizice

Petru Sandu [1], Cosmina Ioana Bondor [2], Floarea Mocean [1]
[1] Department of Community Medicine, "Iuliu Haţieganu"University of Medicine and Pharmacy, Cluj-Napoca, Romania
[2] Department of Medical Education, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania

Abstract

Background. Medical students' physical activity preferences are important to explore, as this population subgroup represents future models in society.

Aims. To explore the infrastructure and community programs accessed by medical students when being physically active.

Methods. Online questionnaire administered to medical school students in Cluj-Napoca and Iasi.

Results. 65% of the options expressed accessed free-of-charge infrastructure (outdoor, university and home or around home). Students in the 1st and 2nd years of study accessed the University infrastructure significantly more than their 3rd to 6th year peers. Only 16% of the respondents accessed community programs for practicing physical activity in the last 12 months.

Conclusions. Medical school students prefer free-of-charge (outdoor) sport infrastructure and have a very low participation rate in community physical activity programs. Efforts should be directed into research and policy for ensuring proper physical activity services to medical school students.

Keywords: medical school students, physical activity, preferences, infrastructure, community programs.

Rezumat

Premize. Preferinţele studenţilor medicinişti în practicarea activităţilor fizice trebuie explorate, aceste persoane având rolul de viitoare modele în societate.

Obiective. Explorarea infrastructurii şi a programelor comunitare accesate de studenţii medicinşti pentru practicarea activităţilor fizice.

Metode. Chestionar electronic administrat studenţilor la medicină din Cluj-Napoca şi Iaşi.

Rezultate. 65% dintre opţiunile exprimate au fost reprezentate de infrastructură gratuită (outdoor, infrastructura universităţii, în locuinţă). Studenţii din anii de studiu 1 şi 2 au accesat semnificativ mai mult infrastructura Universităţii faţă de colegii lor din ani 3 până la 6. Doar 16% dintre respondenţi au accesat programe comunitare de practicare a activităţilor fizice în ultimele 12 luni.

Concluzii. Studenţii medicinişti preferă infrastructura de practicare a activităţilor fizice (outdoor) gratuită şi au nivele foarte scăzute de participare în programe comunitare de practicare a activităţilor fizice. Eforturi de cercetare şi politici trebuie făcute pentru a asigura servicii adecvate de practicare a activităţilor fizice de către studenţii medicinişti.

Cuvinte cheie: studenţi medicinişti, activitate fizică, preferinţe, infrastructură, programe comunitare.

Introduction

Chronic non-communicable diseases represent the most important causes of death, approximately 38 million deaths being attributed to these diseases worldwide. In the European Region of the World Health Organization, chronic diseases account for 86% of total deaths and 77% of general morbidity (2). In Romania, chronic non-communicable diseases account for 92% of total deaths, cardiovascular diseases (58%), cancers (20%) and other chronic diseases (10%), being the most important contributors to the total number of deaths caused by non-communicable diseases (3).

Physical inactivity, smoking, alcohol abuse and unhealthy diets represent the most important risk factors for mortality from chronic disease, being estimated that

Received: 2014, March 21; *Accepted for publication:* 2015, April 3;
Address for correspondence:"Iuliu Hatieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania, Public Health and Management Discipline, 31 Avram Iancu Street, Cluj-Napoca, Romania, 400083
E-mail: petrusandumd@gmail.com
Corresponding author: Petru Sandu

insufficient physical activity can be attributed a number of approximately 3.2 million deaths each year, worldwide (4).

Children and youth are population subgroups of major interest in the strategies for promoting healthy lifestyles (Mocean, 2007) from two perspectives: 1) overweight and obesity at the age of adolescence and youth represent important predictors for overweight and obesity and associated non-communicable diseases at the age of adulthood. Thus, preventing the onset of these conditions in young people and adolescents could limit the increasing incidence and prevalence of non-communicable diseases (Meiro-Lorenzo, Villafana & Harrit, 2011) (5); 2) Children and youth's health related behaviors are predictors for the future adults' health related behaviors: physically active adolescents and youth are more prone to become physically active adults, whereas sedentary adolescents and youth are more prone to become sedentary adults (Jose et al., 2011; Weiss et al., 2007). However, it is estimated that worldwide more than 80% of adolescents do not meet physical activity levels recommended by the World Health Organization (6).

Among the adolescent and young population subgroup, medical school students represent an important target population for health promotion strategies and programs, because: 1) It has been acknowledged in the literature that the physical activity levels of medical school students are important predictors for their perceptions of physical activity and their consecutive behavior related to promoting physical activity among their patients. It has been thus revealed that physically active medical school students and young doctors promote physical activity as a health promotion tool to their patients more than their sedentary peers. Also, the level of knowledge regarding the benefits of physical activity as well as their own level of physical activity are factors that increase the self-confidence of doctors in promoting and prescribing physical activity to their patients (Frank et al., 2008; Stanford et al., 2014); and 2) Doctors represent trustworthy sources of information for their patients, when these patients want to acquire health related information, thus making the doctors (especially general practitioners) key persons in developing effective health promotion programs and campaigns. This is an important argument for taking into consideration the medical school students and young doctors' knowledge, attitudes and behavior related to health promotion and specifically to physical activity (Petrilli et al., 2015; Griffin et al., 2004). Hence, the physical activity knowledge, perceptions, attitudes and behavior of medical school students in regards to (health enhancing) physical activity are important to explore and describe, as these persons have the potential to become models as well as educators in society, the positive impact of influencing the behavior of this population subgroup having the potential to positively influence society as a whole.

The aforementioned arguments support the importance of studying the levels of physical activity of medical school students and their preferences regarding community based physical activity infrastructure and programs.

Material and methods

Research protocol

The approval of the Ethics Board of the "Iuliu Hatieganu" University of Medicine and Pharmacy Cluj-Napoca for conducting the current study was obtained, reference number 204, 4/06/2014. The participants in the study were all 18 years old and above, and agreed to participate in the study by checking off *"Yes, I want to participate"* on the online informed consent presented at the beginning of the online questionnaire.

a) *Period and place of the research*

An online cross-sectional observational study was conducted between November - December 2014, by means of an online questionnaire. The questionnaire was emailed to medical students through email groups via student representatives. In this way, all students from the 1st to 6th year of study at the Faculties of Medicine of the two universities had equal chances to participate in the study. For maximizing the participation rate, the invitation to participate in the study (along with the link to the online questionnaire) was sent three times to the medical school students, at a 2-3 week interval. The Qualtrics quantitative data collection software was used for administering the online questionnaire.

b) *Subjects and groups*

The study included medical school students from the 1st to the 6th year of study at the Faculties of Medicine of the "Iuliu Hatieganu" University of Medicine and Pharmacy Cluj-Napoca and "Gr.T. Popa" University of Medicine and Pharmacy Iasi. The only inclusion criterion was being a student at the Faculty of Medicine in one of the two selected Universities.

c) *Tests applied*

An online questionnaire was administered to medical school students from both centers, Cluj-Napoca and Iasi. Socio-demographic data were collected, along with the self-reported levels of physical activity and physical fitness. The two questions presented in the current paper were developed by the first author of the paper. Respondents were asked to mention the three most frequent places they accessed in the last 12 months when practicing leisure time physical activity. Also, respondents were asked to indicate if they participated in physical activity community programs in the last 12 months.

d) *Statistical processing*

Data collected by means of online questionnaires using the Qualtrics quantitative data collection software were exported to Microsoft Excel. Statistical analysis was performed using the SPSS 20.0 statistical package. Data in tables are presented as arithmetic mean ± standard deviation (SD), or absolute frequencies (n) and relative frequencies (%). The Mann-Whitney statistical test was applied to check for statistically significant differences between the respondents' expressed preferences.

Results

a) *Socio-demographic characteristics of the respondents*

A total number of 386 respondents from Cluj-Napoca and Iasi answered the online questionnaire. Out of this total number, following the cleaning of the database we obtained a final number of 334 respondents, of which 138 were from the "Iuliu Hatieganu" University of Medicine and Pharmacy Cluj-Napoca, and 196 from the "Gr.T. Popa"

University or Medicine and Pharmacy Iasi.

Regarding the socio-demographic characteristics of the respondents, we observed a much higher percentage of female students responding to the questionnaire, and there were no significant differences in male and female participation between different years of study (p=0.63). However, a significant statistical difference (p=0.007) could be observed in the sex distribution between the two centers, Cluj and Iasi.

In regards to the study year, more respondents were in the 1st, 2nd and 5th study years, the 3rd, 4th and 6th years being less represented. However, this difference was not statistically significant (p=0.08). Also, for UMF Iasi, there was no statistically significant difference in sex distribution between the different years of study (p=0.15).

With respect to the respondents' age, most of the respondents (95%) fit into the 19-24 age group, the 19, 20, 21 and 23 ages being the most frequent ones and correlating with the 1st, 2nd and 5th study years, which were better represented (Table I).

Table I

Socio-demographic characteristics of the respondents.

Parameters	U.M.F. Cluj (n=138)	U.M.F. Iaşi (n=196)	p
Age (mean±SD)	21.58±1.78	21.62±2.46	0.400
Male sex, n (%)	36 (26.1)	28 (14.4)	0.007
Year of study, n (%)	–	–	–
I	23 (16.7)	47 (24.2)	0.083
II	30 (21.7)	45 (23.2)	
III	16 (11.6)	27 (13.9)	
IV	15 (10.9)	24 (12.4)	
V	39 (28.3)	29 (14.9)	
VI	15 (10.9)	22 (11.3)	
BMI (mean±SD)	21.18±2.95	20.97±3.51	0.190

Using height and weight, the body mass index (BMI) of the respondents was computed. Thus, the average BMI was 21.06, with a standard deviation of 3.28. According to the World Health Organization classification, most of the participants had a normal BMI (18.50-24.99) (1). Statistically significant differences between the average BMI of female (20.61±2.87) and male (21.18±2.95) respondents from the "Iuliu Hatieganu" University of Medicine and Pharmacy Cluj-Napoca were observed. These differences could be explained by either real differences or systematic bias introduced by the social desirability concept - female respondents might have declared a lower body weight, even though the questionnaire was administered online and no personal data of respondents were collected.

b) *Infrastructure accessed by medical students when being physically active*

Respondents to the online questionnaire were first asked to mention the three places they went to most frequently in the last 12 months when they wanted to have leisure time physical activities (*Please mention three places you frequented most in the last 12 months, when you went to do physical activities (e.g. university sport hall, parks, gyms, etc.*)).

The total number of options (frequent places to practice physical activities) expressed by the 334 respondents was 606, distributed in the following categories (see Fig. 1): The apartment/home or the surrounding areas (answers included: my own home, home, my dorm room, my yard, my neighborhood, the alley behind my block of flats) (CJ, n=13; IS, n=31); 2) Free-of-charge outdoor infrastructure (answers included: park, stadium, running track, streets, hills, forest, mountain, beach) (CJ, n=108; IS, n=123); 3) Paid sport infrastructure (answers included: gyms, synthetic football pitch, swimming pool, dance hall) (CJ, n=117; IS, n=117); 4) Free-of-charge university infrastructure (answers included: university, university sport hall, university sport field) (CJ, n=50; IS, n=69). There were no significant differences in the types of infrastructure accessed by medical school students from Cluj and Iasi (p=0.20).

Table II

The distribution of preferences for physical activity infrastructure by socio-demographic charactericstics of the respondents.

Parameters	Home	Outdoor	Paid	University	p
U.M.F. Cluj					
Age (mean±SD)	22.69±1.38	21.89±1.64	21.79±1.93	20.80±1.50	<0.001
Male sex, n (%)	2 (15.4)	30 (27.8)	21 (22.1)	15 (30.0)	0.552
Year of study, n (%)					
I	1 (7.7)	12 (11.1)	15 (15.8)	12 (24.0)	0.020
II	1 (7.7)	23 (21.3)	19 (20.0)	18 (36.0)	
III	0 (0.0)	11 (10.2)	11 (11.6)	8 (16.0)	
IV	1 (7.7)	9 (8.3)	11 (11.6)	3 (6.0)	
V	6 (46.2)	38 (35.2)	31 (32.6)	6 (12.0)	
VI	4 (30.8)	15 (13.9)	8 (8.4)	3 (6.0)	
BMI (mean±SD)	20.90±2.65	21.35±2.75	21.69±3.15	21.53±2.79	0.802
U.M.F. Iaşi					
Age (mean±SD)	21.65±2.26	22.03±2.79	21.54±2.37	20.77±2.33	0.004
Male sex, n (%)	1 (3.2)	13 (10.7)	23 (19.8)	11 (15.9)	0.057
Year of study, n (%)					
I	8 (25.8)	26 (21.7)	34 (29.6)	23 (33.3)	0.002
II	5 (16.1)	28 (23.3)	24 (20.9)	32 (46.4)	
III	5 (16.1)	13 (10.8)	8 (7.0)	5 (7.2)	
IV	5 (16.1)	16 (13.3)	17 (14.8)	2 (2.9)	
V	2 (6.5)	18 (15.0)	17 (14.8)	3 (4.3)	
VI	6 (19.4)	19 (15.8)	15 (13.0)	4 (5.8)	
BMI (mean±SD)	20.83±3.02	21.14±3.91	21.25±3.37	20.15±3.04	0.069

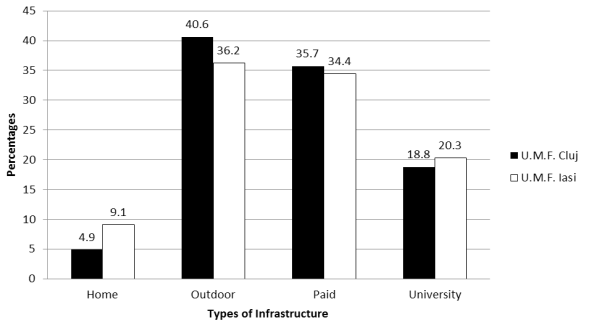


Fig. 1 – The distribution of physical activity infrastructure types accessed by medical school students from Cluj and Iasi.

As it can be observed in Fig. 1, only 35% of the total options expressed by medical school students from Cluj and Iasi involved the accessing of paid sport infrastructure, the rest of 65% being represented by the types of infrastructure that are free-of charge, i.e. university infrastructure, outdoor infrastructure and home or around home opportunities. This results could be interpreted as a preference of most students to get physically active in the university infrastructure (e.g. for playing sports with colleagues) or in free-of-charge outdoor facilities such as parks. The results can also be interpreted as the avoidance of paid infrastructure, for limiting the costs associated with the practice of physical activities in these settings. Only about 20% of the options expressed by students from each center referred to the university infrastructure. This might have a set of explanations such as the (lack of) availability and accessibility of this infrastructure or the students' preferences for certain favourite sports, not offered by the university infrastructure.

Regarding the types of infrastructure accessed by medical students when being physically active, a statistically significant difference (p=0.002, IS; p=0.020, CJ) in the preferences for a certain type of infrastructure was observed between the different years of study, i.e. the 1st and 2nd years accessed more the university infrastructure than the other years of study (3rd to 6th). This result might be explained by the fact that in the first two years of medical school, students have compulsory physical education and sport classes, so they might get more opportunities to use the university infrastructure for practicing physical activities in comparison with their older colleagues. Not least, a statistically significant difference (p=0.004) could be observed in the mean age of students accessing different types of infrastructure (Table II).

c) *Community programs accessed by medical students when being physically active*

In this section of the online questionnaire, the respondents were asked to mention if they participated in the last 12 months (prior to the moment of filling in the questionnaire) in any community programs for practicing physical activities (*Please mention three community programs in which you have participated in the last 12 months*). These programs were defined as courses for learning a certain sport, sports events organized by the local public administration or by student NGOs, running events, etc.

The vast majority of the respondents (84%) declared that they did not participate in physical activity community programs in the last 12 months prior to their participation in the study (Fig. 2).

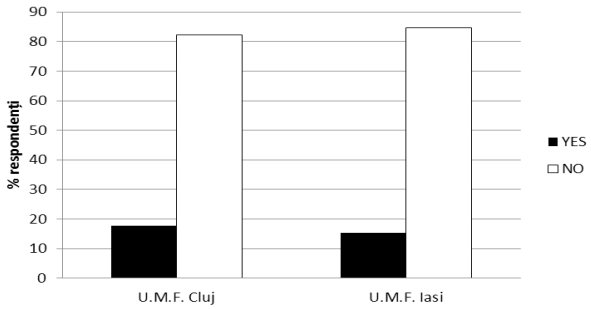


Fig. 2 – The distribution of participation of students from Cluj and Iasi in physical activity community programs

No statistically significant differences between participants and non-participants in physical activity community programs from Cluj and Iasi could be observed (Table III).

Table III

The distribution of participation in physical activity community programs by socio-demographic charactericstics of the respondents

Parameters	Participation	Non-participation	p
U.M.F. Cluj			
Age (mean±SD)	21.37±1.74	21.85±1.77	0.296
Male sex, n (%)	5 (25.0)	23 (24.7)	1.000
Year of study, n (%)			
I	2 (10.0)	14 (15.1)	0.104
II	8 (40.0)	16 (17.2)	
III	3 (15.0)	8 (8.6)	
IV	2 (10.0)	10 (10.8)	
V	2 (10.0)	35 (37.6)	
VI	3 (15.0)	10 (10.8)	
BMI (mean±SD)	20.77±2.12	21.46±3.06	0.547
U.M.F. Iaşi			
Age (mean±SD)	21.50±2.77	21.65±2.48	0.596
Male sex, n (%)	6 (27.3)	14 (11.7)	0.088
Year of study, n (%)			
I	4 (18.2)	31 (26.1)	0.456
II	8 (36.4)	28 (23.5)	
III	2 (9.1)	13 (10.9)	
IV	4 (18.2)	11 (9.2)	
V	3 (13.6)	18 (15.1)	
VI	1 (4.5)	18 (15.1)	
BMI (mean±SD)	20.25±2.25	20.87±3.55	0.902

The respondents who declared having participated in such programs were asked to mention three programs in which they participated in the last 12 months prior to filling in the questionnaire. The results were grouped into the following categories: 1) types of events attended: courses, competitions, other events, 2) sports practiced and 3) organizers. From the total of 47 entries (i.e. community programs accessed), 32 were sports competitions, 13 were courses, the rest of 2 being a training session and a social cause.

The most practiced sports in the community programs were running, dancing, table tennis and swimming. More rare sports were also practiced, such as kayak or qwan-qi-do. In terms of organizers, most of them were sport NGOs and student NGOs, followed by sport associations

and public institutions such as universities or public local administration authorities.

Discussions

The current study adds to the literature approaching the physical activity levels and preferences for physical activity in youth and adolescents. The results presented indicate a higher tendency of medical school students to access sport infrastructure for practicing leisure time physical activities such as home and around home, outdoor infrastructure and university infrastructure. The results of the current study are in accordance with the results of a study conducted in Romania on a national representative sample of youth aged 14 to 35, which reported that outdoor sport fields (29%), public spaces (21%) and one's own home (17%) were the most accessed places by youth when practicing physical activities. In terms of paying for accessing the sport infrastructure, the same study showed that 56% of the respondents did not spend any money on sport per month, whereas 21% spent between 10 and 50 RON and only 2% spent over 200 RON (***, 2014).

The fact that only about 20% of the medical school students access the university infrastructure might be related to motivations or reasons such as the quality of the infrastructure, opportunities to play favourite sports or safety. A study conducted in a sample of Australian students concluded that the use of university sport facilities declined after the introduction of a tax for accessing this infrastructure (Jones & Barrie, 2011). This might also be the case of students from the Cluj and Iasi universities, as results show that 1st and 2nd year students, who have free access to the university sport infrastructure during their physical activity classes, access this infrastructure significantly more than their 3rd to 6th year peers, who probably would have to pay for access to the university infrastructure.

Thus, acquiring an increased knowledge and understanding of the infrastructure and community programs preferred by the medical school students for practicing physical activities is very important in order to make evidence informed decisions regarding the organization and delivery of these types of services for this particular population subgroup.

Positively influencing the attitudes and knowledge related to physical activity as well as physical activity behavior of these individuals can provide multiple benefits from the aforementioned perspectives, i.e. more physically active and more knowledgeable medical doctors (in regards to the benefits of physical activity) represent models in society and are more prone to promote the practice of physical activities to their patients (Frank et al., 2008; Stanford et al., 2014).

More in-depth research into the preferences for the types of physical activities and places for practicing physical activities of medical school students should be conducted and the results obtained should be presented to universities, in order to obtain the highest possible impact of the research results on the target population.

Conclusions

1. A majority of medical school students (65%) prefer free-of-charge sport infrastructure, 20% of which is university infrastructure.

2. First and 2nd year students access university sport infrastructure significantly more (p=0.002, IS; p=0.020, CJ) than their 3rd to 6th year peers.

3. A large majority (84%) of the medical school students did not access any type of physical activity community program in the last 12 months prior to participation in the study and there are no statistically significant differences between participants and non-participants in these programs.

4. Increased efforts should be oriented towards offering accessible and enjoyable physical activity services to medical school students, as physical activity related behaviors in this population subgroup can exert a high influence on the general population.

Conflicts of interests

The authors have no conflict of interest.

Acknowledgments

This paper was published under the frame of the European Social Fund, Human Resources Development Operational Programme 2007-2013, project no. POSDRU/159/1.5/138776.

References

Frank E, Tong E, Lobelo F, Carrera J, Duperly J. Physical activity levels and counseling practices of U.S. medical students. Med Sci Sports Exerc. 2008; 40(3):413-421. doi: 10.1249/MSS.0b013e31815ff399.

Griffin SJ, Kinmonth AL, Veltman MW, Gillard S, Grant J, Stewart M. Effect on Health-Related Outcomes of Interventions to Alter the Interaction Between Patients and Practitioners: A Systematic Review of Trials. Ann Fam Med. 2004;2(6):595-608.

Jones SC, Barrie L. Declining physical activity levels as an unintended consequence of abolishing mandatory campus service fees. J Am Coll Health, 2011;59 (6):511-518.

Jose AK, Blizzard L, Dwyer T, McKercher C, Venn AJ. Childhood and adolescent predictors of leisure time physical activity during the transition from adolescence to adulthood: a population based cohort study. Int J Behav Nutr Phys Act. 2011;8 Article 54. doi:10.1186/1479-5868-8-54.

Meiro-Lorenzo M, Villafana TL, Harrit MN. Effective responses to non-communicable disease: embracing action beyond the health sector. Washington: The World Bank; (Health, Nutrition and Population Discussion Paper), 2011.

Mocean F. Sănătate, marketing și management. Ed. Medicală Universitară, Cluj-Napoca, 2007.

Petrilli CM, Mack M, Janowitz Petrilli J, Hickner A, Saint S, Chopra V. 2015 Understanding the role of physician attire on patient perceptions: a systematic review of the literature-targeting attire to improve likelihood of rapport (TAILOR) investigators. BMJ Open. 2015;5:e006578:1-18. doi:10.1136/bmjopen-2014-006578.

Stanford F, Durkin M, Stallworth J, Powell C, Poston M, Blair S. Factors that influence physicians' and medical students' confidence in counseling patients about physical activity. J Primary Prevention. 2014;35(3):193-201. DOI 10.1007/s10935-014-0345-4.

Weiss DR, O'Loughlin JL, Platt RW, Paradis G. Five-year

predictors of physical activity decline among adults in low-income communities: a prospective study. Int J Behav Nutr Phys Act. 2007;4:23. doi: 10.1186/1479-5868-4-23.

***. Ministerul Tineretului şi Sportului. Participarea tinerilor la activităţi sportive. Studiu sociologic cantitativ reprezentativ la nivelul tinerilor din România. Participarea tinerilor la activităţi sportive. Studiu sociologic cantitativ reprezentativ la nivelul tinerilor din România. Available online at: http://mts.ro/wp-content/uploads/2014/11/RAPORT-CERCETARE-SPORT-AVANGARDE-SEPTEMBRIE-2014.pdf Accessed on April 24, 2015

Websites

(1) WHO Europe. Body Mass Index-BMI. Available online at: http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi. Accessed on 2015, June 16.

(2) World Health Organization. Noncommunicable diseases-Fact sheet. Available online at: http://www.who.int/mediacentre/factsheets/fs355/en/. Accessed on 2015, June 16.

(3) World Health Organization. World Health Organization Country Profiles. Available online at: http://www.who.int/nmh/countries/rou_en.pdf?ua=1. Accessed on 2015, June 16.

(4) World Health Organization. Physical Inactivity: A Global Public Health Problem. Available online at: http://www.who.int/dietphysicalactivity/factsheet_inactivity/en/. Accessed on 2015, June 16.

(5) World Health Organization. Global Strategy on Diet, Physical Activity and Health. Childhood overweight and obesity. Available online at: http://www.who.int/dietphysicalactivity/childhood/en/. Accessed on 2015, June 16.

(6) World Health Organization. Physical activity Fact Sheet No.385. Available online at: http://www.who.int/mediacentre/factsheets/fs385/en/. Accessed on 2015, June 16.

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 144–148

Psychomotor skills – a general or specific approach?
Psihomotricitatea - abordare generală sau specifică?

Adrian Alexandru Moşoi, Lorand Balint
Faculty of Physical Education and Mountain Sports, Transylvania University of Braşov

Abstract

Background. The progressive transformation of the psychomotor components necessary in an activity depends greatly on each individual's capacity to understand this process and act on prefiguring exclusive skills for a particular area of practice.

Aims. This study is based on comparing groups of subjects with various professional activities, depending on the psychomotor components development.

Methods. The methodology of the study is based on the use of measuring instruments, with an objective character, applied to emphasize the differences between individuals by using psychological tests (the motivation test - PM Inventory, the psychosocial test - Social self-esteem inventory) and bio-motor tests (Vienna Test Sport System, the hand-eye coordination test - SMK, the space-time anticipation test - ZBA, the Opto-Jump test and the Equilibrium Platform test).

Results. The results of the study generally indicated a medium adaptation level for the measured psychomotor components and a high adaptation level of those specific psychomotor components in relation to the task and dominant field of activity.

Conclusions. We must emphasize that these measured components have an average level regardless of the activity, but the score increases (or is lowered) for the specific components, depending on the activated aptitude of the individual.

Keywords: psychomotor, indicators, specific, behaviour, activity.

Rezumat

Premize. Transformarea progresivă a componentelor psihomotorii care sunt necesare într-o activitate, depinde în mare măsură de capacitatea fiecăruia de a înţelege acest proces şi de a acţiona/a se acţiona în sensul prefigurării unor deprinderi exclusive pentru un anumit domeniu de practică.

Obiective. Compararea unor grupuri de subiecţi care prestează activităţi sportive diferite, în funcţie de dezvoltarea psihomotrice.

Metode. Metodologia studiului se bazează pe folosirea unor instrumente de măsurare cu caracter obiectiv, aplicate în vederea evidenţierii diferenţelor dintre indivizi cu ajutorul testelor psihologice, (testul de motivaţie – Inventarul PM, testul psihosocial – Inventar de stimă de sine socială) şi a testelor biomotrice (Vienna Test Sport System – proba de coordonare mână – ochi SMK,1 şi proba de anticipare în timp şi spaţiu ZBA; Testul Opto-Jump şi Platforma de echilibru).

Rezultate. Rezultatele studiului au indicat un nivel de adaptare mediu, la modul general, pentru componentele psihomotorii măsurate şi un nivel ridicat al acelor componente psihomotorii specifice, în raport cu sarcina şi cu domeniul de activitate dominant.

Concluzii. Componentele măsurate au un nivel mediu, indiferent de activitate, însă componentele specifice, scorul acestora creşte (deşi poate uneori să şi scadă), în funcţie de rezerva aptitudinală activată a individului.

Cuvinte cheie: psihomotricitate, indicatori, specific, comportament, activitate.

Introduction

In everyday life we often hear people talking about their occupations. Most often these occupations are chosen on the basis of decisions about their own qualities in various fields. These opinions, in one field or another, have formed based on some accumulated experiences, through success or failure in different tasks. The acquisition level of psychomotor components is reflected in the development of individuals through their behaviour. Manifesting an efficient behaviour in relation to certain situations is the key to the individual's adaptation to the social environment and demonstrates the possibility to innovate attitudes and capacities. Our environmental activities are carried out through the "environment – action" relationship, by creating an interior model of the outside world (Albus, 1991).

From general to specific, the psychomotor components' metamorphosis implies shaping the outside world (general abilities), by adapting it to the interior model (individual specific abilities). The individual is born with a genetically acquired psychomotor background. The individual's ontogenetic evolution depends on several social, cultural

Received: 2014, March 29; *Accepted for publication:* 2015, April 10;
Address for correspondence: "Universitatea Transilvania din Braşov, Facultatea de Educaţie Fizică şi Sporturi Montane, Str. Colina Universităţii nr.1 cod 500068, Romania
E-mail: alex2mos@yahoo.com
Corresponding author: Adrian Alexandru Mosoi

and environmental factors. Individual differences can be observed from this perspective or from the individual's capacity to evolve.

The individual's evolution by reaching the human limits is a goal in high-performance sports. In order to overcome the barriers which appear during the sports training process, some specialists (Smith et. al., 1995; Young & Knight, 2014) discuss psychological skills as contributing factors to maximizing the potential of the individual's physical abilities, especially for sports with a high risk. The involvement of mental skills in high-risk sports indicates that athletes who practice extreme sports have the capacity to maintain a very high skill level in any event; moreover, in case of danger, they have the resources to overcome any psychological situation. The authors studied a large number of sports, including glider flight. Differences between a pilot and a non-pilot were identified in the brain by an increase in the ventral premotor cortical matter and the peripheral field of vision. These discoveries reveal cognitive and motor processes associated with the studied areas (Ahamed et al., 2014).

Flying a glider implies developing psychomotor skills such as an airline pilot's. Identification and development of an airline pilot's skills are essential when technical problems arise and aircraft maneuvering is switched from automatic to manual. Technical components and narrow skills are not enough for safe aircraft functioning; a synergistic relationship between desire (motivation), ability (emotional stability, cognitive synthesis, psychomotor skills) and means (adaptation possibility to the flight's specific requirements and risks) is also required (1). This approach shows that selection in high risk activities involves several perspectives, one of these being the motivational component of the individual's personality. In this context, it is considered that although high-level psychomotor skills have their degree of importance, they depend on the individual's degree of involvement in activity. For the development of psychomotor skills in a shorter time, Bolstadt et al. (2010) have developed a system of six modules, to improve the awareness of risk situations. Generally, the training modules have improved the participants' performance in these specific skills, without producing the desired effect regarding the degree of awareness of risk situations.

Another step of our research was the study of the literature on athletes practicing judo. We chose this sport because it involves adaptation to one-on-one combat situations, including as an induced state of danger. A high level of adaptability is a prerequisite for a higher degree of activity, and developing formative adaptation responses depends on the quality of psychic and motor skills (Lech & Sterkowicz, 2004). Supiński et al. (2014) indicate in their study that high athletic performance in judo would be conditioned by an optimal level of psychomotor skills.

The third direction of this investigation has been oriented towards field tennis, which is currently one of the most publicized sports in the world. Confrontation in this situation is face to face, and the opponents are separated by a net. The net also has the role of an obstacle and the main objective of a tennis player is to hit as many balls as possible over the net, so that the opponent will miss the ball or just make a mistake, provoked or unprovoked. Crespo et al. (2006) discuss the importance of training physical and mental abilities in a steady rhythm. A tennis match is not as dangerous as a glider flight or fight on the tatami, but involves a high level of adrenaline when the score is very close. Sheldon & Eccles (2005) have conducted research investigating tennis players in relation to physical and psychological skills. The research has shown that perceived confidence and achievement motivation have a significant role in the athletes' results. Carlsted (2007) used a neurocognitive test battery in tennis players for measuring neurochemical activity in each lobe of the brain. This battery of tests is based on the athlete's understanding of certain tasks; the measured psychological factors are attentional behaviour in terms of concentration, maintenance and diversification; hand-eye coordination, and spatial ability; executive function – planning; social cognition - social recognition.

Objectives

The study's objective is to compare some groups of subjects who perform different professional activities, whose psychomotor component development is influenced, with specialization tendencies of the psychomotor components.

Hypothesis

The specific manifestation level of necessary psychomotor components for an activity depends largely on the individual's own capacity of understanding this process and of taking action (in the case of a formative process) in the sense of prefiguring exclusive skills for a certain practice field.

Material and methods

Protocol research:

a) *Period and place of the research*

The approval of the University's Ethics Commission for conducting research on human subjects was obtained. The requirement of the subjects' informed consent was met through the POSDRU project and the collaboration contract between the Rectorship and Brasov Aero Club. Each participant filled in a form of factual data, among which the testing participation agreement.

In this study, we used the psychomotor testing equipment of the Transylvania Research Institute in Braşov. The study was conducted over a period of four months, November 2014 – February 2015.

b) *Subjects and groups*

The participants in this study were gliders from Braşov Aero Club, n=6, and athletes from the judo (n=6) and tennis (n=6) sections of Dinamo Sports Club, all aged between 14 and 24 years.

c) *Tests applied*

For this study, the following tests were used:

Social Self-Esteem Inventory – a questionnaire developed to measure self-esteem in social situations. This questionnaire has the advantage of measuring only one dimension of self-esteem.

Intrinsic/extrinsic motivation questionnaire: The inventory describes motivational preferences, work

motivating factors. It contains two primary scales: intrinsic motivation and extrinsic motivation. Secondary intrinsic scales are pleasure and challenge, and extrinsic ones are reward and recognition.

Balance platform: The equipment allows the study of the position of a horizontal projection of the athlete's mass centre. It acquires data on the time course of the pressure centre, provides real-time visual informational reactions to the athlete and performs standard calculations of data on the development of the centre of pressure position. Only one acquisition was taken into consideration – the route length (total route) calculated in millimetres, for the rebalancing task (with eyes opened).

Opto-jump: This device measures and evaluates sport performance for various parameters such as expansion and responsiveness. The optical detection system measures the contact time with an accuracy of 1/1000 seconds during the execution of a jumping series. We considered the following acquisitions: time on the ground (ms), time in the air (ms), flight height (cm) and strength (w/kg).

Vienna test - hand-eye sensorimotor coordination, measured using the SMK 1 test, which lasts ten minutes. The test consists of manipulating a segment on a circular trajectory, the movement taking place into a three-dimensional space. The purpose is to provide information about sensorimotor development on a hand-eye level and the following data are provided: angular deviation, measured in degrees (right hand coordination on rotation level), horizontal deviation measured in pixels (left hand coordination, horizontally), vertical deviation, measured in pixels (right hand coordination, vertically). Space and time anticipation was measured using the Time/Movement Anticipation test. In our study, we used the ZBA S3 test with 8 items. Time anticipation is measured by the athlete's ability to predict where the ball will reappear on the target line. In the second phase of the test, the subject also has to indicate where the ball is placed. This last execution measures the athlete's ability of anticipating motion in space and time. For the Space and Time Anticipation test, the following variables were taken into account: median time deviation and median direction deviation. For all variables, the raw score was taken into consideration. The testing protocol was achieved by: a) psychosocial testing (15 minutes); b) biometric testing (Vienna Test - 10 minutes, Equilibrium Platform - 3 minutes and Opto-Jump - 2 minutes).

d) *Statistical processing*

All data were analysed using SPSS 18. Each variable's distribution was analysed in order to identify abnormalities or extreme data. These data were analysed using the unifactorial Anova test, with one independent variable, group type, consisting of 6 athletes for each group. F critical (F (0.05, 2, 15)) from table F, for p =0.05: F critical = 3.6823.

Results

Table I shows significant data for the conducted research. The rest of data are not included in the table because of the high information volume. No differences were identified for

Table I

Descriptive data according to each group - for the analysed indicators.

Indicators		N	Average	Standard deviation	Standard error	95% Av. confidence interval	
						Lower limit	Upper limit
Intrinsic Recognition	gliding	6	27.00	2.530	1.033	24.35	29.65
	judo	6	31.00	2.000	.816	28.90	33.10
	tennis	6	27.17	2.787	1.138	24.24	30.09
	Total	18	28.39	2.993	.705	26.90	29.88
Balance LT4	gliding	6	1292.00	283.564	115.764	994.42	1589.58
	judo	6	753.00	253.787	103.608	486.67	1019.33
	tennis	6	1396.33	139.688	57.027	1249.74	1542.93
	Total	18	1147.11	363.982	85.791	966.11	1328.12
Air Time	gliding	6	.38583	.072334	.029530	.30992	.46174
	judo	6	.46900	.052998	.021636	.41338	.52462
	tennis	6	.28617	.054591	.022287	.22888	.34346
	Total	18	.38033	.095690	.022554	.33275	.42792
Flight Height	gliding	6	18.9500	6.79198	2.77281	11.8223	26.0777
	judo	6	30.8650	5.09841	2.08142	25.5146	36.2154
	tennis	6	21.1850	6.87960	2.80859	13.9653	28.4047
	Total	18	23.6667	7.96536	1.87745	19.7056	27.6277
Strength	gliding	6	25.3167	7.83944	3.20044	17.0897	33.5436
	judo	6	36.1400	5.21702	2.12984	30.6651	41.6149
	tennis	6	27.2567	7.57070	3.09072	19.3117	35.2016
	Total	18	29.5711	8.15147	1.92132	25.5175	33.6247
Average Angle	gliding	6	24.650	4.9168	2.0073	19.490	29.810
	judo	6	31.997	5.8449	2.3862	25.863	38.131
	tennis	6	30.450	2.3839	.9732	27.948	32.952
	Total	18	29.032	5.4239	1.2784	26.335	31.729
Average Vertical	gliding	6	34.950	11.1177	4.5388	23.283	46.617
	judo	6	47.833	12.3801	5.0542	34.841	60.825
	tennis	6	54.033	9.1782	3.7470	44.401	63.665
	Total	18	45.606	13.1568	3.1011	39.063	52.148
Average Horiz. after 5 minutes	gliding	6	40.633	15.3530	6.2678	24.521	56.745
	judo	6	50.683	17.4848	7.1381	32.334	69.032
	tennis	6	65.567	7.3896	3.0168	57.812	73.322
	Total	18	52.294	16.9230	3.9888	43.879	60.710
Average Vert.1 after 5 minutes	gliding	6	31.383	10.3507	4.2257	20.521	42.246
	judo	6	43.883	10.4840	4.2801	32.881	54.886
	tennis	6	50.183	8.6675	3.5385	41.087	59.279
	Total	18	41.817	12.2706	2.8922	35.715	47.919

the social self-esteem questionnaire, intrinsic motivation, pleasure, p = .510; intrinsic motivation, challenge, p = .254, extrinsic motivation, reward, p = .666. There were also no differences for Opto-Jump, ground–time acquisition, p = 117. There were no differences for the Vienna Test, SKM 1 test, angle average after 5 minutes, p = .075, and the ZBA 3 test, median time deviation, p = 409 and median direction deviation, p = .280. Group differences were distributed, for all significant indices, in Table 2, where data statistically processed by the unifactorial Anova procedure are found. For the comparison of the groups, we also used Post-Hoc analysis, for which we chose the Games-Howell test, one of the most powerful procedures, when the groups of subjects are small (Field, 2009).

From descriptive data, the presence of differences between the three groups can be noted. The confidence interval is different. The average is not significantly equal between the three groups, which indicates the presence of differences between them (Table II).

Table II
Unifactorial ANOVA results

Psychomotor abilities	(F)	df	(p≤ .005)*	ŋ²
Intrinsic Recognition	5.073	2	.021	.4
Balance (LT 4)	13.058	2	.001*	.63
Opto-Jump – Air Time	13.686	2	.000*	.64
Opto-Jump – Flight Height	6.044	2	.012	.44
Opto-Jump – Strength	4.106	2	.038	.35
Vienna Test Average Angle	4.218	2	.035	.36
Vienna Test – Average Vert	4.724	2	.026	.36
Vienna Test Average Horiz .1	4.782	2	.025	.38
Vienna Test – Average Vert.1	5.641	2	.015	.42

Note: df (degrees of freedom); p (significance degree); ŋ (effect size).

The results of Post-Hoc analysis for motivation indicated differences between group 1 (gliders) and group 2 (judo practitioners), p = .034; no differences were found between tennis players and judo practitioners and gliders. The results of Post-Hoc analysis for balance showed differences between group 2 and group 1, p = .015 and group 3, p = .002; there were no differences between tennis players and gliders. The results of Post-Hoc analysis for Opto-Jump indicated differences in the time spent in the air between judo practitioners and tennis players, p = .000, in flight height between judo practitioners and gliders, p = .018, no differences in strength between the three groups. The results of Post-Hoc analysis for the Vienna Test evidenced differences in average vertical deviation between tennis players and gliders, p = .023 and differences in horizontal and vertical average after 5 minutes between gliders and tennis players, p = .02, p = .017, respectively. No differences in average angle deviation between the groups were found.

Discussions

Identifying extrinsic motivation recognition as difference between groups allows us to discuss the motivational aspect of personality, the athlete's involvement in tasks, regardless of the field. Our results revealed that those who fly in an airplane have a significantly higher desire of recognition than those who practice judo. There were no differences on motivational level between tennis players and judo practitioners, which shows that motivation on this level is intrinsic. This approach confirms the study of Harwood et al. (2004), conducted on elite athletes; the authors maintain that mobilized psychological competences are as important as the actual skills. Another important approach was identifying differences in rebalancing, judo practitioners proving to be superior from this point of view to tennis players and gliders. This difference could be explained by the development of this quality over time in judo practitioners, balance being one of the fundamental qualities for obtaining performance in this sport (Witkowski et al., 2014).

The results of hand-eye coordination tests revealed differences between gliders and tennis players. Judo practitioners, due to the specifics of this sport, possess very high coordination skills, especially since these are acquired in time without any devices (the handle in the glider) or objects (the racquet in tennis). Differences between athletes were found for both hands. Compared to judo practitioners, who use both their hands when they fight, tennis players mostly use their dominant hand and while flying, gliders also use their dominant hand the most. It was interesting to observe the difference in the right hand for vertical tasks during the first five minutes and after five minutes. These results are similar to those of Thullier et al. (2008), who made a device to evaluate psychomotor performance during a visual indication task. The study's results showed a lower performance level in the case of vertical compared to horizontal objects – a demonstrated fact in this study for tennis players and gliders, but not for judo practitioners. Visual feedback being connected between the hand rotation direction and the effect produced by localizing the target, it would seem it is far easier to discriminate for judo practitioners and gliders and more difficult for tennis players.

In the same direction of study, Obminski et al. (2011) tested whether hand-eye coordination has a predictive role in performance in junior boxing. The results indicated a better coordination in experienced athletes, without explaining the experimentally evidenced performance. Our results, in accordance with the literature, reinforce the need for high performance athletes to learn how to control their movements in stressful situations, in order to achieve success, emphasizing the fact that there is a basic level for these psychomotor skills (Button et al., 2011).

Conclusions

1. This study's results show a medium adaptation level, generally speaking, for the measured psychomotor components and a high level of specific psychomotor components, in relation to the task and the subjects' dominant field of activity.

2. All measured components have a medium level regardless of the activity practiced by the athlete, but the score of the specific indicators of each sport increases (and can sometimes decrease) depending on the individual's activated aptitude.

Conflicts of interests
There were no conflicts of interests.

Acknowledgments

This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the Project number POSDRU / 159 / 1.5 / S / 134378 and we hereby acknowledge the structural funds project PRO-DD (POS-CCE, O.2.2.1., ID 123, SMIS 2637, ctr. No 11/2009) for providing the infrastructure used in this work.

References

Ahamed T, Kavanabe M, Ishii S, Callan ED. Structural differences in gray matter between glider pilots and non-pilots. A voxel-based morphometry study. Frontiers in Neurology | Sports Neurology. 2014;5:248. doi: 10.3389/fneur.2014.00248.

Albus J. Outline for a theory of intelligence. IEEE Trans. Syst. Man Cybern. 1991;21(3):473-509.

Bolstadt CA, Endsley MR, Costello AM, Howell CD. Evaluation of Computer-Based Situation Awareness Training for General Aviation Pilots. The international journal of aviation psychology, 2010;20 (3):1-26. DOI: 10.1080/10508410105084142010487013

Button C, MacMahon C, Masters R. Keeping it together: motor control under pressure. Performance Psychology - A practitioners Guide, Churchill Livingstone Elsevier, 2011,77-190

Carlsted A. Integrative Evidence-Based Athlete Assessment and Intervention: A Field-Tested and Validated Protocol. J Am Board Sport Psychol, 2007;1:1-30, Article # 1.

Crespo M, Reid M, Quinn A. Tennis Psychol. ITF 2006:17-18, 29-30; 46.

Field A, 2009. Discovering Statistics Using SPSS. Third Edt, London, SAGE Publications, Thousand Oaks.

Harwood C, Cumming J, Fletcher D. Motivational Profiles and Psychological Skills Use within Elite Youth Sport. J Appl Sport Psychol, 2004;16(4):318-332.

Lech G, Sertić H, Sterkowicz S, Sterkowicz-Przybycień K, Jaworski J, Krawczyk R. Effects of different aspects of coordination on the fighting methods and sport skill level in cadet judo contestants. Kinesiology 2014;46(1):69-78.

Obminski Z, Mroczkowska H, Kownacka I, Stabno J. Personality traits and eye-hand co-ordination in less and more succesful young male boxers. J Combat Sports Mart Arts, 2011;2(2):83-89.

Sheldon JP, Eccles JS. Physical and Psychological Predictors of Perceived Ability in Adult Male and Female Tennis Players. J Appl Sport Psychol, 2005;17(1):48-63.

Smith RE, Schutz RW, Smoll FL, Ptacek JT. Development and validation of a multidimensional measure of sport specific psychological skills: The Athletic Coping Skills Inventory-28. J Sport Exerc Psychol, 1995;17:379-398.

Supiński J, Obmiński Z, Kubacki R, Jerzy K, Waldemar M. Usefulness of the psychomotor tests for distinguishing the skill levels among older and younger judo athletes. Arch Budo 2014;10:315-322.

Thullier F, Lepelley MC, Lestienne GF. An evaluation tool for psychomotor performance during visual motor task: An application of information theory. J Neurosci Meth, 2008;171: 183-189.

Witkowski K, Maśliński J, Remiarz A. Static and dynamic balance in 14-15 year old boys training judo and in their non-active peers. Arch Budo 2014;10:323-331.

Young PR, Knight EL. Use of Psychological Skills by Risk Sport Athletes. J Human Perform Extreme Environ. 2014;11(2), Article 2. DOI:http://dx.doi.org/10.7771/2327-2937.1061.

Websites

(1) ECA 2013 - European Cockpit Association. Pilot training compass. Available online at https://www.eurocockpit.be/sites/default/files/eca_pilot_training_compass_back_to_the_future_13_0228.pdf. Accessed on 23.03.2015

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 149–153

An inexpensive solution for tracking the knee flexion angle for patients in motor recovery

O soluţie ieftină de urmărire a unghiului de flexie a genunchiului pentru pacienţii aflaţi în recuperare motrică

Mircea Mihălcică [1], Ioan Burcă [2], Violeta Munteanu [1]
[1] *Transilvania University of Brasov, Romania*
[2] *University of Medicine and Pharmacy Târgu Mures, Romania*

Abstract

Background. The knee flexion angle is an important parameter to follow for patients in motor recovery. By measuring this parameter frequently during walking, the physicians are able to reach some conclusions on the state of the patient, in terms of recovery of motor functions. Unfortunately, in low income countries, this is almost impossible because of the rarity or lack of the equipment and/or specialized rehabilitation centers where this procedure can be performed.

Aims. This paper mainly aims to demonstrate that knee flexion is recovered differently depending on the patient, and also proposes an inexpensive solution for the tracking of the knee flexion angle during the recovery period.

Methods. By using a motion capture and analysis system, we obtained a series of experimental data, specific for patients in motor recovery. Using these data, we were able to extract the knee flexion angle during three sessions over twenty days during postoperative recovery (the video recording sessions beginning 10 days after surgery). In our study we used data from three patients who had suffered a total knee arthroplasty surgery and were in postoperative motor recovery.

Results. After performing the motion capture and analysis procedures, it was found that the knee flexion angle values measured over three sessions during the twenty days were significantly different for the three patients.

Conclusions. After a total knee arthroplasty procedure, the patients recover their knee flexion angle differently. During the recovery period, having access to frequent data about the knee flexion angle (in walking) will help the therapist to adjust the recovery procedures specifically for each patient, for a more efficient recovery.

Keywords: motor recovery, motion analysis, biomechanics, knee flexion angle, total knee arthroplasty.

Rezumat

Premize. Unghiul de flexie al genunchiului este un parametru important în perioada de recuperare motrică a unui pacient. Prin măsurarea repetată a acestui parametru în timpul mersului, postoperator, odată cu începerea perioadei de recuperare, medicii au posibilitatea de a ajunge la o serie de concluzii asupra stadiului în care se găseşte pacientul, din punct de vedere al recuperării funcţiilor motrice. În ţările cu venituri mici, acest lucru este aproape imposibil, datorită rarităţii sau chiar lipsei aparaturii şi/sau centrelor de recuperare specializate unde s-ar putea realiza această operaţiune.

Obiective. Acest articol îşi propune să demonstreze în principal faptul că flexia genunchiului se recuperează în mod diferit în funcţie de pacient şi, în mod secundar, propune o soluţie ieftină pentru a realiza urmărirea unghiului de flexie a genunchiului de-a lungul perioadei de recuperare.

Metode. Cu ajutorul unui sistem de înregistrare şi analiză a mersului, am obţinut o serie de date experimentale specifice pentru pacienţii în recuperare motrică. Folosind aceste date, am extras valorile unghiului de flexie a genunchiului pacienţilor pe parcursul a trei sesiuni de-a lungul a douăzeci de zile de recuperare postoperatorie (înregistrările au început la 10 zile după intervenţia chirurgicală). În studiul nostru am folosit datele pentru trei pacienţi ce au suferit o operaţie de înlocuire totală a articulaţiei genunchiului şi se aflau în perioada de recuperare a funcţiilor motrice.

Rezultate. În urma înregistrărilor şi analizei mişcării, se constată că valorile unghiului de flexie a genunchiului, măsurate de-a lungul celor trei sesiuni pe perioada celor douăzeci de zile, sunt vizibil diferite pentru cei trei pacienţi.

Concluzii. Pacienţii îşi recuperează diferit unghiul de flexie a genunchiului în urma unei proceduri de înlocuire totală a respectivei articulaţii. Cunoaşterea frecventă a unghiului de flexie în mers a pacienţilor aflaţi în recuperare motrică va ajuta kinetoterapeutul în a adapta procedurile de recuperare în mod specific pentru fiecare pacient, pentru o recuperare cât mai eficientă.

Cuvinte cheie: recuperare motrică, analiza mişcării, biomecanică, unghi de flexie a genunchiului, artroplastie totală de genunchi.

Received: 2015, April 14; *Accepted for publication:* 2015, May 3;
Address for correspondence: Transilvania University of Braşov, Mechanical Engineering Department, B-dul Eroilor nr.29, 500036 Brasov, Romania
E-mail: mihalcica.mircea@unitbv.ro
Corresponding author: Mircea Mihălcică

Introduction

After a total knee arthroplasty surgery, patients in motor recovery are instructed to follow a specialized recovery program which consists of specific recovery procedures and techniques, or at least to frequently perform some series of physical exercises (Cup et al., 2007; Daves et al., 2006; Hardling et al., 2005). These procedures should be prescribed based on an individualized approach which considers many factors that influence the recovery process. Unfortunately, in low income countries, the paraclinical tools that help create this individualized approach are usually very rare or do not even exist. This leads to high patient dissatisfaction after total knee arthroplasty (Nam et al., 2014). It is common sense that patients recover their motor functions differently, influenced by factors such as age, sex, medical history, mental attitude, etc. (Allen et al., 2014) and therefore, each patient should be targeted individually, using a specific recovery program (Minns et al., 2007; Simpson et al., 2014). In order to be able to develop customized programs for every patient, analysis of their gait would help considerably (Molloy et al., 2008). In developed countries, this might not be such an important issue, but in low and even some middle income countries, we have to talk about an effective coverage of medical services before we can even take customized recovery programs into consideration (Debas et al., 2006; Ozgediz et al., 2009). For example, according to local recovery and rehabilitation physicians, in Romania, only one out of three patients who undergo a total knee arthroplasty procedure (our data refer only to procedures supported by the country's national healthcare system, excluding private clinics) will follow a dedicated post-operative program. On the other hand, it is proven by the literature (Akça & Doğan, 2012) that exercising at home helps reduce symptoms associated with osteoarthritis. Therefore, an acceptable solution to create a customized recovery program for low income countries would consist of a simple, inexpensive, portable and easy to install and use motion analysis system to be used at home or in a nursing home.

Hypothesis

In this paper, we present the capture and analysis of the knee flexion angle, an important gait parameter in motor recovery following a total knee arthroplasty procedure. The data are collected and analyzed by using an inexpensive, portable, easy to install and use motion analysis system, designed to be used frequently, at home or in a nursing home. We believe that, by adapting to the rate of recovery for this parameter, which we prove is specific to each of the three considered patients, physicians would be able to design recovery exercise programs with higher degrees of customization, which will lead to an overall better motor recovery.

Material and methods

A motion analysis system can be divided in hardware components (components which are used for motion recording) and software components (components used for the digitization of motion data, followed by the analysis of digitized data). We designed the motion analysis system aiming to avoid the use of any hard-to-find components, so that it can be easily implemented in any part of the world.

The idea behind this system's components and installation conditions was to be able to easily install such a system at home. From the hardware perspective, a 60+ frames per second video camera is needed along with a good, solid tripod and long power cables. We obtained decent results using a 63 frames per second video camera - a more expensive, 500 frames per second camera is not required, but welcomed. The video materials in this paper were recorded at 63 frames per second.

From the software perspective, two things are needed: software able to track the motion, extract the motion data and export them in a digital form to some commonly used type of database, and a set of programs which can analyze the digital data, in order to offer results that have meaning for the physician. For this paper, we considered for analysis the knee flexion angle (Fig. 1).

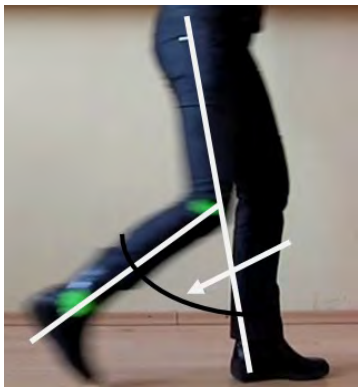


Fig. 1 – The knee angle which we captured and analyzed in this paper.

It was very important for us to choose software that is very popular, so there would be no regional limitations related to software. We have chosen Adobe After Effects (even if it is not specifically dedicated for human motion analysis, it is a very popular application, designed by a software giant, so it is likely to receive updates for a long period of time). For motion analysis, we chose Matlab (a great engineering application, it offers a lot of tools related to advanced analysis, with the use of curve fitting techniques, etc.), but it is not an exclusive requirement - any programming language which can read Excel files should be suited for the task.

The decisions above were also taken because we wanted to make sure that the system would actually have its use, considering low income countries: motion data can be recorded at the patient's home or in a nursing home.

Our subjects were all female, over 60 years old, suffering from gonarthrosis (arthrosis of the knee). They were treated with total knee arthroplasty (total replacement of the knee). They followed the normal, classical rehabilitation routine which implies different physiotherapy procedures and exercises during the recovery period. During 20 days (starting 10 days after surgery), we video recorded and analyzed the motion of their affected leg.

For each patient, we had a video capture session every 10 days, at the patient's home. All patients used a walking

frame for support. They performed 10 walks in a normal gait during each session, covering a fixed distance of 2.3 meters for each walk. The camera was placed laterally, at 2.8 meters, perpendicular to the direction of walking and in the middle of the distance, so that it covered the sagittal plane of the subjects. Markers were installed on the ankle, knee and hip of the patient. The camera was placed at a height of 30 cm from the ground. The numbers were chosen based on our previous studies (Mihalcica et al., 2014; Munteanu, 2014), which delivered good results.

To better understand the procedure, we will describe how things work for a subject of the experiment:

- the system is set up as described above, markers are installed at the position of the joints (the subjects wear the same clothes, as fixed to the body as possible, with the markers fixed in the same spots during all sessions - practically, the patients use the same set of clothes without removing the markers).
- the subject starts walking (the first step is made with the affected leg) and, at the same moment, the camera starts filming
- the subject exits the frame, the camera stops filming
- the video material is saved to the computer
- the video material is then imported in VirtualDub where we cut the extra material, so that the subject walking from the starting point to the end point is all that remains
- the video material is then imported in Adobe After Effects, and then the tracking tool is used (Animation/ Track Motion) on the three markers, one by one (Fig. 2).

Fig. 2 – Tracking the ankle motion in Adobe After Effects.

- the ankle, knee and hip markers are followed during the walk and the trajectory is then exported in Excel, as X-Y pairs of coordinates for each frame
- data are pre-processed using a program developed in Matlab (realigned to 0.0 as origin)
- data are processed using a second program developed in Matlab, to determine the trajectory of the ankle, knee and hip; this is graphically represented in time (Fig. 3).

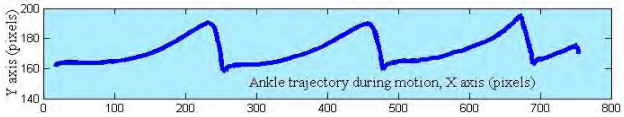


Fig. 3 – The ankle trajectory for a subject, processed with MATLAB.

- data are processed using a third program developed in Matlab to determine the flexion angle of the knee

We present the evolution of the knee flexion angle, during a walk (Fig. 4). We have the coordinates for the ankle, knee and hip, and from the triangle formed, this angle is easy to determine. This angle of flexion is then extracted for each step, and then an analysis is done in order to extract important information about the state of recovery of the patient. This information can lead to adaptations and modifications of the recovery program, which will help the patient in his motor recovery.

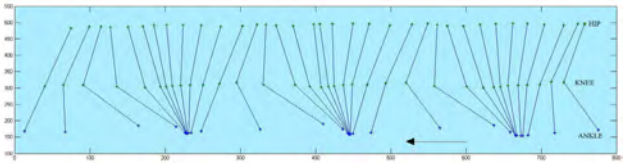


Fig. 4 – Model of the leg during walking, after the joint coordinates are obtained.

We recommend that the gait parameters should be calculated and analyzed in at least one session every two weeks, with an ideal of two sessions per week. More data not only lead to a better analysis, but also to a faster identification of serious progress or a possible issue. The idea is to observe the progress of recovery for the patient in time. At the discretion of the physical therapist, changes in the recovery program or changes in walking devices might be needed, as the long-lasting use of a walking device or the inappropriate selection of such a device has a negative impact on the patient (Poncumhak, 2014).

Results

For patients in recovery after total knee arthroplasty, the ideal situation is being able to bend the knee to at least 130 degrees (to obtain a knee flexion angle of at least 130 degrees), with 110 degrees being a minimum needed to perform regular activities (Devers et al., 2011). We are interested in the same knee flexion angle, but this time during normal walking. Obviously, the values are lower (the normal maximum knee flexion angle during a full stride for a healthy person is considered to be around 60 degrees). The analysis of this angle provides a lot of information about motor recovery - being able to flex the knee better during normal walking is a positive thing, especially considering the fact that a good recovery would imply that the patient is able to perform well during natural activities such as walking up and down the stairs, gardening, etc. The presented graphics contain the value of the knee flexion angle in degrees on the Y axis and the time, in frames, on the X axis. Considering a 63 frames per second conversion rate, the value of time in seconds can be easily calculated (we present the graphics in pixels only to show full values on the X axis, as time does not influence in any way the results in this analysis).

If we analyze the maximum knee flexion angle in walking for the first subject during the three sessions, we observe just a small improvement from the first session to the second, followed by a significant improvement from the second to the third session. The overall improvement for the maximum knee flexion angle was an important one, going from about 42 degrees to about 60 degrees (Fig. 5).

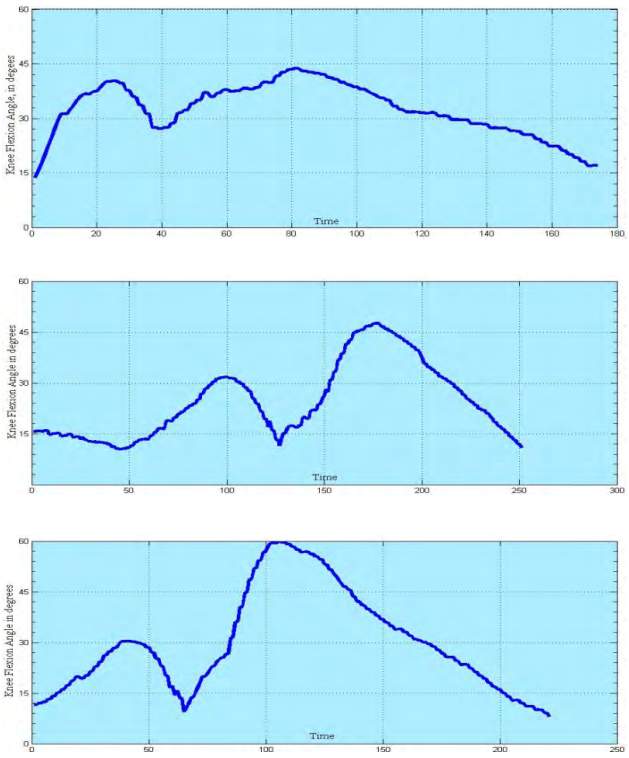


Fig. 5 – The knee flexion angle for a full stride, in degrees, during the three sessions, for the first subject.

For the second subject, it is easy to see that the overall improvement for the maximum knee flexion angle is significantly lower compared to the first subject (only about 6 degrees, from about 51 to about 56 degrees), with the major change occurring between the first two sessions and not between the last two, as in the case of the first subject (Fig. 6).

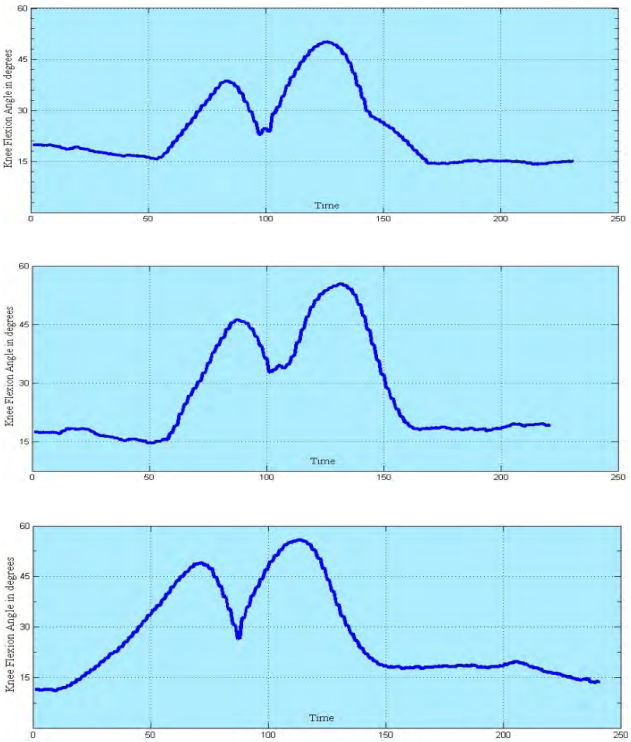


Fig. 6 – The knee flexion angle for a full stride, in degrees, during the three sessions, for the second subject.

For the third subject, we can observe a significant and steady improvement for the maximum knee flexion angle between all the sessions. The subject progresses from a knee flexion angle of about 40 degrees during the first session to about 49 degrees in the second session, and about 56 degrees during the third session (Fig. 7).

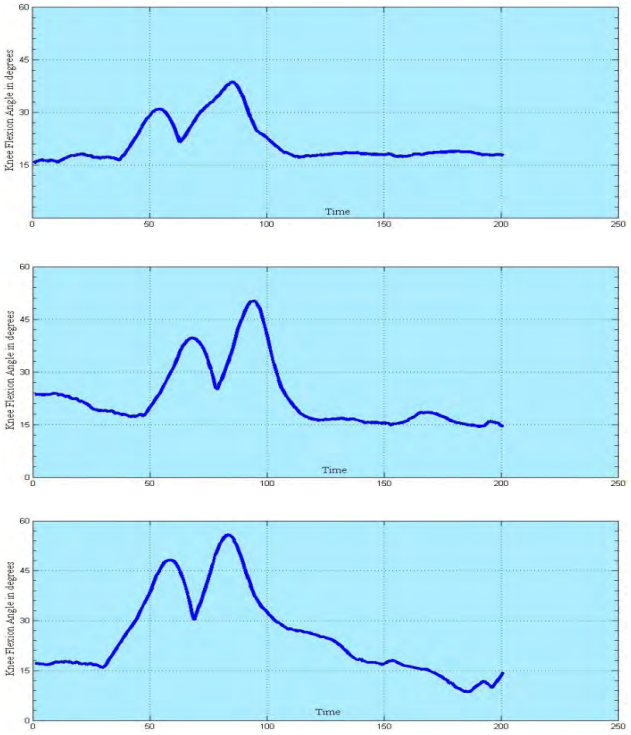


Fig. 7 - The knee flexion angle for a full stride, in degrees, during the three sessions, for the third subject.

These results show that each of the three subjects has their own patterns regarding the recovery of the knee angle, and this factor should be taken into consideration when designing a customized recovery exercise program.

Discussion

In order to track the knee flexion angle, we aimed to design a motion analysis method that is inexpensive, easy to install and can be used at the patient's home or in a nursing home, with the help of one or more family members/staff. This is not an easy task, because the system needs to be installed at the exact same position for each recording session (the camera distance, the walking distance, etc., all need to be the same). For a possible replication of the experiment, the patient and his helpers should be clearly instructed in this area.

For motion capture and analysis, we considered only one leg. We are sure that better results would be obtained by gathering data also for the other leg, but this would mean that the subject needs to be filmed from both sides - this is difficult to obtain, especially if the video recording sessions take place at the patient's home (space limitations). Other solutions were explored, such as using different radio technologies (GPS) but we wanted the system to be totally non-intrusive, widely available and not to influence the patient's walking patterns in any way (installing heavy sensors on the leg is usually not a good idea). Also, we decided to choose this "paper markers" approach because

it is simple and safe for the patient - not using any electrical devices installed on the patient's body was important for us, as many patients in motor recovery are elderly people.

As future research, there are more interesting aspects to observe, one being the difference in the knee angle "shape" between sessions recorded with the patients using a walking frame and those recorded with them using a cane. If we look at the flexion angle of a patient when using the walking frame and compare it with the angle of the same patient when using a cane, we can see that the angle while using the walking frame has a specific, shorter and sharper shape and the angle while using the cane resembles somehow the shape that we see in healthy people, so the change from the walking frame to the cane has a serious impact on the patient's gait. However, this needs a specific analysis in order to be able to draw useful conclusions (Fig. 8).

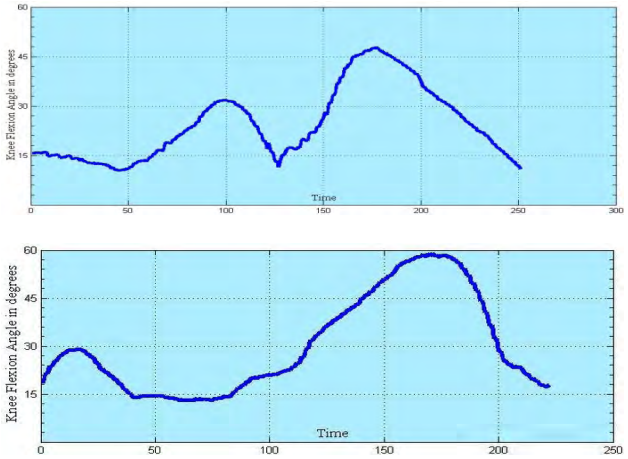


Fig. 8 – The knee flexion angle for a full stride, in degrees, for the same patient using a walking frame (left) and a cane (right).

Conclusions

1. We were able to determine the variation of the knee flexion angle for patients in motor recovery, over three sessions during their postoperative recovery program. Significant differences in the angle values between three patients were observed, and we can say that the patients recover their knee flexion angle differently. We believe that physicians who have access to these frequently recorded data are able to adjust and customize the recovery program for the patients.

2. Data capture and analysis procedures were performed by using an inexpensive, portable, easy to install and use motion analysis system, which might be a solution for motion analysis in low income countries.

3. As future research, we aim to establish a set of at least 5 relevant geometric and kinematic parameters for patients in motor recovery, which we can follow in time so that we can have a better picture of the recovery specifics of each patient. Also, analysis of gait for patients using different support (walking frame, cane and no support at all) is planned.

Conflicts of interests

There were no conflicts of interests.

Acknowledgement

This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the project number POSDRU/159/1.5/S/134378.

References

Akça NK, Doğan A. Benefits of Home-Based Exercising Ability in Patients With Osteoarthritis. Turkiye fiziksel tip ve rehabilitasyon dergisi, 2012;58:288-293.

Allen KD, Bosworth HB, Chatterjee R, Coffman CJ, Corsino L, Jeffreys AS, Oddone EZ, Stanwyck C, Yancy WS, Dolor RJ. Clinic variation in recruitment metrics, patient characteristics and treatment use in a randomized clinical trial of osteoarthritis management. BMC Musculoskelet Disord, 2014;15(1): 413. doi: 10.1186/1471-2474-15-413.

Cup EH, Pieterse AJ, Ten Broek-Pastoor JM, Munneke M, van Engelen BG, Hendricks HT, van der Wilt GJ, Oostendorp RA. Exercise therapy and other types of physical therapy for patients with neuromuscular diseases: a systematic review. Arch Phys Med Rehabil. 2007;88(11):1452-1464.

Dawes H, Korpershoek N, Freebody J, et al. A pilot randomised controlled trial of a home-based exercise programme aimed at improving endurance and function in adults with neuromuscular disorders. J Neurol Neurosurg Psychiatry, 2006;77(8):959-962.

Debas HT, Gosselin RA, McCord C, Thind A. Surgery. In: Jamison D, Evans D, Alleyne G, Jha P, Breman J, Measham A, et al. Eds. Disease control priorities in developing countries, 2nd edn. New York, NY: Oxford University Press; 2006.

Devers BN, Conditt MA, Jamieson ML, Driscoll MD, Noble PC, Parsley BS. Does Greater Knee Flexion Increase Patient Function and Satisfaction After Total Knee Arthroplasty? J Arthroplasty 2011; 26(2):178-186.

Hartling L, McAlister FA, Rowe BH, Ezekowitz J, Friesen C, Klassen TP. Challenges in systematic reviews of therapeutic devices and procedures. Ann Intern Med, 2005;142(12 Pt 2):1100-1111.

Mihalcica M, Burca I, Munteanu V. A motion capture and analysis system to aid the physician during the motor recovery of patients, Palestrica of the third millennium - Civilization and Sport, 2014, 15(4):296-300.

Minns LC, Barker KL, Dewey M, Sackley CM. Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: Systematic review and meta-analysis of randomised controlled trials. Br Med J, 2007:335(7624):812-815.

Molloy M, Salazar-Torres J, Kerr C, McDowell BC, Cosgrove AP. The effects of industry standard averaging and filtering techniques in kinematic gait analysis. Gait & Posture 2008;28(4):559-562.

Munteanu V. Contributions to the analysis of human body motions with applications in recovery medicine, PhD Thesis, Transylvania University of Brasov, Romania, 2014.

Nam D, Nunley RM, Barrack RL. Patient dissatisfaction following total knee replacement: a growing concern? Bone Joint J, 2014;96-B(11 Supple A): 96-100. doi: 10.1302/0301-620X.96B11.34152.

Ozgediz D, Hsia R, Weiser T, Gosselin R, Spiegel D, Bickler S, Dunbar P, McQueen K. Population Health Metrics for Surgery: Effective Coverage of Surgical Services in Low-Income and Middle-Income Countries. World J Surg, 2009;33(1):1-5.

Poncumhak P. Assistive Walking Devices. Srinagar Med J, 2014;28(4):583-588.

Simpson RW, Hamilton DF, Beard DJ, Barker KL, Wilton T, Hutchison JD, Tuck C, Stoddard A, Macfarlane GJ, Murray GD. Targeted rehabilitation to improve outcome after total knee replacement (TRIO): study protocol for a randomised controlled trial. Trials, 2014;15(1): 44. doi: 10.1186/1745-6215-15-44.

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 154–157

Theoretical and experimental aspects regarding long jump dynamics

Aspecte teoretice şi experimentale privind dinamica probei de săritură în lungime

Maria Violeta Guiman [1], Ioan Burcă [2], Mihaela Violeta Munteanu [1], Mircea Mihălcică [1]
[1] *Transilvania University of Brasov, Romania*
[2] *University of Medicine and Pharmacy Târgu Mures, Romania*

Abstract

Background. The interest in increasing sport performance has led to the development of biomechanics studies focused on human body schematic approximation as a mechanical system with joints, usually named multibody systems.

Aims. In the present paper, a multibody model of a long jump athlete is presented. Based on this model, one can find the joint reaction forces that have a key role in the human motion dynamics during different actions such as walking, jumping, gymnastics, etc. The question that arises is how joints are used during sports activities.

Methods. The model validation was based on a video recording compiled with a high speed camera during a long jump trial.

Results. Based on the visualisation of the markers' trajectories with the Adobe After Effects code, their coordinates during the long jump trial were found.

Conclusions. An experimental validation of the mechanical model was performed and the coordinates of the points of interest were found. Using these coordinates, the parameters required for a high level of performance can be established.

Keywords: biomechanics, motion analysis, long jump, theoretical model.

Rezumat

Premize. Interesul pentru sporirea performanţelor sportive a dus la dezvoltarea unor studii de biomecanică, în care rolul principal îl are reproducerea schematică a organismului uman, abordat din punct de vedere al unui sistem mecanic cu legături (cu denumirea actuală uzuală de sistem multicorp).

Obiective. În acest articol este prezentat un model multicorp al săritorului în lungime. Pe baza acestui model pot fi determinate forţele de reacţiune din articulaţii, care joacă un rol important în dinamica mişcărilor umane, precum: mersul, săriturile, exerciţiile de gimnastică etc.

Metode. Validarea modelului se bazează pe o serie de înregistrări video ale unor atleţi în timpul executării probei, cu ajutorul unei camere video de mare viteză.

Rezultate. Pe baza urmăririi traiectoriei markerilor, cu programul Adobe After Effects, au fost obţinute coordonatele acestora în timpul executării săriturii.

Concluzii. S-a reuşit validarea experimentală a modelului mecanic, fiind determinate coordonatele punctelor de interes. Pe baza acestor coordonate, sunt stabiliţi parametri utili îmbunătăţirii performanţelor sportive.

Cuvinte cheie: biomecanică, analiza mişcării, săritura în lungime, model teoretic.

Introduction

Nowadays, at global level, sport becomes more relevant each day. Severe competition between athletes has induced a change in performance achievement, which cannot be based only on human driving force. In this context, coaches have to acquire the latest knowledge for the improvement of the technique of execution.

The long jump can be considered as one of the most natural athletic trials, due to the bodily qualities developed, the required spontaneity of movements, and to its beauty, all these elements involving the improvement of technique and its development without hindrance.

The long jump with run-up represents, by the involved motions, an acyclic action: the long jump proper, in which the sequence of movements does not repeat, has a start and an end (Gevat et al., 2007).

The long jump phases, in the order of their succession, are as follows (Burcă et al., 2010; Hay et al., 1990; Ionescu-Bondoc, 2007; Mihăilă et al., 2008): run-up, take-off, flight and landing. Between these phases, there are conditioning ratios, but the share of each phase in performance achievement is determined by the specific nature and purpose of jumping.

The use of linked mechanical systems known as multibody systems for human motion analysis becomes a

Received: 2014, May 10; *Accepted for publication:* 2015, May 29;
Address for correspondence: Transilvania University of Brasov, Department of Mechanical Engineering, Politehnicii Street, room NP-1, 500024, Brasov, Romania
E-mail: violeta.guiman@unitbv.ro
Corresponding author: Violeta Guiman

usual method due both to biomechanics development and virtual modelling facilities.

Various models, methods, applications and solutions, presented in the literature, come mostly from industrial applications, but can be found in many applications of human movement studies.

In the most used dynamic representations, multibody models often consist of sets of minimum levels of generalized coordinates, and the forces from the joints (unused reaction forces of the intrinsic constraint model) are excluded from calculation; therefore, in order to determine these forces of reaction from the joints, a new model is required and numerical procedures are difficult to calculate (Schiehlen, 2006).

When dealing with small bodies, motion equations can be obtained through manual calculations, while for more complicated systems or for checking the results, specialized software for multibody systems such as NEWEUL should be used (Kreuzer et al., 1991).

To solve the problem of the way in which joints are loaded during routine activities or sports, it is necessary to consider a mathematical model of dynamics of human body and its use to determine reaction forces from joints, using numerical simulation (Eberhard et al., 1999).

Two of the most widely used multibody system examples in sports motion analysis are presented below (Figs. 1 and 2).

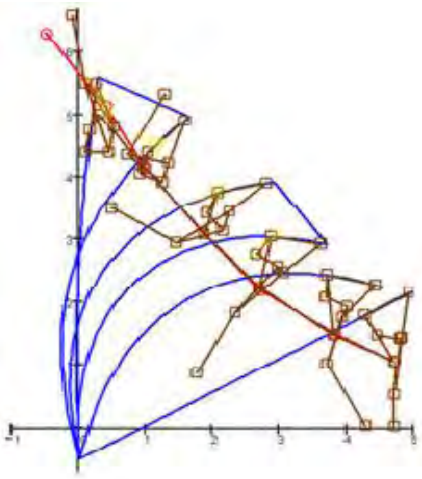


Fig. 1 – Identification of pole vault kinematics (Micu, 2006).

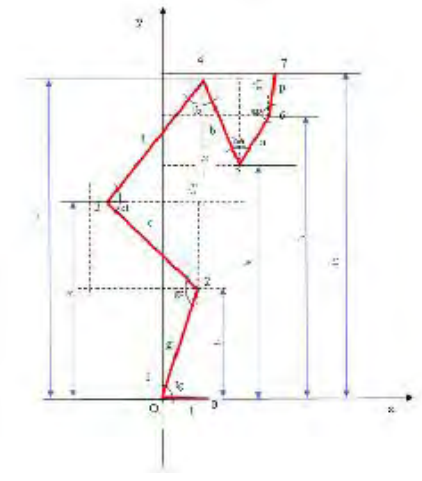


Fig. 2 – Basketball players' body segments (Haba, 2006).

The proposed models are used in motion analysis based on differential equations to find the joint force, to optimise different motion phases, etc.

As part of the present research work, a plan template model that contains 12 segments of a human body was taken into consideration (Fig. 3).

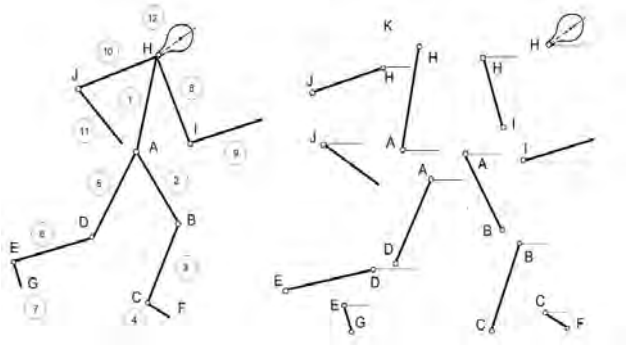


Fig. 3 – The jumper model made of segments.

Considering the first segment, the kinematic conditions are:

$$\begin{cases} x_1 = x_A + c_1 l_1 \cos\alpha_1; \\ y_1 = y_A + c_1 l_1 \sin\alpha_1 \ . \end{cases} \quad (1)$$

By deriving the equations from (1), both mass centre velocities (2):

$$\begin{cases} \dot{x}_1 = \dot{x}_A - c_1 l_1 \omega_1 \sin\alpha_1; \\ \dot{y}_1 = \dot{y}_A + c_1 l_1 \omega_1 \cos\alpha_1, \end{cases} \quad (2)$$

and accelerations are obtained:

$$\begin{cases} \ddot{x}_1 = \ddot{x}_A - c_1 l_1 \varepsilon_1 \sin\alpha - c_1 l_1 \omega_1^2 \cos\alpha_1; \\ \ddot{y}_1 = \ddot{y}_A + c_1 l_1 \varepsilon_1 \cos\alpha - c_1 l_1 \omega_1^2 \sin\alpha_1. \end{cases} \quad (3)$$

Based on the force diagram presented in Fig. 4, the following equilibrium equations can be written:

$$\begin{cases} X_{A1} + X_{H1} = m_1 \ddot{x}_1; \\ Y_{A1} + Y_{H1} - G_1 = m_1 \ddot{y}_1; \\ M_1 - Y_{A1} c_1 l_1 \cos\alpha_1 + X_{A1} c_1 l_1 \sin\alpha_1 + Y_{H1}(1-c_1) l_1 \cos\alpha_1 - X_{H1}(1-c_1) l_1 \sin\alpha_1 = J_1 \varepsilon_1 \end{cases}$$

(4)

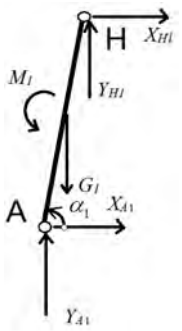


Fig. 4 - Force diagram of Segment 1.

By combining equations (3) and (4), the dynamic equations of the segment are obtained. The approach used for the first segment is applied to all the 12 segments of the

human body. Based on the above concept, a system of 36 differential equations can be obtained, which describes the motion of the whole system.

To solve the equation system generated by the above mechanical model, it is necessary to consider some input data that can be obtained by experimental set-up.

The proposed model of the jumper body was validated by an experimental test consisting of data video recording with a high speed camera (AOS X - PRI).

Hypothesis

In this paper, a theoretical and experimental model used for take-off jump analysis is proposed. The jumper model is based on the above presented multibody concept.

Material and methods

Research protocol

Each athlete was informed of the following aspects: the nature of the research, the fact that the data retrieved will be used strictly for research purposes, and at the end, a consent form to participate in experimental research was signed by each athlete and each coach.

a) *Period and place of the research*

These experimental recordings were performed during the summer camp training of the athletics team in the national sports complex Poiana Brasov, for a period of two weeks.

b) *Subjects and groups*

Four international high-performance long jump athletes were considered for the present study: two females and two males. The four athletes were members of the Romanian National Athletics Team and they had different jumping techniques.

c) *Tests applied*

Coloured markers were attached on the body of each athlete (Fig. 5). The attachment points were established considering both the mechanical model and the suggestions and acceptance of the trainers. All markers were placed on one side (the same where the video camera was placed), the video recorded data being later used for motion trajectory analysis (Mihălcică et al., 2014a).

Fig. 5 - Marker attachment.

d) *Statistical processing*

Each jumper had to do 10 jumps and images were recorded at a resolution of 800x600 pixels at 500 frames/s.

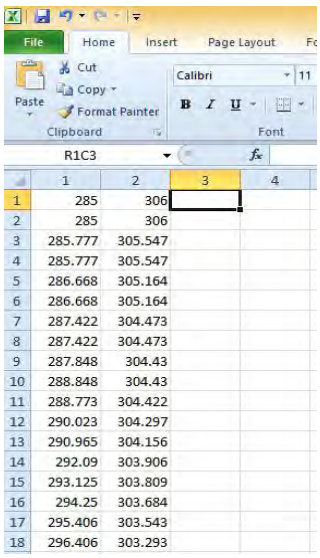
At the same time, based on marker position recording, accelerations and velocities can be found using inverse kinetics. By analysing the video recordings of markers, the geometrical dimensions of the segments and the angles between them can be established.

Results

The code used to obtain experimental data was Adobe After Effects. This application was used to visualize the main motion trajectory, although its main use is for professional video editing and visual effects creation (Christiansen et al., 2007). Fig. 6 shows the trajectory of the mass centre of the jumper.

Fig. 6 - Marker motion trajectory in Adobe After Effects.

Since Adobe After Effects is not specially designed for motion analysis, this application does not achieve export of automatic marker coordinates, which need to be exported in the desired format (Mihălcică et al., 2014b). Thus, the recorded experimental data were exported in EXCEL (Fig. 7).



	1	2	3	4
1	285	306		
2	285	306		
3	285.777	305.547		
4	285.777	305.547		
5	286.668	305.164		
6	286.668	305.164		
7	287.422	304.473		
8	287.422	304.473		
9	287.848	304.43		
10	288.848	304.43		
11	288.773	304.422		
12	290.023	304.297		
13	290.965	304.156		
14	292.09	303.906		
15	293.125	303.809		
16	294.25	303.684		
17	295.406	303.543		
18	296.406	303.293		

Fig. 7 Marker positions exported in EXCEL.

The converted EXCEL data were imported in MATLAB code; using its facilities, an analysis of the last step of the run-up approach, of take-off and the start of flying through the air was performed (Mihălcică et al., 2014b; Guiman et al., 2014). Thus, a number of parameters (geometric and

mechanical) leading to jumper plan model validation were identified.

Discussions

The above proposed method is useful due to: portability of the system, the fact that it is easy to use by any person with a minimum of computer knowledge, and the software is easy to use compared to other dedicated codes.

It is necessary to mention that the ideal environment for recording is the outdoor stadium, where light is natural, which is preferred during video recording, and in indoor experiments, additional light sources are needed. The system can be easily applied to the proposed or similar research, while considering the use of different data processing codes is time-expensive.

While data recording requires laptop equipment that can have a battery, for the high speed video camera, a stationary source of electricity is needed, considering that the battery life is very poor.

Conclusions

1. The considered theoretical model with 12 segments may very well shape the body of the jumper. Based on the considered multibody model, a system of 36 differential and algebraic equations was obtained. The mathematical system consists of 24 unknown joint forces and 12 unknown independent coordinates. By removing the reactions, a 12 differential equation system is obtained.

2. The theoretical model was validated by the proposed capture system, which provides valuable information that can lead to obtaining motion laws for independent coordinates, and inverse dynamics can be applied to determine the forces and moments that occur in the human system studied during jumping.

3. The presented theoretical model can be used as a basis for optimising the performance of each jumper taking into consideration human driving forces.

Conflicts of interests

There are no conflicts of interests.

References

Burcă I, Szabo B, Ciulea L. Atletism 1 - Note de curs, Litografiat Universitatea de Medicină şi Farmacie, Târgu-Mureş, 2010.

Christiansen M. Adobe After Effects CS3 Professional, Studio Techniques, Adobe Press, 2007.

Eberhard P, Spägele T, Gollhofer A. Investigations for the dynamical analysis of human motion, Multibody System Dynamics 1999;3(1):1-20.

Gevat C, Larion A, Popa C. Atletism curricular. Ovidius University Press, Constanţa, 2007.

Guiman MV, Mihălcică M, Munteanu MV. A method for determinate the run-up velocity of the long jump. The 5th International Conference ”Advanced Composite Materials Engineering” and The 3rd International Conference ”Research & Innovation in Engineering”, Ed. Comat, Braşov, 2014; 189-191.

Haba PS. Studiul biomecanic al aruncărilor la coş în jocul de baschet. Teză de doctorat, Facultatea de Inginerie Mecanică, Universitatea Transilvania din Braşov, 2006.

Hay JG., Nohara H. Techniques used by elite long jumpers in preparation for take-off. J Biomech. 1990;23(3):229-239.

Ionescu-Bondoc D. Pregătire specializată în atletism. Ed. Universităţii Transilvania, Braşov, 2007.

Kreuzer E, Leister G. Programmsystem NEWEUL 92, Manual AN-32, Institute B of Mechanics, University of Stuttgart, 1991.

Micu I. Contribuţii la identificarea mişcărilor sportive. Aplicaţie: Saltul cu prăjina. Teză de doctorat, Facultatea de Inginerie Mecanică, Universitatea Transilvania din Braşov, 2006.

Mihăilă C, Neamţu M, Ionescu-Bondoc D, Scurt C, Nechita F. Atletismul pentru toţi. Ed. Universităţii Transilvania, Braşov, 2008.

Mihălcică M, Guiman V, Munteanu V. A cheap and portable motion analysis system. The 5th International Conference ”Advanced Composite Materials Engineering” and The 3rd International Conference ”Research & Innovation in Engineering”. Ed. Comat, Braşov, 2014a; 109-111.

Mihălcică M, Guiman V, Munteanu V. Using motion analisys software to gather sports experimental data. The 5th International Conference ”Advanced Composite Materials Engineering” and The 3rd International Conference ”Research & Innovation in Engineering”. Ed. Comat, Braşov, 2014b; 112-114.

Mihălcică M, Guiman V, Munteanu V. Using curve fitting as a method to analyze motion analisys data for sports. The 5th International Conference ”Advanced Composite Materials Engineering” and The 3rd International Conference ”Research & Innovation in Engineering”. Ed. Comat, Braşov, 2014c; 115-117.

Schiehlen W. Computational dynamics: theory and applications of multibody systems. Eur J Mech A/Solids 2006;25(4):566-594. doi:10.1016/j.euromechsol.2006.03.004.

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 158–163

REVIEWS
ARTICOLE DE SINTEZĂ

The role of singing therapy in pulmonary rehabilitation
Rolul terapiei prin cântat în reabilitarea pulmonară

Adela-Raluca Nistor [1], Ioan Onac [1,2], Adriana Ştefănescu [3], Ileana Monica Borda [1,2], Viorela Ciortea [1,2], Laszlo Irsay [1,2], Adriana Mureşan [2], Rodica Ungur [1,2]
[1] *Clinical Rehabilitation Hospital, Rehabilitation Department, Cluj-Napoca*
[2] *"Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca*
[3] *Eurosan Clinic Cluj-Napoca*

Abstract

Pulmonary rehabilitation is a multidisciplinary therapeutic intervention intended for patients with chronic respiratory diseases, which may include singing therapy as a method for improving physical and psychosocial status. This study aims to evidence the benefits of singing therapy for pulmonary patients and thus, to highlight the role of this therapy as part of respiratory rehabilitation.

There are literature data that suggest singing as an adjuvant therapy in respiratory diseases.

Regarding symptomatology, studies demonstrated that singing therapy reduced dyspnea and facilitated cough and expectoration. Objectively, pulmonary function improved through a reduction of lung hyperinflation, with the increase of arterial blood oxygen saturation. The questionnaires applied to subjects showed an increase of exercise capacity and the ability to control symptoms by breathing techniques acquired during the singing lessons. The majority of the patients reported an improvement of psycho-emotional status, with the reduction of anxiety associated with the sensation of suffocation, and an increased desire to socialize. The quality of life was significantly improved in these studies.

Singing therapy as a pulmonary rehabilitation method remains an area open to research. The benefits of this therapy for patients with chronic respiratory diseases vary from one individual to another, but its positive effects on the patients' mental state and quality of life are a certainty.

Keywords: pulmonary rehabilitation, singing.

Rezumat

Reabilitarea pulmonară reprezintă o intervenţie terapeutică multidisciplinară destinată pacienţilor cu boli respiratorii cronice, ce poate include şi terapia prin cântat ca mijloc de îmbunătăţire a stării fizice şi a statusului psihosocial. Prezentul studiu îşi propune să evidenţieze beneficiile pe care terapia prin cântat le aduce bolnavilor pulmonari, şi astfel să accentueze rolul acestei terapii în cadrul reabilitării respiratorii.

În literatura de specialitate există date care sugerează ca terapie adjuvantă în bolile respiratorii cronice, cântatul.

În privinţa simptomatologiei, unele studii au demonstrat că terapia prin cântat a redus dispneea şi a facilitat tusea şi expectoraţia. Obiectiv, funcţia pulmonară s-a ameliorat prin scăderea hiperinflaţiei pulmonare cu creşterea saturaţiei în oxigen a sângelui arterial. Chestionarele aplicate subiecţilor au relevat creşterea capacităţii de efort, şi abilitatea de controlare a simptomelor prin tehnici de respiraţie însuşite în cadrul lecţiilor de cântat. Majoritatea pacienţilor au raportat o îmbunătăţire a statusului psiho-emoţional, cu reducerea anxietăţii asociată senzaţiei de sufocare, şi cu creşterea dorinţei de socializare. Calitatea vieţii s-a demonstrat a fi important ameliorată în toate studiile urmărite.

Terapia prin cântat ca mijloc de reabilitare pulmonară rămâne un domeniu deschis cercetării. Beneficiile pe care acest tip de terapie le aduce pacienţilor cu boli respiratorii cronice variază de la un individ la altul, însa efectele pozitive asupra stării psihice şi a calităţii vieţii pacienţilor sunt o certitudine.

Cuvinte cheie: reabilitare pulmonară, cântat.

Received: 2015, May 9; *Accepted for publication:* 2015, May 21;
Address for correspondence: "Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca; Clinical Rehabilitation Hospital, Rehabilitation Department, No. 46-50, Viilor St. 400437 Cluj-Napoca
E-mail: viorela.ciortea@yahoo.com
Corresponding author: Ileana Monica Borda: monicampop@yahoo.fr

Introduction

Respiratory diseases are a major public health problem particulary in industrialized countries, having an increasing incidence and a strong economic and social impact. Epidemiologists estimate that by 2020, chronic obstructive pulmonary disease will become the fourth most frequent cause of death worldwide (Croitoru & Miron, 2014).

The most important diagnostic and treatment guidelines currently used in pneumology recognize the place of rehabilitation in the modern therapy of respiratory diseases (Croitoru & Miron, 2014), with the recommendation of its application as early as possible in order to obtain optimal results (1).

The effectiveness of pulmonary rehabilitation is continuously reinforced by international research and clinical experience (1).

Definition of pulmonary rehabilitation

According to the most recent definition of the American Thoracic Society / European Respiratory Society in 2013, *"pulmonary rehabilitation is a comprehensive intervention based on a thorough patient assessment, followed by patient-tailored therapies which include, but are not limited to: exercise training, education and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors"* (Spruit et al., 2013).

In other words, pulmonary rehabilitation is focused on the patient, not on the disease, the challenge consisting of the need to act simultaneously on several parameters – symptomatology, quality of life, exercise tolerance. Finally, for the chronic pulmonary patient, compliance with a correctly applied quality pulmonary rehabilitation program can allow an improvement of lifestyle, with benefits for health status (Croitoru & Miron, 2014).

Objectives of pulmonary rehabilitation

The major objectives of pulmonary rehabilitation can be formulated from three perspectives. Patients wish through their participation in pulmonary rehabilitation programs to obtain a diminution of dyspnea and fatigue, an improvement of skeletal muscle strength and an amelioration of respiratory capacity with the increase of exercise tolerance, an improvement of emotional status and the quality of life. The therapist aims to educate the patient to acquire breathing strategies allowing an optimal control of symptoms, as well as to preserve residual pulmonary function and prevent pulmonary disease complications; the challenge for the therapist is to increase the degree of independence for these patients. From the perspective of society, respiratory rehabilitation programs are designed to obtain the active participation of patients in work and activities of daily life with an increased effectiveness and implicitly, with the reduction of costs associated with the management of the disease – reduction of the number and duration of hospitalizations, reduction of pharmacological requirements (2).

Indications of pulmonary rehabilitation

Candidates for respiratory rehabilitation are patients with signs and symptoms of respiratory system disorder, for whom standard pharmacological treatment has proved to be partially effective, and who are capable of understanding the role of physical therapy as an addition to the basic treatment (Matcovschi et al., 2011). The disorders benefiting from pulmonary rehabilitation are: obstructive pulmonary diseases (bronchial asthma, bronchiectasis, chronic bronchitis, chronic obstructive pulmonary disease (COPD), cystic fibrosis, sarcoidosis), restrictive pulmonary diseases (interstitial diseases, thoracic wall diseases, neuromuscular diseases, post-poliomyelitis and post-tuberculosis syndromes, thoracic cage abnormalities), bronchopulmonary cancer. For lung transplantation or any thoracic or abdominal surgery, pulmonary rehabilitation is an integrated part of pre- and postoperative treatment (1). There are many literature studies that focus on the benefits obtained by pulmonary rehabilitation programs in the main respiratory diseases.

Chronic obstructive pulmonary disease

In COPD, according to GOLD guidelines published in 2013, pulmonary rehabilitation applied in the periods in which the disease is compensated is beneficial for the increase of exercise capacity, the reduction in the intensity of the sensation of suffocation, the improvement of the quality of life, the reduction of the number of hospitalizations for disease exacerbations, the amelioration of anxiety and depression secondary to the disease, the enhancement of the effect of long-acting bronchodilators, and the increase of survival (3). A review published in 2015 systematized the effects of pulmonary rehabilitation in patients with moderate COPD, analyzing randomized clinical trials available in the literature. It was found that adherence to pulmonary rehabilitation programs results in a significant improvement in the quality of life and a less spectacular but obvious increase of exercise tolerance (Rugbjerg, 2015). Nikoletou published in 2015 a study conducted over a 7-week period, including 68 patients with moderate/severe COPD who attended an inspiratory muscle training program at home. An improvement of maximum inspiratory pressure and an amelioration of the patients' perception of their health status were found at the end of the training period (Nikoletou et al., 2015). Recently, Pothirat et al. analyzed the role of physical training as an integrated part of pulmonary rehabilitation in hospitalized patients. 30 patients diagnosed with advanced COPD performed exercises for the increase of strength and endurance during an 8-week period. The parameters indicating respiratory function, the strength of muscles involved in training, dyspnea and the quality of life were continuously monitored. A significant improvement in the strength of limb and thoracic cage muscles, with a decrease of dyspnea, an increase of exercise tolerance and an amelioration of the quality of life were demonstrated. The authors suggest that such a pulmonary rehabilitation program which involves low costs and is easy to use brings important benefits for patients with advanced chronic obstructive pulmonary disease (Pothirat et al., 2015).

Lung neoplasms

Regarding the benefits of pulmonary rehabilitation for patients with lung neoplasms, recent literature data indicate positive effects and open an optimistic perspective for this non-pharmacological therapy. Jastrzebski published in 2015 the results of a study evaluating the effects of pulmonary rehabilitation in patients with advanced lung neoplasms, under chemotherapy. A definite improvement of exercise tolerance and dyspnea, with the increase of lung volumes, and an improvement of the quality of life were obtained following participation in pulmonary rehabilitation programs with a duration of 8 weeks (Jastrzebski et al., 2015). Another study on former smokers with operated lung neoplasms under chemotherapy monitored the effects of pulmonary rehabilitation initiated simultaneously with chemotherapy. Respiratory exercises improved lung volumes and capacities, with more important benefits in patients with respiratory failure (Tarumi et al., 2015). Recently, Maeda et al. published the results of a study that assessed the effects of pulmonary rehabilitation programs in patients undergoing pulmonary resection for neoplasms. The study demonstrated an improvement of exercise tolerance in general, even in geriatric patients, which did not exceed the physical exercise capacity existing prior to surgery (Maeda, 2015).

Bronchial asthma

In January 2013, a meta-analysis was published which studied the effects of physical exercise on the quality of life, bronchial reactivity, exercise-induced bronchoconstriction, pulmonary function and exercise tolerance in asthmatic patients who attended different physical training programs. 17 studies including 599 asthmatic patients were analyzed, and it was shown that physical training induced an improvement of respiratory symptoms, a decrease in the number of days without symptoms, an increase of exercise tolerance, and a significant improvement in the quality of life of these patients (Eichenberger et al., 2013). In 2014, Evaristo et al., proposed for the amelioration of respiratory function in asthmatic patients a program combining aerobic exercises and breathing reeducation techniques (Evaristo et al., 2014). The World Allergy Organization conducted a study on patients with bronchial asthma and allergic disorders. 280 clinicians were questioned, and their opinions, as well as their experience and confidence in physical training as a therapy for allergic respiratory tract disorders were assessed. The results of the study indicated the advanced level of knowledge of the interviewed doctors regarding the benefits of physical activity in asthma and the confidence of these specialists in this adjuvant therapy. It was concluded that a wide-scale promotion of physical training as a complementary treatment in bronchial asthma was required (Moreira et al., 2014).

Sport and pulmonary rehabilitation programs are extremely important in patients with bronchial asthma and COPD, in the context in which these patients tend to avoid physical activity, with the consecutive decrease of exercise tolerance and the development of dyspnea on increasingly smaller efforts. These patients should be made aware that a sedentary lifestyle exposes them to the risk of aggravation of symptoms, and they should be encouraged to practice sport at the limit of tolerance and attend pulmonary rehabilitation programs, in order to prevent the reduction of exercise capacity and muscle strength, to avoid muscle atrophy, and to improve their quality of life (Rohrer & Schmidt-Trucksäss, 2014).

The mentioned studies reported no adverse effects of physical training programs in pulmonary patients. However, this does not mean that pulmonary rehabilitation is indicated in any pulmonary condition.

Contraindications of pulmonary rehabilitation

Contraindications of pulmonary rehabilitation include: severe cognitive dysfunctions or psychiatric disorders that reduce treatment compliance; organic diseases in a decompensated stage (unstable angina pectoris, decompensated congestive heart failure; severe hepatic dysfunction; advanced stage/metastatic neoplasms, renal failure); exacerbations and complications of bronchopulmonary diseases (exacerbation of COPD, severe exercise-induced hypoxemia that cannot be corrected by additional oxygen administration, acute cor pulmonale, severe pulmonary hypertension); absence of physical exercise ability (Matcovschi et al., 2011).

Singing therapy in pulmonary rehabilitation

Singing, the act of producing musical sounds by using the vocal cords, is a very natural human act, with origins that go beyond the age of articulate speech (Bonilha et al., 2009). It involves the acquisition of specific posturing and breathing techniques, which for professional singers become essential in modulating and controlling the generated sounds (Bonilha et al., 2009; Thomasson & Sundberg 1999).

It has been observed that patients with chronic pulmonary diseases tend to involuntarily use ”breathing strategies” – active expiration with protruded lips, use of the abdominal wall or specific body postures during breathing, thus obtaining an improvement of dyspnea and physical performance (Matcovschi et al., 2011).

There is a very high similarity between these behaviors and those of a singer who sings a piece of music. Singing requires an adequate posture to facilitate effective breathing control; secondarily to correct posturing, the singer executes a short, deep inspiration using the contraction of the diaphragm muscle, followed by an active and prolonged expiration supported by the contraction of respiratory muscles, with the exsufflation of an air column through the half-closed vocal cords. Thus, respiratory muscle training and at the same time, effective lung ventilation occur (Bonilha et al., 2009).

If these techniques used by singers were transferred to the daily life of the pulmonary patient as respiratory hygiene rules, benefits for the control of symptoms, with the improvement of the quality of life would be obtained (Bonilha et al., 2009). Thus, singing might become an adjuvant therapy in pulmonary rehabilitation through the breathing exercises involved (Lord et al., 2012).

Effects of singing on the respiratory system

Singing acts by three major factors that contribute to an increased effectiveness of the respiratory act: *posture, mechanics of ventilation, and contractile capacity of respiratory muscles*.

Posture

The ideal posture for singing and, at the same time, adequate for effective breathing involves the positioning of the singer/pulmonary patient in orthostatism, with the head elevated, in slight extension, with a straight spine, retracted abdomen, relaxed shoulders, and a slightly increased support polygon. The benefits of this posture for the singer as well as for the respiratory patient have been proved by specialized studies. Some studies have evidenced the role of the correct positioning of the spine in improving thoracic cage expansion, with a beneficial effect on ventilation and vocal parameters (Jang et al., 2015; Staes et al., 2010). A diminished vocal quality in the absence of adequate head and cervical spine positioning during singing in opera singers has been demonstrated (Jonson & Skinner, 2009). It has also been shown that thoracic muscles, particularly the pectoralis major muscle, play an important role in thoracic positioning as well as in improving the efficiency of respiratory effort, with an impact on respiratory capacity and vocal quality in singers (Pettersen, 2006). Through the same correct posturing, both the singer and the respiratory patient make a first step towards a more effective respiration.

Mechanics of ventilation

Correct singing involves deep inspiration with the obligatory involvement of the diaphragm. Diaphragmatic respiration facilitates a uniform distribution of ventilation, mobilizes large air volumes and allows *complete lung aeration* with a low energy cost (Matcovschi et al., 2011). Professional singers are trained to use their diaphragm during singing for a better vocal quality. Pulmonary patients are encouraged by therapists to use the same type of respiration to improve dyspnea. Studies have demonstrated that the involvement of the diaphragm muscle during singing is beneficial for the capacity to modulate sounds, contributing to vocal cord *stabilization*, with an impact on phonation (Leanderson et al., 1987). In patients with lung neoplasms, and in pulmonary patients with reduced function in general, diaphragmatic respiration has proved to be a good instrument for diminishing anxiety caused by dyspnea (Yates et al., 2013).

Once complete inspiration has been performed, the singer executes a prolonged active expiration, which coincides with the generation of musical sounds. In obstructive pulmonary diseases, the airways tend to close before expiration has been completed (Matcovschi et al., 2011); thus, air trapping occurs – the unexpired air remains trapped in the lungs along with the reserve residual volume, so that at the next inspiration, there will be a lower alveolar capacity to receive oxygenated air; in this way, the gas exchange will also be diminished, and arterial blood will be less oxygenated. When the singer executes the active expiration, airway collapse no longer occurs. Transposed to the situation of a pulmonary patient, singing means avoiding the air trapping phenomenon, with the increase of current volume at the next inspiration and the improvement of arterial blood oxygenation. These phenomena lead to a reduction of dyspnea, with the consecutive decrease of respiratory rate and a lower energy consumption by respiratory muscles (Matcovschi et al., 2011; Yates et al., 2013).

Contractile capacity of respiratory muscles

During singing, the vocal cords are mobilized in adduction, with the reduction of the diameter of the larynx. For the generation of musical sounds, the singer executes a prolonged active expiration with the release of an air column through the half-closed vocal cords (Bonilha et al., 2009). Thus, an active expiration results, concomitantly with the increase of air flow resistance, which allows the training of expiratory muscles and at the same time, effective lung ventilation by the prevention of airway collapse and lung hyperinflation (Matcovschi et al., 2011; Bonilha et al., 2009; Lord et al., 2012; Yates et al., 2013).

In conclusion, active expiration with protruded lips that pulmonary patients are trained to perform has an even greater impact on the respiratory system if paralleled by the generation of a musical sound. Thus, singing becomes a natural act, which combines various motor activities that have the potential to improve pulmonary ventilation, gas exchange, respiratory muscle function, dyspnea and exercise tolerance, facilitating in this way the act of respiration and increasing the quality of life.

In experimental models, hypercapnia is associated in the long term with the reduction of output in the phrenic nerve (Baker et al., 2001), involving the reduction of contractile activity in respiratory muscles (Hopkinson et al., 2004; Hopkinson et al., 2012). Singing can increase the participation of the diaphragm in the act of respiration, through a reduction in the degree of hypercapnia and an improvement of excitability in the corticospinal tract, with an increase in the conduction velocity of nerve impulses. In other words, singing allows a higher effectiveness of the diaphragm muscle, compared to the situation in which diaphragmatic breathing would apply in the absence of singing. This effect, added to the effects that result from *respiratory hygiene* required by singing – adequate posturing, breathing techniques for the prevention of lung hyperinflation, training of respiratory muscles, will definitely lead to an improvement of respiratory symptoms.

Singing as a therapeutic method in pulmonary rehabilitation – clinical studies

Over the past years, the interest of researchers in the field of respiratory rehabilitation has focused on non-pharmacological therapies, with the study of their benefits on symptomatology, respiratory function, psycho-emotional status and, not least, on the quality of life in patients with chronic pulmonary diseases. Among these non-pharmacological therapies, singing therapy has been the object of studies carried out both in USA and Europe. Despite the small number of studies, the results are promising and open new perspectives in pulmonary rehabilitation.

A study performed in Brazil in 2009 by Bonilha assessed the effects of weekly singing lessons on respiratory parameters and on the quality of life in patients with moderate or severe COPD, in a compensated stage. For 24 weeks, the subjects of the experimental group attended weekly singing lessons with the duration of one hour, coordinated by a voice teacher and a kinesiotherapist. The therapy program comprised the relaxation of neck and

upper limb muscles for 5 minutes; breathing exercises – rapid and deep inspiration, followed by prolonged complete or interrupted expiration, with the training of using the diaphragm in respiration, for another 10 minutes; vocal exercises under the guidance of the voice teacher for 15 minutes, continued by effective singing – Brazilian folk songs for 30 minutes. The subjects were encouraged to practice singing at home for 30 minutes a day, at least 2 days a week. In parallel, the subjects of the control group attended manual workshops, with the same duration and periodicity. The most important objective result of this study was a significantly higher expiratory output in the experimental group compared to the control group. Spirometric and arterial blood gas measurements indicated a reduction of lung hyperinflation during singing, with an important increase of oxygen saturation (SaO_2). There was also a marked reduction of dyspnea, according to the Borg scale. In patients with bronchial secretions, the singing lessons stimulated cough and expectoration of a significant amount of sputum (Bonilha et al., 2009).

Another randomized clinical trial carried out in a university hospital in Victoria, Australia, and published by Tamplin (2012), focused on the potential benefits of singing in improving respiratory function, vocal intensity and emotional state in tetraplegic patients. The study included 24 tetraplegic patients, who were divided into two groups: an experimental group and a control group. The subjects of the experimental group attended singing lessons 3 times a week, for 12 weeks, while the subjects of the control group participated in music relaxation sessions for the same time period. The patients were clinically evaluated at the beginning of the study, at the middle of the study period, immediately after the end of the 12 weeks, and 6 months after the intervention. The tests involved the evaluation of respiratory function, the contraction force of accessory respiratory muscles, measurements for the quantification of vocal quality and intensity, as well as questionnaires assessing the quality of life. The results obtained showed an increase in the vocal intensity and phonation time of patients in the group attending singing lessons. Also, this group had a tendency to improved pulmonary function and respiratory muscle strength. In both groups there was an improvement of the emotional state.

The authors concluded that music therapy in tetraplegic patients can have positive effects on both physical and mental status, improving the patients' emotional state. These positive effects are amplified when music therapy is associated with therapeutic singing (Tamplin, 2012).

A review published in June 2014 (Irons et al., 2014) assessed the role of singing therapy as an adjuvant treatment method in patients with cystic fibrosis. Randomized clinical trials were selected in which the effects of singing on the quality of life, disease evolution, respiratory muscle strength and pulmonary function of patients with cystic fibrosis were evidenced.

Following the application of inclusion and exclusion criteria, only one study proved to be eligible and was finally analyzed. This was a randomized trial carried out in two pediatric hospitals in Australia, which evaluated the effects of singing programs on the quality of life and respiratory muscle strength in children diagnosed with cystic fibrosis. The study included 51 subjects divided into two groups: the experimental group, attending 8 singing lessons, and the control group, attending recreational therapy programs.

At the end of the experimental period, an improvement in the quality of life according to the Cystic Fibrosis Questionnaire-Revised was demonstrated in both groups. In the experimental group, there was an increase of maximum expiratory volume 6-8 weeks after the intervention. No significant differences in the other respiratory parameters were found between the two groups.

The authors of this review established that at the time when this meta-analysis was attempted, data supporting the potential of singing therapy in the treatment of cystic fibrosis were insufficient. However, the authors conclude in an optimistic note, considering that the increasing interest in the non-pharmacological treatment of this disease might generate new studies on the effects of singing therapy on the respiratory function and psycho-emotional state of patients with cystic fibrosis (Irons et al., 2014).

Studies performed in UK (Lord et al., 2010) showed that improving the pulmonary function can fail if singing breathing exercises are not practiced for a sufficiently long time period to be correctly acquired and executed or when the individual exercise capacity is not taken into consideration. Starting from this finding and based on previous studies reporting beneficial effects of singing on health status in chronic patients in general, Lord et al. resumed research, adopting a more elaborate protocol. They included in their study patients with COPD diagnosed according to GOLD guidelines, who learned breathing control strategies and subsequently participated in singing lessons two times a week, for 8 weeks. The lessons consisted of relaxation techniques, posturing and vocal exercises. The subjects were encouraged to practice these techniques at home daily, being monitored for exercise tolerance. Patients gained a better breathing control and reported an improvement of mental status, with the amelioration of dysthymia and an increase of the desire to socialize. Understanding the importance of singing as a breathing training method, the patients accepted to include this activity in their daily lives as a method for the self-management of respiratory symptoms (Lord et al., 2012).

Conclusions

1. Pulmonary rehabilitation involves the training of the patient with respiratory disease for correct posturing, driving the air flow into the airways, preventing air trapping, using the diaphragm muscle in the act of respiration and increasing respiratory muscle strength.

2. Singing educates the patient for correct posture, deep inspiration and prolonged expiration, preventing the air trapping phenomenon and improving pulmonary ventilation.

3. Singing increases the participation of the diaphragm muscle and the contraction force of respiratory muscles during respiration, with the improvement of current volumes.

4. Singing improves the quality of life and can be a self-management method in the case of patients with chronic pulmonary diseases.

Conflicts of interest
Nothing to declare

Acknowledgements
Dr. Ungur Rodica acknowledges financial support from POSDRU grant no. 159/1.5/S/138776, entitled "A collaborative institutional model for transferring scientific biomedical research to clinical practice - TRANSCENT".

References

Baker TL, Fuller DD, Zabka AG, Mitchell GS. Respiratory plasticity: differential actions of continuous and episodic hypoxia and hypercapnia. Respir Physiol. 2001;129(1-2):25-35.

Bonilha AG, Onofre F, Vieira ML, Prado MY, Martinez JA. Effects of singing classes on pulmonary function and quality of life of COPD patients.Int J Chron Obstruct Pulmon Dis. 2009;4:1-8.

Croitoru A, Miron AB. Evidenţe legate de reabilitarea pulmonară în patologia respiratorie. Pneumologia, 2014;63(2):88-95.

Eichenberger PA, Diener SN, Kofmehl R, Spengler CM. Effects of exercise training on airway hyperreactivity in asthma: a systematic review and meta-analysis. Sports Med. 2013;43(11):1157-1170.

Evaristo KB, Saccomani MG, Martins MA, Cukier A, Stelmach R, Rodrigues MR, Santaella DF, Carvalho CR. Comparison between breathing and aerobic exercise on clinical control in patients with moderate-to-severeasthma: protocol of a randomized trial. BMC Pulm Med. 2014 Oct 17;14:160.

Hopkinson NS, Sharshar T, Dayer MJ, Lofaso F, Moxham J, Polkey MI. The effect of acute non-invasive ventilation on corticospinal pathways to the respiratory muscles in chronic obstructive pulmonary disease. Respir Physiol Neurobiol. 2012;183(1):41-47.

Hopkinson NS, Sharshar T, Ross ET, Nickol AH, Dayer MJ, Porcher R, Jonville S, Moxham J, Polkey MI. Corticospinal control of respiratory muscles in chronic obstructive pulmonary disease. Respir Physiol Neurobiol. 2004;141(1):1-12.

Irons JY, Petocz P, Kenny DT, Chang AB. Singing as an adjunct therapy for children and adults with cystic fibrosis. Cochrane Database Syst Rev. 2014;6:CD008036. doi: 10.1002/14651858.CD008036.

Jang HJ, Kim MJ, Kim SY. Effect of thorax correction exercises on flexed posture and chest function in older women with age-related hyperkyphosis. J Phys Ther Sci. 2015;27(4):1161-1164.

Jastrzębski D, Maksymiak M, Kostorz S, Bezubka B, Osmanska I, Młynczak T, Rutkowska A, Baczek Z, Ziora D, Kozielski J. Pulmonary Rehabilitation in Advanced Lung Cancer Patients During Chemotherapy. Adv Exp Med Biol. 2015 May 28 (Epub ahead of print).

Leanderson R, Sundberg J, von Euler C. Role of diaphragmatic activity during singing: a study of transdiaphragmatic pressures. J Appl Physiol 1987;62(1):259-270.

Lord VM, Cave P, Hume VJ, Flude EJ, Evans A, Kelly JL, Polkey MI, Hopkinson NS. Singing teaching as a therapy for chronic respiratory disease–a randomised controlled trial and qualitative evaluation. BMC Pulm Med. 2010;10:41. doi: 10.1186/1471-2466-10-41.

Lord VM, Hume VJ, Kelly JL, Cave P, Silver J, Waldman M, White C, Smith C, Tanner R, Sanchez M, Man WD, Polkey MI, Hopkinson NS. Singing classes for chronic obstructive pulmonary disease: a randomized controlled trial. BMC Pulm Med. 2012;12:69. doi: 10.1186/1471-2466-12-69.

Maeda K, Higashimoto Y, Honda N, Shiraishi M, Hirohata T, Minami K, Iwasaki T, Chiba Y, Yamagata T, Terada K, Matsuo Y, Shuntoh H, Tohda Y, Fukuda K. Effect of a postoperative outpatient pulmonary rehabilitation program on physical activity in patients who underwent pulmonary resection for lung cancer. Geriatr Gerontol Int. 2015 May 8. doi: 10.1111/ggi.12505. [Epub ahead of print].

Matcovschi S, Botezatu A, Dumitraş T, Nikolenko I. Noţiuni de reabilitare pulmonară. Ed. Vite-Jesc SRL, Chişinău,2011,5.

Moreira A, Bonini M, Pawankar R, Anderson SD, Carlsen KH, Randolph C, Silvers W, Storms W, Weiler JM, Bonini S. A World Allergy Organization international survey on physical activity as a treatment option for asthma and allergies. World Allergy Organ J. 2014;7(1):34. doi: 10.1186/1939-4551-7-34.

Nikoletou D, Man WD, Mustfa N, Moore J, Rafferty G, Grant RL, Johnson L, Moxham J. Evaluation of the effectiveness of a home-based inspiratory muscle training programme in patients with chronic obstructive pulmonary disease using multiple inspiratory muscle tests. Disabil Rehabil. 2015;17:1-10.

Pettersen V. Preliminary findings on the classical singer's use of the pectoralis major muscle. Folia Phoniatr Logop. 2006;58(6):427-439.

Pothirat C, Chaiwong W, Phetsuk N. Efficacy of a simple and inexpensive exercise training program for advanced chronic obstructive pulmonary disease patients in community hospitals. J Thorac Dis. 2015;7(4):637-643.

Rohrer V, Schmidt-Trucksäss A. Impact of exercise, sport and rehabilitation therapy in asthma and COPD. Ther Umsch. 2014;71(5):295-300.

Rugbjerg M, Iepsen UW, Jørgensen KJ, Lange P. Effectiveness of pulmonary rehabilitation in COPD with mild symptoms: a systematic review with meta-analyses. Int J Chron Obstruct Pulmon Dis. 2015;17(10):791-801.

Johnson G, Skinner M. The demands of professional opera singing on cranio-cervical posture. Eur Spine J. 2009; 18(4):562-569. doi: 10.1007/s00586-009-0884-1.

Spruit MA, Singh SJ, Garvey C et al. An official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. Am J Respir Crit Care Med. 2013; 188(8):e13-64. doi: 10.1164/rccm.201309-1634ST

Staes FF, Jansen L, Vilette A, Coveliers Y, Daniels K, Decoster W. Physical therapy as a means to optimize posture and voice parameters in student classical singers: a case report. J Voice. 2011;25(3):e91-101. doi: 10.1016/j.jvoice.2009.10.012.

Tamplin J, Baker FA, Grocke D, Brazzale DJ, Pretto JJ, Ruehland WR, Buttifant M, Brown DJ, Berlowitz DJ. Effect of singing on respiratory function, voice, and mood after quadriplegia: a randomized controlled trial. Arch Phys Med Rehabil. 2013;94(3):426-434.

Tarumi S, Yokomise H, Gotoh M, Kasai Y, Matsuura N, Chang SS, Go T. Pulmonary rehabilitation during induction chemoradiotherapy for lung cancer improves pulmonary function. J Thorac Cardiovasc Surg. 2015;149(2):569-573.

Thomasson M, Sundberg J. Consistency of phonatory breathing patterns in professional operatic singers. J Voice. 1999;13(4):529-541.

Yates P, Schofield P, Zhao I, Currow D. Supportive and palliative care for lung cancer patients. J Thorac Dis. 2013; 5(Suppl 5): S623-S628.

Websites

(1) http://www.srp.ro/ReabilitareaRespiratorie/default.aspx Accessed on May 2015

(2) http://www.umfiasi.ro/Rezidenti/suporturidecurs/Facultatea%20de%20Medicina/Recuperare%20respiratorie%20-%20conf.%20univ.%20dr.%20Paraschiva%20Postolache/curs%2004%20-%20Reabilitarea%20respiratorie%20obiective%20rez.pdf Accessed on May 2015

(3) http://www.goldcopd.org Accessed on May 2015

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 164–171

Influence of smoking on exercise capacity
Influenţa fumatului asupra capacităţii de efort

Daniela Pintican, Dan Mihu
„Dominic Stanca" Obstetrics and Gynecology Clinic; University of Medicine and Pharmacy, Cluj-Napoca, Romania

Abstract

Smoke resulting from the burning of a cigarette contains up to 4000 chemical compounds, of which at least 50 are carcinogenic. The main chemical substances released after absorption in the respiratory system are nicotine, carbon monoxide and hydrocyanic acid.

Smoking is a risk factor for the development of respiratory, cardiovascular, muscle, bone, immune system diseases, as well as cancer. Exercise capacity represents the capacity of the circulatory, respiratory and muscular system to provide oxygen during sustained physical activity. Smoking is associated with a reduction of aerobic exercise capacity due to low oxygen supply and an impaired heart rate response (negative chronotropic effect), both of which represent important predictive factors of mortality. Nicotine induces the release of catecholamines, aggravates sleep disorders and difficulties falling asleep, and has a negative influence on overall performance capacity. Resistance to infectious bronchial and catarrhal diseases is crucial for smoking athletes, because optimal health is a basic requirement for sports training or the improvement of performance.

Keywords: smoking, aerobic capacity, anaerobic capacity, nicotine, smoking cessation

Rezumat

Fumul rezultat în urma arderii unei ţigări conţine până la 4000 de compuşi chimici, din care cel puţin 50 sunt carcinogeni. Principalele substanţe chimice eliberate, după absorbţia la nivelul aparatului respirator, sunt: nicotina, monoxidul de carbon şi acidul cianhidric.

Fumatul reprezintă un factor de risc în apariţia bolilor respiratorii, cardiovasculare, sistemului muscular, sistemului osos, sistemului imunitar şi în apariţia cancerului. Capacitatea de efort reprezintă capacitatea sistemului circulator, respirator, muscular de a furniza oxigen în timpul activităţii fizice susţinute.Fumatul este asociat cu reducerea capacităţii aerobe de efort datorită aprovizionării reduse a oxigenului şi un raspuns depreciat al ritmului cardiac (efect cronotrop negativ), ambele reprezentând factori predictori importanţi ai mortalităţii. Nicotina induce eliberare de catecolamine, accentuează tulburările de somn şi adormirea, acţionând defavorabil asupra capacităţii globale de performanţă. Rezistenţa la bolile infecţioase bronşice şi catarale este de o importanţă determinantă pentru sportivul fumător, deoarece o sănătate intactă reprezintă condiţia de bază în vederea antrenamentului sportiv sau a creşterii performanţelor.

Cuvinte cheie: fumat, capacitate aerobă, capacitate anaerobă, nicotină, renunţare la fumat.

General considerations

Smoke resulting from the burning of a cigarette contains up to 4000 chemical compounds, of which at least 50 are carcinogenic. The main chemical substances released after absorption in the respiratory system are nicotine, carbon monoxide and hydrocyanic acid (Genbacev-Krtolica, 2005; Weineck, 1995).

According to the World Health Organization (***, 2014), there are over 100 billion smokers worldwide. In the 20th century, smoking was responsible for about 100 million deaths; over the past years, there have been approximately 6 million deaths per year from smoking, a figure that is estimated to increase by 2030 to 8 million per year, of which more than 80% will be represented by developed countries (World Health Organization).

Carbon monoxide

The carbon monoxide content of a cigarette amounts to 1-3%, that of a pipe to approximately 2%, and that of a cigar to 6% (Staicu, 2009).

CO concentration in the exhaled air (COEA) is measured using a CO analyzer, into which the subject blows after an inspiration, followed by a 15 second apnea. In the absence of active or passive smoking, COEA is very low, below 5 ppm (particles per million). In active smokers, COEA exceeds 20 ppm and can reach higher values, over 70 ppm in heavy smokers. A percentage of 20 ppm can be found in passive smokers. The measurement of COEA is the most effective test for detecting non-smokers (below 5 ppm) and smokers (over 10-30 ppm).

Received: 2015, April 30; *Accepted for publication:* 2015, May 15;
Address for correspondence: University of Medicine and Pharmacy, Obstetrics and Gynecology Clinic Dominic Stanca, 21 Decembrie 1989 Av. No 57 , 400124 Cluj-Napoca, Romania
E-mail: dana_bodnar@yahoo.com
Corresponding author: Daniela Pintican

Carbon monoxide (CO) rapidly diffuses through alveolar membranes and pulmonary capillaries, having an increased affinity for hemoglobin, with which it combines to form carboxyhemoglobin (COHb), an affinity 245 times higher than that of oxygen, thus reducing the oxygen carrying capacity and oxygen release, by shifting the oxygen dissociation curve to the left (Rudra et al., 2010). The formation of COHb is reversible by removal of the CO source in favor of inspired oxygen, so that after 4 hours of tobacco abstinence, its value is reduced to half. Carbon monoxide is also an inhibitor of carbonic anhydrase (Ganong, 2005).

The basal COHb level in humans is about 0.1-1% in the absence of environmental contamination or smoking. In the blood of a smoker, the COHb percentage usually ranges between 5-15% or more. COHb levels higher than 20% are usually associated with clinical toxicity symptoms, which can lead to neurotoxicity, cognitive disorders, unconsciousness, and death at chronic or increased concentrations (Gorman et al., 2003).

Recent studies have shown the fact that low CO concentrations can influence the intracellular signal transduction pathways. CO may exert vasoregulatory properties, as well as inflammation, modulation, apoptosis, cellular proliferation in vitro and in vivo.

Cellular exposure to CO has been demonstrated to directly or indirectly modulate the activity of a number of intracellular signaling molecules. Similarly to NO, CO can act as a heme ligand and an activator of soluble guanylyl cyclase (sGC), to increase the production of cyclic guanosine monophosphate (cGMP). Experimental evidence indicates that NO activates sGC in vitro and corresponding vasodilatory action in vivo with greater potency (Furchgott & Jothianandan,1991).

CO is implicated in the first place as a regulator of the sGC/cGMP axis in the context of olfactory transmission (Verma et al., 1993). CO may exert vasorelaxant effects in the liver and other vascular beds that are considered to be cGMP dependent (Durante et al., 2006). Alternatively, CO may also regulate vascular function through additional mechanisms, including the inhibition of cytochrome P450 and the activation of calcium dependent potassium channels in smooth muscle vascular cells (Wang, 2006).

CO can modulate the activation of mitogen-activated protein kinases (MAPK), which are important mediators of inflammatory and stress responses. A potent anti-inflammatory effect of CO has been demonstrated in bacterial lipopolysaccharides (LPS) – stimulating the macrophages, which depend on the modulation of mitogen-activated protein kinase kinase 3 (MKK3)/p38 MAPK (Zhang et al., 2003).

Nicotine

Nicotine, α-3-pyridyl-N-methylpyrrolidine, is a pyrrolidine alkaloid extracted from the leaves of Nicotiana species (tabacum, rustica americana), which contain 1-8+ % active substance. The nicotine content in various tobacco products is variable: 13-32 mg/cigarette, 5-7 mg/cigarette butt, 15-40 mg/cigar, 12-16 mg/1g snuff tobacco.

Nicotine can be introduced into the body by several routes: skin, lungs or mucosae (nasal, gingival). The most common method for introducing nicotine into the body is its inhalation, by smoking. After inhalation, nicotine enters the blood, where it attains an optimal concentration and rapidly reaches (7 seconds) certain brain cholinergic receptors. It stimulates the brain and is responsible both for pleasant sensations during smoking and for irritability specific to the moment when a smoker tries to quit smoking. Nicotine takes its effect in 10-15 seconds, and this effect lasts for about 60 minutes. After 6 hours, 0.031 mg of the nicotine content of a cigarette (0.8-0.7 mg nicotine/ cigarette) remain in the body (Buzoianu, 2002). 80% of nicotine is destroyed by the liver and 19% is eliminated by the kidneys in an unchanged form.

Nicotine has physiological and pathological effects on a variety of organs and systems of the body:

- lymph node system;
- nicotinic acetylcholine receptors (nAChRs) of chromaffin cells through catecholamines;
- stimulation of the central nervous system by nAChRs (Aseem et al., 2015).

Through the catecholamines released from the sympathetic adrenomedullary system, nicotine determines:

- cardiovascular changes: peripheral vasoconstriction, increase of the heart rate and output, increase of blood pressure;
- metabolic changes: increase of glycemia and free fatty acids;
- antidiuretic hormone secretion;
- increase of platelet aggregation (Schneider & Henrion, 1979).

Nicotine and CO concentration are important markers of smoking in the short term. The elimination half-life of nicotine is short (2-3 hours); 80% is metabolized into cotinine, which is found in all biological media (blood, urine, saliva, milk, amniotic fluid, placenta, hair, meconium). This is a good marker of daily smoking, and its half-life is about 15 hours in active smokers and 27 hours in passive smokers. Morning cotininemia has a high sensitivity, specificity and stability in active smokers. It also allows to evaluate passive smoking.

Hydrocyanic acid

Cigarette smoke contains small amounts of cyanide that combines in the body with hydroxocobalamin and thiosulfate, forming hydroxocobalamin and thiocyanate (which has a hypotensive effect). Cyanide inhibits the activity of essential enzymes involved in cellular respiration, such as cytochrome oxidase and carbonic anhydrase (Schneider & Henrion, 1979).

Passive smoking is the secondary exposure to cigarette smoke or other tobacco derivatives of non-smokers, who live in indoor environments with smokers. It is associated with a high risk of COPD, bronchial asthma, lung cancer, ischemic heart disease, acute myocardial infarction, cerebrovascular disease and respiratory infections (Costa et al., 2006).

The effects following the short-term exposure to tobacco smoke, such as irritation of the eyes and airways, among passive smokers (Junker et al., 2001). Even short-term exposure to tobacco smoke can generate significant negative effects on the human respiratory system, as shown in a recent comment (Flouris & Koutedakis, 2011). Finally, Pope et al. (2001) suggest that the effects of acute

exposure to tobacco smoke on autonomic cardiac function may contribute to pathophysiological mechanisms that link passive smoke exposure to an increased risk of cardiovascular mortality (Flouris et al., 2010).

Active smoking is defined as the smoking of at least one cigarette per day, involving nicotine dependence and the maintenance of nicotine levels above a certain threshold. Active smoking induces a number of negative effects on all the organs of the human body.

Smoking - a risk factor for health

a) *The bone system*

Smoking is associated with low bone mineral density, regardless of age and sex (Ortego et al., 1997).

The effect of smoking on bone mineral density increases with age, particularly in postmenopausal women. The association of smoking with low bone density and hip fracture is undoubtedly a cause-effect relationship. Risk is reduced in persons who quit smoking, with a dose-response relationship depending on the number of cigarettes smoked. Smokers have a high risk to develop osteoporosis and fractures, because of a low bone mineral mass (Ward & Klesges, 2000).

The study performed by Fusby et al. (2010) showed that exposure of mice to smoke induced a 50% diminution of B220+ CD43- bone marrow cells - premature, immature and mature B cells, but not B cell precursors, and increased the percentage of CD8+ mature splenic T cells to the detriment of CD4+ T cells. These effects are reversible after the cessation of smoking, the bone marrow having the capacity to restore B cells after smoke exposure. These data provide the first proof that cigarette smoke has a negative impact on the bone marrow. Because B cells that are negatively affected are able to produce osteoprotegerin that determines the formation of osteoclasts, smoking induces a reduction of B cells in the bone marrow, which suggests a plausible mechanism for the way in which smoking contributes to the development of osteoporosis, but also suggests that the restoration of bone marrow B cells lost by smoking exposure can be achieved by smoking cessation (Fusby et al., 2010).

b) *The muscular system*

In patients with chronic pulmonary disease, exercise intolerance has been found. In about 40% of the cases, exercise capacity is limited by skeletal muscle alterations rather than pulmonary problems. Chronic obstructive pulmonary disease (COPD) is frequently associated with a reduction in the number of muscle fibers and a change of their composition, which induces an earlier onset of muscle fatigue (Wüst & Degens 2007).

Healthy smokers frequently complain of an increased sensation of fatigue (Corwin et al., 2002). The etiology of this early onset of fatigue in smokers is unknown and it is not clear whether smoking or other factors such as a reduced level of physical exercise contribute to this phenomenon (Larsson et al., 1988). Studies carried out in young male subjects undergoing physical activity, compared to control subjects, have demonstrated that smoking itself induces a significant decrease of skeletal muscle mass and thus, a lower resistance to fatigue (Morse et al., 2007). The reduction of exercise capacity in healthy smokers suggests that long-term smoking may cause a progressive skeletal deterioration and muscle fatigue (Bernaards et al., 2003).

c) *The cardiovascular system*

Chronic exposure to cigarette smoke determines a prothrombotic as well as an atherogenic effect, increasing the risk of coronary disease, acute myocardial infarction, sudden cardiac death, cerebrovascular accident, aortic aneurysm and peripheral vascular diseases. Even very low exposure doses increase the risk of acute myocardial infarction.

Smoking cessation decreases cardiovascular mortality and morbidity by up to 5 years, regardless of the age and sex of the smoker (Bullen, 2008).

Nicotine stimulates the excitoconductor system of the heart, due to catecholamine release, which determines an increase in the heart rate by 10-20 pulsations/minute. This effect decreases in 15-45 minutes and is no longer detectable after 2-3 hours (Aseem et al., 2015).

In the vascular territory, nicotine induces vasoconstriction, followed by an increase of blood pressure. After smoking one cigarette, finger temperature decreases due to vasoconstriction by 0.6-3.8 degrees in 2 minutes, this effect lasting for 3-4 hours.

Tachycardia and vasoconstriction determine an increase in systolic and diastolic blood pressure, which leads to an intensification of cardiac strain and to a corresponding increase of oxygen requirements.

In a number of observational studies, smoking has been associated with high plasma concentrations of total cholesterol, low-density lipoprotein (LDL cholesterol) and triglycerides, low concentrations of high-density lipoprotein (HDL cholesterol), central obesity, an increase of blood pressure and heart rate (Asvold et al., 2014).

d) *The respiratory system*

Smoking induces a decrease of expiratory volume, a deterioration of alveolar gas exchange, a reduction of respiratory flow and an increase in the oxygen requirements of respiratory muscles.

The diminution of respiratory flow and the increased oxygen requirements of respiratory muscles are due, among others, to the fact that resistance to the passage of air through the airways increases during effort in smokers compared to non-smokers (by 40-50%), which is explained by mucosal edema and mucus overproduction (Flouris et al., 2012). Smoking as well as other factors can potentiate the effect of a respiratory disease on the human body. Studies have shown an association between smoking and respiratory diseases (Murin et al., 2000). Smoking may affect the immune system of the body, and the recovery time after disease can be longer than usual (Murin & Bilello, 2005). Smokers are more predisposed to influenza than non-smokers, and they have an increased risk of bacterial pneumonia, tuberculosis, COPD (Wüst & Degens, 2007; Ryter & Choi, 2013).

In conclusion, smoking has been found to double the number of respiratory disease cases. About 6 million people die every year because of smoking or its complications through respiratory diseases. However, the number of smokers increases every year. This is why smoking is a serious problem in many countries (World Health Organization).

Smoking increases the risk of developing respiratory

diseases by two times and reduces defense against infections, so that infections in smokers are more frequent than in non-smokers. Anti-smoking campaigns can significantly reduce the spread of respiratory diseases (Aldila & Apri, 2014).

Acute effects on respiratory function have been less significant and mainly limited to ventilation-perfusion abnormalities.

e) *The endocrine system*

Nicotine determines an intensification of the formation of thyroid hormones, with an enhancement of general catabolism. This leads, in the case of usual smokers, to a transient weight gain when smoking is stopped, due to a decrease in the lipolytic activity of protein lipase in the absence of nicotine.

Nicotine also induces the release of ACTH and ADH (Staicu, 2009).

f) *The nervous system*

The effects of nicotine are mediated centrally. Nicotine has a neuroregulatory impact on the nervous system, affecting biochemical and physiological functions. Circulating epinephrine and noradrenaline levels are increased, and the bioavailability of dopamine is also changed. Neuroendocrine effects include the release of arginine vasopressin, β-endorphin, adrenocorticotropic hormone and cortisol. Some of these neurochemical substances are psychoactive and/or involved in the modulation of behavior. Thus, emotional and cognitive states can be influenced by the dose of nicotine. When nicotine is inhaled, the neuroregulatory effects described above are immediately available.

In small doses, nicotine induces an increase of dopamine levels in the brain, through the inhibition of monoamine oxidase. Dopamine, an important neuromediator of the perception of pleasure, generates a state of good humor and focused attention. In high or repeated doses, it inhibits synaptic transmission. Under the influence of nicotine, changes in brain waves (desynchronizations) occur (Pomerleau, 1992).

g) *The excretory system*

The risk of chronic renal diseases in smokers is increased. Smoking increases albumin excretion in the urine, decreases the glomerular filtration rate, increases the incidence of renal artery stenosis, and is associated with an increase of mortality in patients with end-stage renal disease. The pathogenesis of renal involvement is due to the action of nicotine on the COX-2 isoform, which causes an increase of acute glomerular inflammation, glomerulonephritis and ureteral obstruction. Thus, nicotine inhibits diuresis (Jaimes et al., 2009).

h) *The immune system*

The qualitative and quantitative effects of cigarette smoke on the immune system depend on the duration of smoking, sex, ethnicity of the studied subjects.

Chronic smoking alters a wide range of immunological functions, both innate and acquired immunity.

Innate immunity

The lungs are an important route of exposure to pathogenic agents and antigens; specific and non-specific defense mechanisms are involved in lung defense. Protection against foreign substances reaching the pulmonary alveoli is ensured by the innate immune system and adaptive immune response. Alveolar macrophages and other monocytes are the most important part of the innate immune system in the lungs. Smoking is a risk factor for acute respiratory diseases and COPD (Wüst & Degens, 2007), alveolar macrophages from the alveolar lavage playing a major role in the pathogenesis of these diseases (Sopori, 2002).

Because smoking is associated with an increased risk for different types of cancer, the effects of smoking on the function of natural killer (NK) cells, lymphoid cells with a role in the monitoring of tumor growth, have been evaluated. The activity of NK cells in melanomas and other cancer cells is significantly reduced in smokers compared to non-smokers. The development of cancer might partially result from the effects of cigarette smoke on the immune system (Sopori, 2002).

Acquired immunity involves specific responses that are triggered by antigens of various origins and are mainly executed by T cells and B cells. A well documented effect of cigarette smoke is leukocytosis; however, the function of these cells is significantly reduced. Smoking is an important cause of morbidity during an influenza epidemic. This might lead, in part, to small titers and a decreased half-life of influenza specific antibodies. Studies have shown that long-term smoking significantly reduces serum immunoglobulin levels (Sopori, 2002) .

Based on the particle size, cigarette smoke is composed of two phases – a vapor phase and a particle phase – each containing thousands of chemical substances. Chronic exposure to the vapor phase does not suppress the immune system, which indicates the fact that one or more components of the particle phase is immunosuppressive. In the particle phase, the most important part of nicotine is found. Animals that are chronically treated with nicotine have a significant antibody loss and T cell proliferation (Sopori, 2002).

i) *The male reproductive system*

Nitric oxide (NO) released by the parasympathetic system plays an essential role in erectile function by vasodilation and relaxation of the cavernous body. Nicotine induces NO insufficiency. This may lead to erectile dysfunction. Various studies on animals suggest that nicotine determines the degeneration of seminal canals, disturbing spermatogenesis in germ cells. Nicotine diminishes testosterone levels secondary to a decreased production of StAR – a protein that plays an important role in testosterone biosynthesis (Aseem et al., 2015).

j) *The female reproductive system*

- *Effects on the menstrual cycle*

Nicotine, through the inhibition of 21-hydroxylase, determines a hypoestrogenic status, the formation of androgenic hormones, which induces chronic anovulation and irregular menstrual cycles. Nicotine acts on the endometrium by inadequate cytokine production and irregular bleeding (Jin et al., 1997).

- *Effects on oocytes*

In studies performed on animals, it has been found that nicotine affects the ovaries and changes oocyte production. Oocytes treated with nicotine lose their spherical shape, they have a rough, disrupted surface, and the zona pellucida is irregular. Nicotine also prevents the maturation of the

oocyte. The blood flow in the oviduct is reduced and thus, fertility is affected (Hammer et al., 1981).

Effects of smoking on exercise capacity

Exercise capacity is the ability of the active muscular system to release the energy required for maximum mechanical work and its maintenance for as long as possible.

Exercise capacity is the basic factor for obtaining performance by sports training (Duck-chul et al., 2010).

Aerobic capacity

Aerobic exercise capacity is the ability of the body to make efforts up to a submaximal level, using the energy produced by aerobic pathways, without lactate accumulation.

The term aerobic system designates all reactions and metabolic pathways in which ATP can by synthesized from food sources, but only in the presence of oxygen. The aerobic system includes aerobic glycolysis, the Krebs cycle and the electron transport system (ETS). ETS, also referred to as the respiratory chain, represents a series of chemical reactions that occur in mitochondria, in which electrons and hydrogen ions combine to form water, and ATP is resynthesized (Afzal et al., 1998).

Smoking is associated with a reduction of aerobic exercise capacity due to low oxygen supply and an impaired heart rate response (negative chronotropic effect), both representing important predictive factors of mortality (Thier de Borba et al., 2014).

Active smokers have an aerobic capacity that can be reduced up to 12% because of the increased carbon monoxide concentration in the blood. During exercise, the muscles under strain are supplied with carbon monoxide from the blood, and the heart rate increases to maintain adequate oxygen requirements for the muscles. Smoking determines during physical exercise an additional energy cost due to the increased activity of respiratory muscles. Smoking cessation and the practice of regular physical activities can cause the restoration of aerobic capacity (Costa et al., 2006).

Persons with a reduced cardiorespiratory capacity are more susceptible to develop systemic arterial hypertension (SAH) (Barlow et al., 2006), diabetes (Sawada et al., 2010), and metabolic syndrome (LaMonte et al., 2005), and have higher mortality rates because of cardiovascular diseases (Bullen, 2008) and cancer (Sopori, 2002) than persons with a good cardiorespiratory capacity.

Wüst et al. (2008) found that the reduction of exercise capacity in smokers was similar in men and women and was not related to a long history of smoking. The decrease of exercise capacity might be caused by neuromuscular transmission failure, changes in the contractile properties of skeletal muscles, reduced oxygen supply to muscles and/or muscle oxidative capacity (Degens et al., 2005). Previous studies found that smokers had a lower activity of mitochondrial enzymes such as cytochrome oxidase (Alonso et al., 2003).

The inhalation of tobacco smoke leads to an alteration of nicotine dependent aerobic capacity, regardless of the level of physical exercise performed (Tchissambou et al., 2004).

The absence of a significant correlation between a long history of smoking (Wüst et al., 2008), muscle fatigue and muscle fiber composition changes that might explain the decreased exercise capacity in smokers suggests that acute smoking prevents oxygen absorption. Low oxygen absorption may occur if the blood flow is diminished or if the blood oxygen content is lower than normal.

Physical exercise induces lower vasodilation in smokers compared to non-smokers (Gaenzer et al., 2001), which can be due to an insufficient production of nitric oxide (Montes de Oca et al., 2008) and/or increased oxidative stress (Gaenzer et al., 2001; Tsuchiya et al., 2002).

Low oxygen absorption might occur when carbon monoxide (CO) competes with oxygen in binding to hemoglobin (Hb), resulting in hypoxemia.

Consequently, it seems unlikely that hypoxemia is the factor that differentiates smokers from non-smokers. The effect of CO through its action on Hb cannot be completely excluded in contrast to hypoxemia, the oxygen dissociation curve shifting to the left, inhibiting oxygen release from Hb.

CO inhalation acutely affects maximum oxygen consumption both in healthy subjects and in patients with COPD (Wüst & Degens, 2007). Corroborated by data from the study of Wüst et al. (2008), this suggests that smoking can have an acute and reversible effect on exercise capacity, caused by CO from the cigarette smoke. This leads to a lower but reversible exercise capacity in smokers, which suggests that smoking itself acutely affects exercise capacity. This mechanism can take place through a reduced and potentially reversible acute oxygen absorption in the contractile muscle and/or a reduction of Hb and myoglobin function because of CO.

CO and other substances from the cigarette smoke inhibit respiratory chain enzymes (such as cytochrome oxidase). Given that smoking has an acute negative effect on exercise capacity, smoking cessation would lead to its recovery whether the subjects have or not clinical symptoms of chronic diseases, such as COPD or heart failure.

Reduced aerobic capacity and smoking were independently associated with a higher probability of injury in men and women during a standardized physical training program (Knapik et al., 2001).

In conclusion, skeletal muscles in smokers are much more fatigable than in non-smokers of the same age who perform the same physical activity, while the contractile properties of skeletal muscles are not different. The reduction of resistance to fatigue is similar in men and women and is not related to the history of smoking.

Anaerobic capacity

Anaerobic exercise capacity is the capacity of the body to perform maximum efforts using the energy produced by anaerobic pathways, with lactate accumulation.

Anaerobic means in the absence of oxygen. Anaerobic power is the development of maximum power during effort, measured as work (force in kg x distance in m) expressed per time unit (min). The anaerobic threshold is the intensity of the work load at which anaerobic metabolism is accelerated (Afzal et al., 1998).

The study carried out by Chia-Lun & Chang (2013) included 12 female smokers and 21 female non-smokers

who performed intermittent sprint tests (IST) and 20 m running tests. Intermittent sprints consisted of 6 sprints x 10 seconds with 60 seconds of active recovery between each sprint.

The mean power of smokers decreased during sprints 4-6 (in smokers: 95% confidence interval = 6.2-7.2 joules/kg, in non-smokers: 6.8-7.6 joules/kg; $P < 0.05$), and the fatigue index increased (smokers: 35.8% ± 2.3%, non-smokers: 24.5% ± 1.76%; $p < 0.05$) during the sprint. Maximal oxygen consumption in non-smokers was significantly higher compared to non-smokers ($P < 0.05$).

Smoking does not affect maximum power during sprint. The mean power of non-smokers during sprints 4-6 was significantly higher compared to smokers. Smoking does not affect sprint performance in initial stages, but reduces muscle strength in subsequent stages. The study performed by Morse et al. (2008) found that the fatigue index of smokers increased by 17%, which shows that smokers were less able to cope with fatigue compared to non-smokers. The increase of the fatigue index during IST indicates that smokers do not have the capacity to resist fatigue in the later phases of the test, which are part of the anaerobic exercise.

Another cause of a high fatigue index among smokers can be the limitation of cardiorespiratory function, because aerobic metabolism plays a critical role in providing energy during intermittent sprint. Because smoking reduces exercise capacity, the body can compensate by limiting the amount of energy provided by the aerobic system for exercise.

The results of lactate concentration in the blood before and after IST suggest that smoking does not influence the use of energy from the matter. High-intensity intermittent sprint requires an effective ATP system and glycolytic metabolism.

In the study of Chia-Lun & Chang (2013), a variation in blood lactate concentrations depending on the type of exercise performed was found.

Smoking mainly causes a decrease of sports performance in the case of endurance sports. Starting from the premise that nicotine induces the release of catecholamines, aggravates sleep disorders and difficulties falling asleep, having a negative action on overall performance capacity, resistance to infectious bronchial and catarrhal diseases is crucial for smoking athletes, because an optimal health is a basic requirement for sports training or the improvement of performance. It can be said that smoking limits health and performance capacity in various ways and is a behavioral error of athletes, in contradiction to their sports performance ambitions. A study carried out in USA on adolescent smokers evidenced that if these performed physical exercise 3 times/week or more and ate a vegetable diet once a week or more or dairy products daily, differences were significant compared to non-smokers. Smoking is usually associated with a reduction of physical exercise and healthy nutrition (Wilson et al., 2005).

Effects of physical exercise on smokers

Smoking cessation is frequently associated with insomnia, irritability, a reduction of the concentration capacity, depression, and an excessive wish to smoke.

Regular physical exercise seems to improve the intensity and frequency of the wish to smoke associated with smoking cessation (Vaughan et al., 2012).

The systematic review performed by Ussher et al. (2012), comprising 15 studies, seven of which including at least 25 persons in each group, with different durations and intensities of the smoking cessation and physical exercise program, studied the influence of physical exercise on smoking cessation. Three studies demonstrated significantly higher abstinence rates in the group performing physical exercise compared to the control group at the end of treatment. One of these studies found a significant benefit for the physically active group compared to the control group during the course of 3 months, and a limited benefit over a 12-month period. One study reported a significantly higher abstinence rate in the physically active group compared to the control group at 3 months, but not at 12 months. The other studies indicated no notable effect on smoking cessation in the physically active group. Only one study provided data indicating that physical exercise contributed to smoking cessation over the 12-month period monitored. The other studies were conducted over a too short time period or physical exercise was not sufficiently intense to attain the required exercise level.

The preventive role of physical exercise on smoking

In addition to the beneficial effect of physical exercise regarding smoking cessation, regular physical activity contributes to the reduction of the negative effects of smoking.

The study carried out by Menegali et al. (2009) on animals exposed to cigarette smoke analyzed the therapeutic effects of physical exercise on oxidative stress markers. The results showed that animals exposed to cigarette smoke had an extensive destruction of alveolar septa and a significant increase in macrophage and neutrophil counts, as well as in the amount of collagen. The results also showed a decrease in the volume density of elastic fibers and an increase in the volume of air spaces. However, physical exercise partially improves these markers. In addition, physical exercise reduces oxidant production and increases the activity of the enzymatic antioxidant defense system, but not of lipids and oxidized proteins induced by cigarette smoke. These results suggest that physical exercise partially improves the histological aspect and the parameters of oxidative stress in the lungs of animals chronically exposed to cigarette smoke.

Another study performed by Toledo et al. (2012) demonstrates that moderate-intensity aerobic training reduces the development of pulmonary embolism induced by exposure to cigarette smoke.

Prospective data from a study conducted in a large group of women indicate that both walking and vigorous physical exercise are associated with a considerable decrease of the risk of coronary events. A strong correlation between walking or vigorous physical exercise and the incidence of coronary disease was evidenced. Women who walked at a normal pace for at least 3 hours a week or those who had vigorous physical exercises for 1.5 hours a week had a 30-40% lower risk. These findings support the practice of moderate exercise, which can be achieved by the majority of the population. Although vigorous exercise should not be discouraged by those who choose it, the results of the study indicate the fact that huge public health benefits might be achieved through the performance of regular

moderate-intensity physical exercise by persons who are currently sedentary (Manson et al., 1999).

Conclusions

1. Smoking is a risk factor for respiratory and cardiovascular diseases, and has a negative effect on the quality of life.

1. The aerobic and anaerobic exercise capacity of smokers is reduced compared to that of non-smokers.

2. Smoking cessation results in restoration of exercise capacity.

3. Regular physical exercise is associated with smoking cessation and has a therapeutic role in pulmonary and cardiovascular diseases.

Conflicts of interest

Nothing to declare.

References

Afzal A, Brawner CA, Keteyian SJ. Exercise training in heart failure. Prog Cardiovasc Dis. 1998;41(3):175-190.

Aldila D, Apri M. Optimal Control Problem in Correlation Between Smoking and Epidemic of Respiratory Diseases AIP Conference Proceedings, 2014;1587(1):14-21.

Alonso JR, Cardellach F, Lopez S, Casademont J, Miro O. Carbon monoxide specially inhibits cytochrome oxidase of human mitochondrial respiratory chain. Pharmacol Toxicol 2003;93:142-146.

Aseem M, Pankaj C, Sourav D, Snita S, Poonam J, Apurva G. Harmful effects of nicotine. Indian J Med Paediatr Oncol. 2015; 36 (1):24-31.

Asvold BO, Bjorngaard JH, Carslake D, Gabrielsen ME, Skorpen F, Smith GD, Romundstad PR. Causal associations of tobacco smoking with cardiovascular risk factors: a Mendelian randomization analysis of the HUNT Study in Norway International J Epidemiol., 2014;43(5):1458-1470.

Barlow CE, LaMonte MJ, Fitzgerald SJ, Kampert JB, Perrin JL, Blair SN. Cardiorespiratory fitness is an independent predictor of hypertension incidence among initially normotensive healthy women.Am J Epidemiol., 2006;163(2):142-150.

Bernaards CM, Twisk JW, Van Mechelen W, Snel J, Kemper HC. A longitudinal study on smoking in relationship to fitness and heart rate response. Med Sci Sports Exerc, 2003;35(5):793-800.

Bullen C .Impact of tobacco smoking and smoking cessation on cardiovascular risk and disease. Expert Rev Cardiovasc Ther. 2008;6(6):883-895.

Buzoianu AD. Farmacologie Vol. I, Ed. Medicală Universitară "Iuliu Haţieganu" , Cluj Napoca, 2002, 58-59.

Chia-Lun L, Chang WD. The effects of cigarette smoking on aerobic and anaerobic capacity and heart rate variability among female university students. Int J Womens Health. 2013;5:667-679.

Corwin EJ, Klein LC, Rickelman K. Predictors of fatigue in healthy young adults: moderating effects of cigarette smoking and gender. Biol Res Nurs. 2002; 3(4):222-233.

Costa AA, Elabras FJ, Araújo ML, Ferreira JES, Meirelles LR, Magalhães CK: Programa multiprofissional de controle do tabagismo: aspectos relacionados à abstinência de longo prazo. Rev SOCERJ, 2006;19(5):397-403.

Degens H, Sanchez HJM, Heijdra YF, Dekhuijzen PN, Hopman MT. Skeletal muscle contractility is preserved in COPD patients with normal fat-free mass. Acta Physiol Scand. 2005;184(3):235-242.

Duck-chul L, Artero EG , Sui X , Blair NS . Mortality trends in the general population: the importance of cardiorespiratory fitness.J Psychopharmacol. 2010;24(4):27-35.

Durante W, Johnson FK, Johnson RA. Role of carbon monoxide in cardiovascular function. J Cell Mol Med. 2006;10(3):672-686.

Flouris AD, Koutedakis Y. Immediate and short-term consequences of secondhand smoke exposure on the respiratory system. Curr Opin Pulm Med. 2011;17(2):110-115.

Flouris AD, Vardavas CI, Metsios GS, Tsatsakis AM , Koutedakis Y. Biological evidence for the acute health effects of secondhand smoke exposure. Am J Physiol Lung Cell Mol Physiol 2010;298:(1): L3-L12.

Flouris DA, Metsios GS, Carrill AE, Jamurtas AZ, Stivaktakis PD, Tzatzarakis MN, Kouteakis Y. Respiratory and Immune Response to Maximal Physical Exertion following Exposure to Secondhand Smoke in Healthy Adults.Plos One 2012;7(2):e31880.

Furchgott RF, Jothianandan D. Endothelium-dependent and -independent vasodilation involving cyclic GMP: relaxation induced by nitric oxide, carbon monoxide and light. Blood Vessels. 1991;28:52-61.

Fusby JS, Kassmeier MD, Palmer VL, Perry GA, Anderson DK, Hackfort BT, Alvarez GK, Cullen DM., Akhter MP, Swanson PC. Cigarette smoke-induced effects on bone marrow B-cell subsets and CD4+:CD8+ T-cell ratios are reversed by smoking cessation: Influence of bone mass on immune cell response to and recovery from smoke exposure. Inhal Toxicol. 2010;22(9):785-796.

Gaenzer H, Neumayr G, Marschang P, Sturm W, Kirchmair R, Patsch JR. Flow-mediated vasodilation of the femoral and brachial artery induced by exercise in healthy nonsmoking and smoking men. J Am Coll Cardiol. 2001;38(5):1313-1319.

Ganong WF. Review of medical Physiology. 22nd Ed. A lange medical book/Mc Graw- Hill Stamford, 2005, 411-454, 534,647-666,690.

Genbacev-Krtolica O. Highlight for phenols, quinolines, indoles, benzene and 2-cyclopenten-1-ones are oviduct toxicants in cigarette smoke, by Prue Talbot, Karen Riveles, and Ryan Rosa: list of tobacco-smoke constituents that are harmful for reproduction grows--passive smokers may be at risk. Toxicol Sci. 2005;86(1):4-5

Gorman D, Drewry A, Huang YL, Sames C. The clinical toxicology of carbon monoxide. Toxicology. 2003;187(1):25-38.

Hammer RE, Mitchell JA, Goldman H. Effects of nicotine on concept us cell proliferation and oviductal/uterine blood flow in the rat. In: Cellular and Molecular Aspects of Implantation. Eds. S. Glasser & D. Bullock. Plenum Press, New York, 1981, 439-442.

Jaimes EA, Tian RX, Joshi MS, Raij L. Nicotine augments glomerular injury in a rat model of acute nephritis. Am J Nephrol 2009;29(4):319-326.

Jin Z, Roomans GM. Effects of nicotine on the uterine epithelium studied by X-ray microanalysis. J Submicrosc Cytol Pathol 1997;29:179-186.

Junker MH, Danuser B, Monn C, Koller T. Acute sensory responses of nonsmokers at very low environmental tobacco smoke concentrations in controlled laboratory settings. Environ Health Perspect. 2001;109(10):1045-1052.

Knapik JJ, Sharp MA, Canham CM, Hauret K, Patton JF,Jones BH. Risk factors for training-related injuries among men and women in basic combat training. Med Sci Sports Exerc. 2001;33(6):946-954.

LaMonte MJ, Barlow CE, Jurca R, Kampert JB, Church TS, Blair SN. Cardiorespiratory fitness is inversely associated with the incidence of metabolic syndrome: a prospective study of men and women. Circulation., 2005;112(4):505-512.

Larsson L, Orlander J, Ansved T, Edstrom L. Effects of chronic nicotine exposure on contractile enzyme-histochemical and

biochemical properties of fast- and slow-twitch skeletal muscles in the rat. Acta Physiol Scand. 1988;134(4):519-527.

Manson JE, Hu FB, Rich-Edwards JW, Colditz GA, Stampfer MJ, Willett WC, Speizer FE, Hennekens CH. A Prospective Study of Walking as Compared with Vigorous Exercise in the Prevention of Coronary Heart Disease in Women. N Engl J Med. 1999;341:650-658.

Menegali BT, Nesi RT, Souza PS, Silva LA, Silveira PCL, Valenca SS, Pinho RA. The effects oh physical exercise on the cigarette smoke-induced pulmonary oxidative reponse. Pulmonary Pharmacology & Therapeutics 2009;22(6):567-573.

Morse CI, Pritchard LJ, Wüst RC, Jones DA, Degens H. Carbon monoxide inhalation reduces skeletal muscle fatigue resistance. Acta Physiol (Oxf) 2008;192(3):397-401.

Morse CI, Wust RC, Jones DA, De Haan A, Degens H. Muscle fatigue resistance during stimulated contractions is reduced in young male smokers. Acta Physiol (Oxf). 2007;191(2):123-129.

Murin S, Bilello KS, Matthay R. Other smoking-affected pulmonary diseases. Clin Chest Med, 2000; 21:121-137.

Murin S, Bilello KS. Respiratory tract infections: Another reason not to smoke, Cleve Clin J Med. 2005; 72(10):916-920.

Ortego-Centeno N, Munoz-Torres M, Jodar E, Hernandez-Quero J, Jurado-Duce A, et al. Effect of tobacco consumption on bone mineral density in healthy young males. Calcif Tissue Int 1997; 60(6): 496-500.

Pomerleau OF. The Effects of Cigarette Smoking: A Global Perspective. Nicotine and the central nervous system: Biobehavioral effects of cigarette smoking Am J Med. 1992;93(1):S2-S7.

Pope CA 3rd, Eatough DJ, Gold DR, Pang Y, Nielsen KR, Nath P, et al. Acute exposure to environmental tobacco smoke and heart rate variability. Environ Health Perspect. 2001;109(7):711-716.

Rudra CB, Williams MA, Sheppard L, Koenig JO, Schiff AM, Frederick OI, Dilla R. Relation of whole blood carboxyhemoglobin concentration to ambient carbon monoxide exposure estimated using regression. Am J Epidemiol. 2010;171:942-951.

Ryter SW, Choi AMK. Carbon Monoxide in Exhaled Breath Testing and Therapeutics. J Breath Res. 2013; 7(1):017111.

Sawada SS, Lee IM, Naito H, Noguchi J, Tsukamoto K, Muto T, Higaki Y, Tanaka H, Blair SN. Long-term trends in cardiorespiratory fitness and the incidence of type 2 diabetes. Diabetes Care, 2010;33(6):1353-1357.

Schneider L, Henrion R. Tabac et grossesse. J.Gyn.Obst.Biol. Repr., 1979;8:7-12.

Sopori M. Effects of cigarette smoke on the immune system. Nat Rev Immunol. 2002;2(5):372-377.

Staicu ML. Factorii de risc şi stresul oxidativ în sarcină. Ed.Risoprint , Cluj Napoca, 2009,141.

Tchissambou BP, Massamba A, Babela JR, Mouanou JK, Mboussa J, Senga P. The effects of smoking and the degree of nicotine dependence on aerobic capacity in sportsmen Rev Mal Respir. 2004;21(1):59-66.

Thier de Borba A, Trevisan JR , Gass R, Nedel BF, Cardoso DM, Pohl HH, Reckziegel MB, Corbellini VA, Paiva DN. The influence of active and passive smoking on the cardiorespiratory fitness of adults. Multidiscip Respir Med. 2014;9:34.

Toledo AC , Magalhaes RM, Hizume DC, Vieira RP, Biselli PJC, Moriya HT, Mauad T, Lopes FDRQS, Martins MA. Aerobic exercise attenuates pulmonary injury induced by exposure to cigarette smoke. Eur Respir J . 2012;39(2):2254-2264.

Tsuchiya M, Asada A, Kasahara E, Sato EF, Shindo M, Inoue M. Smoking a single cigarette rapidly reduces combined concentrations of nitrate and nitrite and concentrations of antioxidants in plasma. Circulation, 2002;105(10):1155-1157.

Ussher MH, Taylor A, Faulkner G. Exercise interventions for smoking cessation. Cochrane Library 2012. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD002295.pub4/abstract

Vaughan R, Maddison R, Simpson C, Bullen C, Prapavessis H. The acute effects of exercise on cigarette cravings, withdrawal symptoms, affect, and smoking behaviour: systematic review update and meta-analysis. Psychopharmacology 2012;222(1):1-15.

Verma A, Hirsch DJ, Glatt CE, Ronnett GV, Snyder SH. Carbon monoxide: a putative neural messenger. Science. 1993;259(5093):381-384.

Wang R. Resurgence of carbon monoxide: an endogenous gaseous vasorelaxing factor. Can J Physiol Pharmacol. 1998;76:1-15.

Ward KD, Klesges RC. A Meta-Analysis of the effects of cigarette smoching on bone mineral density. Calcif. Tisue Int 2001 68(5):259-270.

Weineck J. Biologia Sportului. Ed. CCPS Bucureşti 1995; 2:332-337.

Wilson DB, Smith BN, Speizer IS, Bean MK, Mitchell KS, Uguy LS, Fries EA. Differences in food intake and exercise by smoking status in adolescents. Prev Med. 2005 Jun;40(6):872-879.

Wüst RCI, Degens H. Factors contributing to muscle wasting and dysfunction in COPD patients. Int J Chron Obstruct Pulmon Dis, 2007; 2(3):289-300.

Wüst RCI, Morse CI, De Haan A, Rittweger J, Jones AD, Degens H. Skeletal muscle properties and fatigue resistance in relation to smoking history. Eur J Appl Physiol. 2008;104(1):103-110.

Zhang X, Shan P, Otterbein LE et al. Carbon monoxide inhibition of apoptosis during ischemia-reperfusion lung injury is dependent on the p38 mitogen-activated protein kinase pathway and involves caspase 3. J Biol Chem. 2003;278(2):1248-1258.

***. World Health Organization, 2014; Fact sheet no.339

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 172–175

The importance of an exercise program in breast cancer related lymphedema
Rolul exerciţiului fizic în limfedemul secundar cancerului de sân

Dina Magdalena Puşcaş [1], Simona Tache [2]
[1] *"Prof. Dr. Ion Chiricuţă" Oncology Institute Cluj-Napoca*
[2] *"Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca, Romania*

Abstract
Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death among females. In most cases of breast cancer, breast surgery is the first step in the complex and multidisciplinary treatment of the disease. After surgery, the most common postoperative complication is secondary lymphedema. Lymphedema following breast cancer treatment remains a long-term disabling complication which cannot be treated in a decisive and radical manner. The objective of the treatment is to limit complications, to try to preserve the remaining lymphatic system and to develop new anastomosis. Complete Decongestive Physiotherapy is currently recognized as the gold standard treatment for lymphedema following breast cancer treatment. It includes: exercises, meticulous skin hygiene, manual lymph drainage, bandaging and supportive garments.
Keywords: breast cancer, secondary lymphedema, physical activity, range of motion, fibrosis.

Rezumat
Cancerul de sân este cel mai frecvent tip de cancer diagnosticat şi principala cauză de deces printre tipurile de cancer diagnosticate la femei. În majoritatea cazurilor de cancer de sân, chirurgia este primul pas în tratamentul complex şi multidisciplinar al bolii. Cea mai frecventă complicaţie postoperatorie este limfedemul secundar. Limfedemul secundar postmastectomie este o complicaţie cronică, ce nu poate fi tratată într-un mod decisiv şi radical. Obiectivul tratamentului este limitarea complicaţiilor, conservarea sistemului limfatic restant şi favorizarea noilor anastomoze. Fizioterapia decongestivă completă este recunoscută ca fiind tratamentul de elecţie în cazul limfedemului secundar mastectomiei. Acesta include: exerciţiu fizic, igiena tegumentară riguroasă, drenaj limfatic manual, bandajare cu feşe elastice şi mănuşi elastice.
Cuvinte cheie: cancer de sân, limfedem secundar, exerciţiu fizic, amplitudinea mişcării, fibroza.

Introduction

Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death among females, accounting for 23% of all cancer cases and 14% of cancer deaths (Jemal et al., 2011). Only 5-10% of breast cancers occur in women with a clear genetic predisposition, whereas the rest are "sporadic", meaning that there is no direct relation with the family history. Breast cancer occurs more commonly in the left breast than in the right one (Sperry, 2010). In most cases of breast cancer, breast surgery is the first step in the complex and multidisciplinary treatment of the disease (Delpech & Barranger, 2013).

Both conservative breast surgery and radical mastectomy are accompanied by axillary lymph node excision, while radiotherapy often completes the treatment (Vignes, 2010).

Hormone therapy and chemotherapy are also adjuvant treatments which are recommended before or after surgery, depending on the type and stage of cancer. Each of these therapies has an influence on shoulder mobility, the lymphatic system, well-being and the quality of life.

After surgery, the most common postoperative complications are: reduced range of motion in the shoulder, muscle weakness in the upper extremities, lymphedema, pain and numbness (Chan et al., 2010), fatigue, decreased physical functioning, psychological distress (Basen-Engquist et al., 2010), tension, web syndrome, tingling, itching, burning, partial dislocation of the shoulder (Liao et al., 2012), shoulder and chest wall pain (Nesvold et al., 2008). Radiotherapy may induce fibrosis of the tissues, affecting the muscles, organs and bones in the irradiated area, venous and lymphatic system dysfunction (Liao et al., 2012), skin diseases, pulmonary damage, pulmonary fibrosis (Păcurar et al., 2011). In patients with chemotherapy or/and hormone therapy, the following may occur: joint arthralgia, neuropathy, weight gain, cardiovascular effects, and osteoporosis (Stout et al., 2012).

Received: 2015, April 16; *Accepted for publication:* 2015, May 12;
Address for correspondence: "Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca; "Prof. Dr. Ion Chiricuţă" Oncology Institute, Republicii Str. No. 34-36, RO-400015 Cluj-Napoca
E-mail: dina.puscas@yahoo.com; iuhos.dina@umfcluj.ro
Corresponding author: Dina Puşcaş

The lymphatic system

The lymphatic system consists of lymphatic capillaries, lymphatic vessels, lymph nodes, lymphatic trunks, the thoracic duct and the right lymphatic duct, where the lymph passes into the venous system. Lymphatic vessels are divided into two types: initial lymphatics and collecting lymphatics. The valves and smooth muscle in their walls contract in a peristaltic way, propelling the lymph along the vessels. The normal 24 h lymph flow is 2 to 4 liters (Barrett, 2010).

The role of lymphatic circulation

The lymphatic system is part of the circulatory system. Along with the vascular system, it mediates the systemic transportation of substances. The lymphatic system also has a drainage function, preventing excessive accumulation of the interstitial fluid (Barrett, 2010).

In the majority of capillary beds, filtration of fluid exceeds absorption by the capillaries and pericytic venules. If the excess fluid was not removed, it would accumulate in tissues, causing *edema* (Pocock & Richards, 1999).

Factors that influence the interstitial fluid volume

The amount of fluid in the interstitial spaces depends on capillary pressure, interstitial fluid pressure, oncotic pressure, the capillary filtration coefficient, the number of active capillaries, the lymph flow and the total extracellular fluid volume. Changes in any of these variables lead to changes in the volume of interstitial fluid to an abnormally large amount. Another cause of edema is inadequate lymphatic drainage. Edema caused by lymphatic obstruction is called *lymphedema* (Barrett, 2010).

Secondary lymphedema after breast surgery

Secondary lymphedema is one of the most common problems after breast surgery in breast cancer treatment (Lacomba et al., 2010). It is a major concern for physiotherapists and for the whole team involved in the treatment of breast cancer patients.

Acquired interruption or damage to the axillary lymphatic system after surgery or radiotherapy for breast cancer can lead to regional or generalized accumulation of lymph fluid in the interstitial space, known as secondary lymphedema. This condition is the most important chronic complication after dissection of the axillary lymph nodes and if untreated, it has a tendency to progress. Secondary lymphedema can cause disfigurement, physical discomfort, and functional impairment. The condition may also precipitate cellulite, erysipelas, lymphangitis, and occasionally lymphangiosarcoma (Lacomba et al., 2010).

There are several possible risk factors identified for breast edema: an increased irradiated breast volume, an increased boost volume, an increased breast separation, a higher density of the breast tissue, a large tumor, a higher specimen weight, postoperative infection, acute postoperative toxicity, and diabetes mellitus (Verbelen et al., 2014). After axillary lymph node dissection, the incidence of secondary lymphedema is about 23-38% if the criterion used to identify it has a greater than 2 cm increase in upper arm circumference measured at two adjacent points compared with the circumferences in the other arm (Lacomba et al., 2010).

Most women (71%) develop secondary lymphedema within 12 months after breast surgery for cancer (Tambour, 2014).

Problems associated with lymphedema include: pain, altered sensations such as discomfort and heaviness, difficulties with physical mobility, physiological distress, recurrent infections and social isolation. Lymphedema has been shown to significantly negatively affect the quality of life, and it is a traumatic condition because in addition to inconveniences and functional impairment that starts at the arm level, the aesthetic factor plays a determinant role in the loss of self-esteem, which causes psychological sequelae in many patients (Martin et al., 2011).

Prevention and treatment

Preventing lymphedema implies correct information of the patient about this complication, risk factors, and the role of physiotherapy, consisting of a regular exercise program and manual lymphatic drainage in preventing lymphedema. A supervised and personalized program of exercises is safe, has no risks and may improve physical functions (Anderson et al., 2012). Also, a structured program of exercises is recommended, because it has a grater potential of improving the range of motion than an unstructured program, containing only general directions.

A containment elastic orthosis and manual lymphatic drainage significantly improve the quality of life by decreasing the volume of extracellular water, the volume of the limb on the mastectomized side, and by improving the upper limb's function (Castro-Sanchez et al., 2011).

Lymphedema following breast cancer treatment remains a long-term disabling complication which cannot be treated in a decisive and radical manner. The objective of the treatment is to limit complications, to try to preserve the remaining lymphatic system and to develop new anastomosis (Marcos et al., 2012).

Lymphedema treatment remains a problem even with modern treatment modalities, since there are no clear therapeutic protocols. Several methods have been used with varying results. Among them, the physical treatment introduced by Winiwarter (1892), improved by Vodder (1932-1960) and later termed Complex Physical Therapy (CPT) by Foldie has been recommended by several groups of experts (Martin et al., 2011).

No cure for lymphedema currently exists, and incidence rates in breast cancer patients post treatment remain high. While Complete Decongestive Physiotherapy is currently recognized as the gold standard treatment for lymphedema after breast cancer treatment, its efficacy as a means of preventing the development and/or progression of lymphedema following treatment has yet to be firmly established. Current literature has identified Complex Decongestive Physiotherapy (CDP) as a possible effective prevention mechanism against the development of lymphedema in breast cancer patients if implemented immediately after surgery, instead of being implemented post-diagnosis of lymphedema (Ecclestone et al., 2014).

Complete decongestive physiotherapy

Complex Physical Therapy, also called Complex Decongestive Physiotherapy, is a treatment regimen that

includes exercises, meticulous skin hygiene, manual lymph drainage, bandaging and supportive garments. This therapy is carried out in two phases; in the first phase (treatment), the aim is to mobilize the accumulated lymph, reduce the fibrous tissue and improve the health of the skin using mainly daily Manual Lymph Drainage (MLD) during a variable period of time. In addition, patients receive instructions regarding skin care, prophylactic measures and the use of multilayer bandages. In the second phase (maintenance), compression bandaging, regular physical exercise and weight control are used (Martin et al., 2011).

Exercise program

An exercise program is very important in recovery after breast surgery and in preventing or treating lymphedema. Physical activity increases the lymph volume which is drained from the thoracic duct into the venous system from 2 liters/24 h to over 3 liters/24 h. Accelerating lymphatic circulation prevents lymph stasis and lymphedema.

The introduction of aerobic training caused a slowdown in negative changes in bones, and body fat was reduced in patients with hormone therapy. The introduction of resistance therapy reverses an adverse tendency for bone strength and sarcopenia. Mixed type physical activity (aerobic training and resistance training) during breast cancer associated with endocrine therapy can prevent negative changes of hormone therapy in the body build in premenopausal women (Hojan et al., 2013).

Most common symptoms after radiotherapy or chemotherapy are: tissue fibrosis, muscle mass loss, fatigue and poorer physical health. Exercise and physical activity can improve many of the symptoms and health problems experienced by breast cancer survivors (Basen-Engquist et al., 2008).

Increased energy expenditure was associated with better physical functioning and general health, less pain and depression. High energy expenditure is significantly related to an optimal general health, lack of depression, good physical functioning and less pain (Basen-Engquist et al., 2008).

Regarding physical activity frequency, as the frequency of activity increases, physical functioning improves, the pain is less, and general health is improved. Depression scores decreased as the frequency of physical activity increased (Basen-Engquist et al., 2008).

Physical activity duration has also an importance in improving physical functioning, general health and reducing pain. Most of the physiotherapists prescribe moderate to vigorous exercise 3 to 5 days per week, with sessions lasting 20 to 30 min.

It is recommended to initiate the physiotherapy program immediately after breast surgery, in the first postoperative 24-48 h, to prevent muscle contracture and tightening of the arm muscles, chest and upper back muscles (Dell, 2001).

Early recommendations emphasized vigorous exercise for at least 20 min. Current recommendations also endorse moderate activity done for at least 30 min on most days of the week, allowing people to accumulate this activity in short bouts throughout the day. The latter regimen decreases the risk of cardiovascular disease and mortality (Basen-Engquist et al., 2008). Many studies conclude that 90-120 minutes/week of moderate exercises are much more effective than a high-dose exercise program (Carayol, 2013).

A complete program of exercise contains specific exercises for the shoulder (Seung et al., 2010): flexions, extensions, rotations, abductions, adductions; it is recommended to perform the exercises alternatively with both upper limbs, then simultaneously to regain or improve the upper limb, anterior and posterior thorax muscle strength. This way, a correct posture is regained or improved.

Meanwhile, it is recommended to perform general aerobic exercises that involve the entire body (Cho et al., 2012), exercises inspired from the Pilates program, stretching elements inspired from Yoga, walking, hiking, gymnastics, folk dance, chi kung, tai chi. When planning patient education after breast cancer surgery, healthcare professionals should consider not only the role of exercise in breast cancer recovery, but also the new trends in exercise behavior among breast cancer survivors (Hsu et al., 2012).

Aquatic exercise in chest-high pools obtains a good adherence (almost 90%) to the physiotherapy program in breast cancer patients with hormone therapy induced arthralgia. Participants experience a decrease in pressure pain threshold in the neck, hand, shoulder and leg measured by algometry, as well as in waist circumference (Cantarero-Villanueva et al., 2013), increased muscle strength, an improved range of motion of the shoulder (especially flexion), improved exercise resistance, improved blood flow and muscle relaxation (Bordinic & Irsay, 2014). The initial exercise program can be replaced by hydrotherapy only when wound healing has occurred and the drain tubes have been removed.

The physiotherapy recovery program should establish progressive doses of exercise and encourage performing the exercises until full range of motion is restored. Exercise should be performed only to the point of discomfort, not pain (Dell, 2010).

Lifting heavier objects than 5 pounds (2.3 kg) is contraindicated (Dell, 2010). Thermotherapy, sauna (Bordinic & Irsay, 2014) are also contraindicated, because heat causes vasodilatation, low lymphatic pressure, determining lymphatic stasis and, implicitly, lymphedema.

There was no evidence of increased risk of lymphedema from exercise at any time point (McNeely et al., 2011). Yet, overstrain and over-workout should be avoided.

Conclusions

1. An exercise program is very important in recovery after breast surgery and in preventing or treating lymphedema. It is recommended to initiate the physiotherapy program immediately after breast surgery. Current recommendations endorse moderate activity performed for at least 30 min on most days of the week, allowing people to accumulate this activity in short bouts throughout the day. A complete program of exercise contains specific exercises for the shoulder and general aerobic exercises that involve the entire body.

2. The physiotherapy recovery program should establish progressive doses of exercise and encourage

performing the exercises until full range of motion is restored. Exercise should be performed only to the point of discomfort, not pain. There is no evidence of increased risk of lymphedema from exercise at any time point. Yet, overstrain and over-workout should be avoided.

Conflicts of interest

This paper uses partial results from the ongoing thesis of the first author. There are no conflicts of interest to declare.

References

Anderson RT, Kimmick GG, McCoy TP, Hopkins J, Levine E, Miller G, Ribisl P, Mihalko SL. A randomized trial of exercise on well-being and function following breast cancer surgery: the RESTORE trial. J Cancer Surviv, 2012;6(2):172-181. doi: 10.1007/s11764-011-0208-4.

Barrett KE, Barman SM, Boitano S, Brooks HL. Ganong's Rewiew of Medical Physiology 23rd Edition, McGraw Hill Lange, International Edition, 2010, 550

Basen-Engquist K, Hughes D, Perkins H, Shinn E, Taylor CC. Dimensions of physical activity and their relationship to physical and emotional symptoms in breast cancer survivors. J Cancer Surviv, 2008;2(4):253-261. DOI: 10.1007/s11764-008-0067-9.

Bordinc E, Irsay L. Indications and contraindications of physiotherapy in breast cancer patients. Balneo Res J, 2014;5(3):99-107.

Cantarero-Villanueva I, Fernandez-Lao C, Caro-Moran E, Morillas-Ruiz J, Galiano-Castillo N, Diaz-Rodriguez L, Arroyo-Morales M. Aquatic exercise in a chest-high pool for hormone therapy-induced arthralgia in breast cancer survivors: a pragmatic controlled trial, Clin Rehabil, 2013; 27(2):123-132. doi: 10.1177/0269215512448256.

Carayol M, Bernard P, Boiché J, Riou F, Mercier B, Cousson-gélie F, Romain AJ, Delpierre C, Ninot G. Psychological effect of exercise in women with breast cancer receiving adjuvant therapy: What is the optimal dose needed?, Ann Oncol, 2013;24(2):291-300. doi: 10.1093/annonc/mds342.

Castro-Sanchez AM, Moreno-Lorenzo C, Mataran-Penarrocha GA, Aguilar-Ferrandiz ME, Almagro-Cespedes I, Anaya-Ojeda J. Preventing lymphoedema after breast cancer surgery by elastic restraint orthotic and manual lymphatic drainage: a randomized clinical trial. Med Clin., 2011;137(5):204-207. doi: 10.1016/j.medcli.2010.09.020.

Chan DNS, Lui LYY, So WKW. Effectiveness of exercise programmes on shoulder mobility and lymphoedema after axillary lymph node dissection for breast cancer: systematic review: Effectiveness of exercise programmes on shoulder mobility and lymphoedema. J Adv Nurs, 2010;66(9):1902-1914. DOI: 10.1111/j.1365-2648.2010.05374.x.

Comparisons of exercise dose and symptom severity between exercisers and nonexercisers in women during and after cancer treatment. J Pain Symptom Manag, 2012; 43(5):842-854. doi: 10.1016/j.jpainsymman.2011.05.016.

Dell D. Regaining range of motion after breast surgery, Nursing, Lippincott Williams & Wilkins, Inc 2001;31(10):50-52.

Delpech Y, Barranger. Chirurgie du cancer du sein. Rev. Praticien, 2013;63(10):1395-1399.

Ecclestone C, Bedard G, Popovic M, Thavarajah N, Lam H, Verma S, Leahey A, McDonald R, Wong E, Chow EC. Prevention of lymphedema following complete decongestivephysiotherapy in breast cancer patients: A literature review. J Pain Manag, 2014;7(2):107.

Hojan K, Milecki P, Molińska-Glura M, Roszak A, Leszczyński P. Effect of physical activity on bone strength and body composition in breast cancer premenopausal women during endocrine therapy. Eur J Phys Rehab Med, 2013;49(3):331-339.

Hsu HT, Huang CS, Liu Y, Dodd MJ, Juan CH, Lai YH, Guo SE. Exercise behaviors in breast cancer survivors in Taiwan. Cancer Nurs, 2012, 35(6):E48-E56. doi: 10.1097/NCC.0b013e3182479984.

Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D. Global cancer statistics, CA: Cancer J Clin, 2011;61(2):69-90; DOI: 10.3322/caac.20107.

Lacomba MT, Sánchez MJY, Goñi ÁZ, Merino DP, Del Moral OM, Téllez EC, Mogollón EM. Effectiveness of early physiotherapy to prevent lymphoedema after surgery for breast cancer: randomised, single blinded, clinical trial. BMJ (Online), 2010;340(7738):140-148. doi:10.1136/bmj.b5396.

Liao SF, Li SH, Huang HY. The efficacy of complex decongestive physiotherapy (CDP) and predictive factors of response to CDP in lower limb lymphedema (LLL) after pelvic cancer treatment, Gynecol Oncol, 2012;125(3):712-715. doi: 10.1016/j.ygyno.2012.03.017.

Marcos AL, Animar El Gaaied AB, Ayed FB, Hassen SB, Zervoudis S, Navrozoglou I, Pechlivani F, Iatrakis G. Lymphedema of the arm after surgery for breast cancer: New physiotherapy, Clin Exp Obstet Gyn, 2012;39(4):483-488.

Martín ML, Hernández MA, Avendaño C, Rodríguez F, Martínez H. Manual lymphatic drainage therapy in patients with breast cancer related lymphoedema, BMC Cancer, 2011; 11(1):94-100. doi:10.1186/1471-2407-11-94.

McNeely ML, Campbell K, Ospina M, Rowe BH, Dabbs K, Klassen TP, Mackey J, Courneya K. Exercise interventions for upper-limb dysfunction due to breast cancer treatment. Cochrane database of systematic reviews (Online), 2010; 6(6):CDOO5211-CDOO5286. doi: 10.1002/14651858.CD005211.pub2.

Nesvold IL, Dahl AA, Løkkevik E, Marit Mengshoel A, Fosså SD. Arm and shoulder morbidity in breast cancer patients after breast-conserving therapy versus mastectomy. Acta Oncol, 2008; 47(5):835-842. doi:10.1080/02841860801961257.

Păcurar R, Miclăuş C, Miclăuş M. Morbidity associated with breast cancer therapy and the place of physiotherapy in its management. Timişoara Phys Educat Rehab J, 2011;3(6):46-54.

Pocock G, Richards CD. Human Physiology. The Basis of Medicine, Oxford Core Texts, 1999, 309-310.

Seung AL, Kang JY, Yong DK, Ah RA, Kim SW, Kim YS, Lim JY. Effects of a scapula-oriented shoulder exercise programme on upper limb dysfunction in breast cancer survivors: a randomizedcontrolled pilot trial. Clin Rehabil, 2010;24(7):600-613. doi: 10.1177/0269215510362324

Sperry L. Breast Cancer, Depression, Culture, and Marital Conflict, The Family Journal, SAGE Publications, 2010; 18(1):62-65, DOI: 10.1177/1066480709356228.

Stout NL, Binkley JM, Schmitz KH, Andrews K, Hayes SC, Campbell KL, McNeely ML, Soballe PW, Berger AM, Cheville AL, Fabian C, Gerber LH, Harris SR, Johansson K, Pusic AL, Prosnitz RG, Smith RA. A prospective surveillance model for rehabilitation for women with breast cancer. Cancer, 2012; 118(S8):2191-2200. doi: 10.1002/cncr.27476

Tambour M, Tange B, Christensen R. Gram B. Effect of physical therapy on breast cancer related lymphedema: protocol for a multicenter, randomized, single-blind, equivalence trial. BMC CANCER, 2014;14(1):239-245.

Verbelen H, Gebruers N, Beyers T, De Monie AC, Tjalma W. Breast edema in breast cancer patients following breast-conserving surgery and radiotherapy: a systematic review. Breast Cancer Res Tr, 2014;147(3):463-471. doi: 10.1007/s10549-014-3110-8.

Vignes S. Lymphœdèmes secondaires des membres. Presse Med, 2010;39(12):1287-1291. doi: 10.1016/j.lpm.2009.06.023.

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 176–179

Evolution of the men's Olympic basketball tournaments using a geographical perspective

Evoluţia turneelor olimpice de baschet masculin din perspectivă geografică

Vasile Grama [1], Ildiko Manasses [2], Ştefan Maroti [1]
[1] *Faculty of Geography, Tourism and Sports, University of Oradea*
[2] *Faculty of Physical Education and Sports, Babeş-Bolyai Universitaty, Cluj-Napoca*

Abstract

The article refers to the evolution of Men's Olympic Basketball Tournaments, trying to present and analyze these tournaments by associating the information related to the study of basketball with mapping representation.

In the first part, the authors refer to a number of papers approaching the research of sports as a result of the common study of specialists in physical education and sports, and geography. The main events that determined the inclusion of men's basketball in the Olympic Games program are also presented. The gradual evolution of Men's Olympic Basketball Tournaments, the participation of national teams, the medals obtained are presented and analyzed by mapping using different ways of graphical representation.

Keywords: geography, Olympic Games, men's basketball.

Rezumat

Lucrarea se referă la evoluţia turneelor olimpice de baschet masculin, încercând să prezinte şi să analizeze aceste turnee prin asocierea datelor care se referă la datele studiate cu reprezentarea cartografică.

În prima parte, autorii se referă la o seamă de lucrări care abordează cercetarea sportului ca rezultat al studiului comun al specialiştilor din domeniul educaţiei fizice şi sportului şi al geografiei. De asemenea, sunt prezentate principalele evenimente care au condus la includerea baschetului masculin în programul Jocurilor Olimpice. Evoluţia în timp a turneelor olimpice de baschet masculin, participarea echipelor naţionale, medaliile obţinute de către acestea sunt prezentate şi analizate prin asocierea hărţii cu diferite modalităţi de reprezentare grafică.

Cuvinte cheie: geografie, Jocurile Olimpice, baschet masculin.

Introduction

Basketball is a team sports game which, over the one hundred years of its existence, has gained the status of universality, being practiced in almost all countries. In 2013, there were 214 national federations affiliated to the International Basketball Federation (FIBA) (6). The official international competitions of the national teams, the ones reserved for club teams and also, domestic championship matches have a high audience among viewers from all over the world, being broadcast to hundreds of millions of basketball fans. Being one of the sports that enjoy a wide popularity and holding an important place in the national systems of physical education and sports in many countries, basketball is an interesting subject of study for specialists from various fields of science.

As sport has developed over time, it has been studied by its specialists, but also by researchers from other fields of science: psychologists, doctors, sociologists, computer scientists, etc. In Romania, there are also specialists who work and contribute through their activities and results to a better knowledge of sport activity in general, as well as of some sports disciplines (Epuran, 2005). Thus, Romanian sports literature includes a number of studies from the perspective of disciplines such as geography (Mihăilă & Ulmeanu, 1938; Bogdan, 2009; Maroti & Ilieş, 1995; Sandor, 2005), which contributes through its specific means to a better knowledge of various aspects of the sports phenomenon.

By approaching sports from a geographical perspective, we aimed to identify the relationships between the spatial variations of the distribution, structure, dynamics and geographic framework of men's Olympic basketball. In analyzing the data, the association of maps with charts by columns, the frequency polygon, statistical topography, point and symbol combinations, etc. enables the presentation,

Received: 2015, April 4; *Accepted for publication:* 2015, April 21;
Address for correspondence: Oradea University, Faculty of Geography, Tourism and Sport, 1-5 Universităţii Str. 410087, Oradea, Romania
E-mail: marotistefan@yahoo.com
Corresponding author: Ştefan Maroti

analysis and understanding of the studied phenomenon from a different angle compared to the perspective of those who study sports only from the physical education and sports specialist's point of view. We consider that our article is an interesting one, and will be well received and appreciated by those who are interested in this phenomenon.

Pre-Olympic basketball

In Saint Louis, in 1904, less than 14 years after its invention by Dr. James Naismith, basketball featured among demonstrative sports during the Summer Olympics, officially known as the Games of the III Olympiad (Wallechinsky, 1996).

After World War I, when sports faced a great development by an increase in the number of sports practitioners, by the enrichment of the competitive system with the organization of continental and global competitions (Antal, 1974), the issue of extending the number of Olympic sports was increasingly raised. The basketball representatives acted to form a leading international body, able to support the efforts for the recognition of this sport by the International Olympic Committee and its inclusion in the Olympic Games program. In this process, the most important steps were the International Olympic Committee session in Paris in 1924, when basketball became a voluntary sport (***, 1998 c), and the International Olympic Committee session in Berlin in 1930, when the Committee decided that along with polo, water polo, field hockey and handball, basketball was among the team sports games that the Organizing Committee could include in the Olympic Games program (***, 1998a).

The establishment of the International Basketball Federation on 18 June 1932, the renunciation of the tutelary mandate over basketball by the International Handball Federation, and the investment of the International Basketball Federation as the supreme authority of this sport on 28 February 1935 (Ströher, 1998) were other important moments in the pre-Olympic history of basketball.

Although some members of the International Olympic Committee were against the process of including team sports among Olympic disciplines, the agreement between William Jones, the International Basketball Federation General Secretary, and Karl Diem, the President of the Olympic Games Organizing Committee, in Berlin in 1936, was approved by the International Olympic Committee session on 28 February 1935 and thus, basketball was officially included in the Olympic Games program. (Ströher, 1998).

William Jones, Léon Bouffard, Marcel Baril and other leaders of the International Basketball Federation, in collaboration with Olympic organizers, carried out extensive and laborious work during the pre-Olympic period such as: development of general rules, their experimental application during the University International Tournament in Turin, organization of the first European Basketball Championship in 1935 in Geneva, providing technical support for the homologation of the Olimpiastadion Berlin sports facilities, tournament scheduling and basketball coach training.

Men's Olympic Basketball Tournament attendance

Since the early years, the international basketball forum leaders have understood that the strength of such an organization, its prestige and recognition depend on the number of National Federations that compose it. From the earliest years of the International Basketball Federation, its leaders have campaigned to increase the number of affiliated members. In the first four years, the number of affiliated members increased from eight (at the Constitution Congress in Geneva, Switzerland, 1932) to twenty-nine (at the first Olympic basketball tournament, the 1936 Summer Olympics in Berlin) (2). Since then, the number of affiliated federations has consistently increased to 214 today (53 in Africa, 52 in Europe, 44 in America, 44 in Asia and 21 in Australia-Oceania) (4) (Fig. 1).

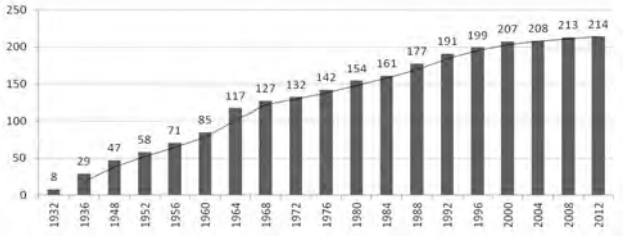


Fig. 1 – International Basketball Federation members 1932-2014 (4).

The number of national teams participating in the Olympic tournaments provides information on the extent of a sport, its popularity and international recognition, the value achieved by this sport discipline over time, etc.

In the evolution of the Men's Olympic Basketball Tournaments, the number of participating teams and the play format have undergone several changes. If in the period 1936-1952 the number of teams was not regulated, between 1952-1972 it was set to sixteen, based on qualification criteria, and starting with Montreal 1976 the number of teams participating in Men's Olympic Basketball Tournaments was reduced to twelve (the host country, the world champion, two teams qualified from the Confederations Championships of Europe and America, respectively - the continents with the most developed basketball and the best results in the Olympics, the geographical regions of Africa, Asia and Australia-Oceania one team each, and the top three teams from qualifying tournaments (***, 1998 b) (Fig. 2).

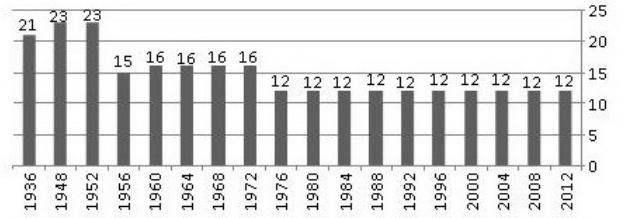


Fig. 2 – Number of participating teams by tournament (5).

An analysis of participation in the Men's Olympic Basketball Tournaments reveals that the eighteen editions of the Olympic Games were attended by fifty-five national teams: USA had seventeen participations, Brazil fourteen participations, Russia (including USSR and CIS) and Australia thirteen participations. In addition, four countries had ten to twelve participations, eight national teams had

Fig. 3 – National team participation in Men's Olympic Basketball Tournaments (5).

seven to nine participations, twelve countries had four to six participations, and twenty-seven countries had one to three participations (5). The teams participating in Olympic Basketball Tournaments and their origin were influenced by the decisions of the International Olympic Committee sessions regarding the number of teams admitted to a tournament and the inclusion of continental championships among the Olympic Qualifying Tournaments, as well as by changes in the world map (***, 2007) (Fig. 3).

Regarding the number of national team participations by continents, the distribution shows that Europe has the largest share, 41.73%, followed by North America, 18.42%, Asia, 13.90%, South America, 13.15%, Australia-Oceania, 7.14%, and Africa, 5.64%.

Europe accounted for the largest proportion of national teams from a continent, 58.33%, at the Olympic Games in Moscow 1980. No team from the geographical area of Australia-Oceania participated in the Olympic Basketball Tournaments in Berlin 1936, London 1948, Helsinki 1952, Rome 1960 and Mexico City 1968. No team from Africa participated in the Olympic Basketball Tournaments in Melbourne 1956, Rome 1960 and Tokyo 1964 (1) (Fig. 4).

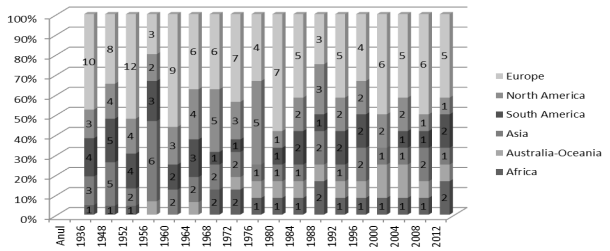


Fig. 4 – Men's Olympic Basketball Tournament attendance by continents (5).

The most important criterion for determining the value of a basketball team participating in the Olympics is the number of medals. In the Men's Olympic Basketball Tournaments, fifty-four medals were awarded to representatives from fourteen countries, accounting for 23.63% of the total number of participants. Of all fifty-four medals awarded, seventeen, 31.48%, were won by the United States. The Olympic medal ranking also includes Russia (USSR and CIS), Serbia (Yugoslavia), Argentina, Spain, France, Italy, Croatia, Canada, Brazil, Lithuania, Uruguay, Cuba and Mexico (3). 50% of the medals were awarded to seven European national teams, 37.07% to four North American national teams, 12.17% to three South American national teams. The geographical areas of Australia-Oceania and Africa won no medals in the Men's Olympic Basketball Tournaments (Fig. 5).

Fig. 5 –Men's Olympic Basketball Tournament medal distribution (3)

Conclusions

1. Basketball is after football, water polo, polo, hockey, rugby and handball the seventh team sports game included in the Olympic Games program.

2. The basketball leaders' joined efforts and personal relationships with the personalities of international sports led to the renunciation of the tutelary mandate over basketball by the International Handball Federation and to the recognition of the International Basketball Federation as the supreme basketball authority. In this way, the International Olympic Committee session in Oslo, on 28 February 1935, decided the official inclusion of basketball in the program of the Olympic Games in Berlin, 1936.

3. The eighteen Men's Olympic Basketball Tournaments were attended by fifty-five national teams. USA had the highest number of participations, seventeen, followed by Brazil, with fourteen participations, and Russia (including USSR and CIS) and Australia, with thirteen participations each.

4. The distribution by continents shows that Europe has the largest share, 41.73%, followed by North America, 18.42%, Asia, 13.90%, South America, 13.15%, Australia-Oceania, 7.14%, and Africa, 5.64%.

5. Of the total number of fifty-four medals awarded, the United States won seventeen, 31.48%. The Olympic medal ranking also includes Russia (USSR and CIS), Serbia (Yugoslavia), Argentina, Spain, France, Italy, Croatia, Canada, Brazil, Lithuania, Uruguay, Cuba and Mexico.

6. An analysis of medal distribution by continents shows that 50% of the medals were awarded to seven European national teams, 37.07% to four North American national teams, and 12.17% to three South American national teams. The geographical areas of Australia-Oceania and Africa won no medals in the Men's Olympic Basketball Tournaments.

Conflicts of interest

Nothing to declare.

References

Antal Z. Kosárlabda. în: Világ és európa-bajnokságok. 1893-1973. Sport Kiadó, Budapest: 1974,7-15.

Bogdan V. Mediul ambient olimpic şi performanţa sportivă. Ed. GMI, Bucureşti, 2009.

Epuran M. Metodologia cercetării activităţilor corporale. Exerciţii fizice, sport, fitness. Ed. FEST, Bucureşti, 2005.

Maroti Ş, Ilieş A. Contribuţii la reprezentarea cartografică a fenomenului sportive. În: Resurse umane ale performanţei sportive, Consiliul Ştiinţei Sportului din România, Bucureşti, 1995.

Mihăilă J, Ulmeanu FC. Raportul dintre performanţă şi mediul geografic, Analele de Educaţie Fizică, Academia Naţională de Educaţie Fizică, Bucureşti, 1938.

Ströher M. Dr.H.C.R. William Jones. 1906-1981, International Basketball Federation, München, 1998, 60

Şandor I. Mediul rural al României şi posibilităţile acestuia pentru performanţa sportivă. Teză de doctorat, Universitatea Babeş-Bolyai, Cluj-Napoca, 2005.

Wallechinsky D. Basketball. În: The Complete Book of the Summer Olympics. Little, Brown and Company, Boston, New York, Toronto, London, 1996,258-273.

***. Date d`admission des sport et des disciplines. In : Les Jeux Olympique de l`epoque modern, Comité International Olympique, Lausanne, 1998a,15.

***. Le programme olimpique. In: Les Jeux Olympique de l`epoque modern, Comité International Olympique, Lausanne, 1998 b:11-14.

***. Olympic Charter. Published by the International Olympic Committee, Lausanne,2007.

***. Sport obligatoires et facultatifs. In: Les Jeux Olympique de l`epoque modern. Comité International Olympique, Lausanne, 1998c,20.

Websites

(1) Basketball at the Summer Olympics, http://en.wikipedia.org/wiki/Basketball_at_the_Summer_Olympics. Accessed on February 21, 2015.

(2) Basketball at the 1936 Summer Olympics. http://en.wikipedia.org/wiki/Basketball_at_the_1936_Summer_Olympics. Accessed on February 21, 2015.

(3) List of Olympic medalists in basketball. http://en.wikipedia.org/wiki/List_of_Olympic_medalists_in_basketball. Accessed on February 22, 2015.

(4) Members of the International Basketball Federation. http://en.wikipedia.org/wiki/Category:National_members_of_the_International_Basketball_Federation, Accessed on February 20, 2015.

(5) Participating nations. http://en.wikipedia.org/wiki/Basketball_at_the_Summer_Olympics#Participating_nations, Accessed on February 22, 2015.

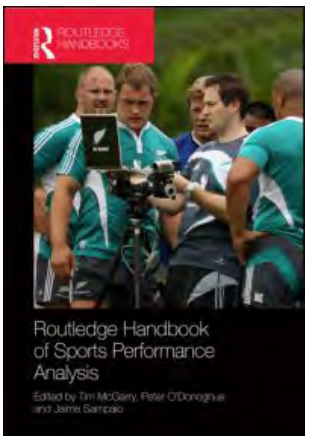
(6) The International Basketball Federation, http://en.wikipedia.org/wiki/FIBA Accessed on February 19, 2015.

Palestrica Mileniului III – Civilizaţie şi Sport
Vol. 16, no. 2, Aprilie-Iunie 2015, 180–182

RECENT PUBLICATIONS
ACTUALITĂŢI EDITORIALE

Book reviews
Recenzii cărţi

Routledge Handbook of Sports Performance Analysis
(Îndreptar de analiză a performanţei în sport, de la Routledge)
Editori: Tim McGarry, Peter O'Donoghue, Jaime Sampaio
Editura: Routledge, martie 2015
494 pagini; Preţ: $67.95 sau 980 lei (eMag)



Nu constituie nici un fel de noutate faptul că, chiar şi într-un domeniu relativ îngust, cum este cel al ştiinţelor sportului, numărul cărţilor ce apar într-o săptămână sau lună, şi cu atât mai mult într-un an, este foarte mare. Ceea ce face din misiunea recenzentului o sarcină evident dificilă şi, până la urmă, una plină de destulă responsabilitate, ţinând cont că, de fapt, alegând să prezinte o carte el ignoră, „trece sub tăcere" multe altele, la fel de valoroase şi aşteptate/căutate de unii dintre cititorii revistei. Prin forţa lucrurilor însă, alegerea, opţiunea de a scrie despre una sau alta dintre ultimele apariţii care ar merita-o, este apanajul subsemnatului, ca responsabil pentru rubrica recenziilor de cărţi străine deşi, sincer – şi ideal, poate – nu ar fi deloc rău ca, măcar din când în când, cititorii noştri să ne sugereze temele pe care şi-ar dori să le trateze cărţile ce urmează a fi recenzate. Se mai întâmplă totuşi ca procesul acesta complicat şi greu de descris, prin care titularul decide cărei lucrări să-i dedice rubrica în numărul viitor al revistei, să nu ţină nici de el însuşi în exclusivitate. Aşa s-au petrecut lucrurile în cazul de faţă când, neavând acces la suficientă informaţie despre volumul „Diabetes and Physical Activity", de la Karger (2014), a trebuit să ne reorientăm şi să ne îndreptăm atenţia către un altul.

Întâmplarea a făcut însă să ajungem la o carte pe care, acum, după ce i-am cunoscut toate plusurile şi foarte puţinele minusuri, o considerăm chiar mai interesantă şi mai binevenită decât cea asupra căreia ne oprisem iniţial. Şi asta în primul rând deoarece lucrarea abordează o problematică asupra căreia nu ne-am mai îndreptat atenţia până acum; este vorba de *analiza performanţei* (AP) *în sport***.** Pe de altă parte pentru că, după cunoştinţa noastră, acest aspect al AP este cvasiignorat, sau tratat rudimentar, de către antrenorii noştri, cu mare probabilitate din cauza faptului că în cadrul cursurilor de formare şi perfecţionare a lor, şi în facultăţile de profil, nu prea se pune accent pe el. La toate aceste argumente adăugându-se şi un amănunt ce ţine strict de biografia „profesională" a subsemnatului; care, perfect întâmplător – bursier Tempus la School of Sport and Exercise Sciences din Liverpool fiind –, a avut şansa ca, în noiembrie 1992, să asiste la lucrările primului „Congres Mondial de Analiză Notaţională (vechiul termen pentru AP) în Sport". Eveniment ce fusese iniţiat şi organizat de echipa binecunoscutului profesor Tom Reilly (conducătorul şi sufletul sus-numitei instituţii de învăţământ, la acea vreme), echipă care, în 1987, iniţiase şi organizase, de asemenea, primul Congres Mondial de Ştiinţă şi Fotbal.

Voluminoasa lucrare, editată de trei specialişti de marcă, este rodul contribuţiei a încă 61 de autori, şi apare în renumita serie *„Routledge International Handbooks"*. Ea este, credem, cel mai complet instrument de iniţiere, informare şi formare în analiza AP sportive, domeniu practic indispensabil azi în sportul de performanţă, întrucât îi ajută pe antrenori şi sportivi să acceadă la cea mai complexă, mai reală şi mai specifică imagine a performanţelor pe care un sportiv, sau o echipă, le etalează în confruntările oficiale; imagine indiscutabil superioară (ca fidelitate şi utilitate) „fotografiilor" obţinute prin evaluarea de către antrenor, prin autoevaluare, prin testările cele mai sofisticate, sau prin experimentele de laborator. Şi asta în condiţiile în care tehnologia actuală permite obţinerea instantanee de date statistice descriptive ale evoluţiei sportivilor/echipelor, iar prin utilizarea sistemelor flexibile de internet, inclusiv accesul la secvenţe video din confruntarea sportivă aflată în curs de desfăşurare.

În absolut însă, tehnica AP sportive le este necesară şi utilă nu doar „actorilor şi regizorilor", adică celor direct implicaţi, ci şi celor care abordează şi asistă la meciuri de pe alte poziţii şi cu alte misiuni. Ne gândim în primul rând la comentatori/ziarişti, dar şi la cei din comisiile de rezolvare a litigiilor şi contestaţiilor sau la cercetători; care, atunci când confruntarea sportivă reală, oficială le devine obiect de studiu, trebuie să identifice, să reţină şi să analizeze date mult mai precise, decât cele pe care

le-ar putea achiziţiona din postura de simpli spectatori. Din fericire cartea de la Routledge răspunde şi nevoilor acestor categorii profesionale, aducând la zi progresele metodologice legate de cercetarea bazată pe AP, evaluând dovezile pe care se fundamentează teoriile contemporane ale performanţei sportive şi trecând în revistă dezvoltările cele mai recente în planul AP aplicate la o gamă largă de sporturi: de la fotbal şi până la atletism. De altfel, aşa cum vom vedea şi din prezentarea structurii sale, cartea acoperă practic fiecare dintre aspectele importante ale domeniului AP, inclusiv cele privitoare la tactica şi strategia sportivă, la chestiunile mecanice ale tehnicii, la componentele fizice ale prestaţiei sportivului, la comportamentul antrenorilor şi arbitrilor etc.

Numărul relativ neobişnuit de mare de capitole - 37 -, ne determină să ne abţinem de la a le menţiona chiar pe toate. Motiv pentru care, îi îndemnăm pe toţi cei ce se vor arăta interesaţi să le cunoască şi pe acelea pe care noi le vom trece cu vederea, să-şi satisfacă îndreptăţita curiozitate accesând link-ul: http://www.taylorandfrancis.com/books/details/9781138908208/.

În debutul secţiunii iniţiale („Aspecte teoretice ale AP în sport"), mai precis în primele două capitole – care se pot lectura gratuit, aici: http://samples.sainsburysebooks.co.uk/9781136658631_sample_819452.pdf - sistemelor diadice şi dinamice din jocurile de echipă se scoate în evidenţă necesitatea (obligativitatea, de fapt) centrării pe sportiv, şi utilitatea AP pentru îmbunătăţirea proceselor de anticipare şi luare a deciziei. După care, în continuare, se glosează pe aspecte ce dau seamă de complexitatea formidabilă a fenomenului foarte special care este confruntarea dintre doi sportivi sau două echipe, complexitate amplificată până la extrem de caracterul său intrinsec dual şi funciarmente dinamic. Astfel, în două capitole, Duarte Araújo (un foarte valoros şi prolific psiholog sportiv european, de la Faculdade de Motricidade Humana din Lisabona), împreună cu alţi doi cercetători, abordează aşa-numitul ciclu „intenţie-percepţie-acţiune" (cap.3), respectiv problema sistemelor diadice şi dinamice din jocurile de echipă (cap.6). Restul capitolelor aplecându-se asupra unor teme plasabile în aceeaşi gamă de preocupări: auto-organizare şi constrângere în performanţa sportivă (cap. 4), competiţia sportivă ca sistem dinamic autoorganizat (5) şi sistemele complexe din jocurile sportive (7).

Următoarele 5 capitole alcătuiesc secţiunea a II-a, intitulată „Metodele, şi evaluarea în AP sportive". Privită în totalitatea sa, această secţiune reprezintă o sinteză asupra întregii game de abordări evaluative în sport, o sinteză - nu se putea altfel - ale cărei capitole par să fie impuse de însăşi existenţa numeroaselor discipline sportive (sporturi); care, în ultima instanţă, nu înseamnă altceva decât modalităţi distincte de întrecere între oameni, cu reguli bine stabilite la un moment dat, dar şi în continuă schimbare-adaptare-perfecţionare. Găsim în această secţiune capitole să le spunem „logice" - cele de la început -, unde autorii epuizează teme „obligatorii", cum ar fi analiza performanţelor tactice în jocurile „invazive", practic în fotbal (cap.8), modul cum trebuie utilizate variabilele colective atunci când se întreprinde AP în jocurile de echipă (cap. 9), sau indicatorii de performanţă în jocuri (cap. 10). Totodată însă, către sfârşitul secţiunii, întâlnim şi capitole mult mai atractive, prin perspectivele mai ingenioase şi mai proaspete pe care le propun. Este în primul rând cazul penultimului capitol (11) al secţiunii, în care Peter O'Donoghue – unul dintre editorii cărţii, preşedinte al International Society of Performance Analy şi editor general al International Journal of Performance Analysis of Sport - tratează aşa-numita „profilare" (stabilirea profilului) a performanţei sportive (sports performance profiling), „metodă ce poate fi utilizată în beneficiul sportivului, de către sportivul însuşi, antrenori, sau părinţi, în scopul facilitării îndeplinirii obiectivelor stabilite" (http://www.asdccr.ca/images/library/022112_E8EqMS23GPjG297_164217.pdf).

Secţiunea a III-a se intitulează „AP sportive în contextele profesionale" şi înglobează 4 capitole, dintre care primele două se ocupă de antrenori; cum este şi firesc, analiza performanţială vizându-i nu doar pe sportivi, ci şi pe antrenorii lor, practic modul lor de comunicare (cap. 13), şi comportamentul (cap. 14). Dar antrenorii/managerii nu sunt doar subiecţi pentru AP ci şi, sau în primul rând, beneficiari ai ei (cap. 15). Pentru aceasta este nevoie ca ei să fie cât mai familiarizaţi cu tehnologia AP şi, desigur, capabili să comprime-convertească imensa cantitate de date pe care ea li le pune la dispoziţie, în acel feedback care le va permite să cunoască atât exprimarea curentă, cât şi potenţialul de exprimare al jucătorilor, luaţi separat şi/sau consideraţi în contextul echipei. Accesul antrenorilor/managerilor la toate aceste avantaje este condiţionat însă de „achiziţionarea"/însuşirea unui model integrat de analiză şi management al performanţei, cum este şi cel propus de autorul capitolului, în încheiere. Despre aplicaţiile media privind AP şi beneficiile pe care continua lor îmbunătăţire şi răspândire le aduce, în planul calităţii şi atractivităţii spectacolului sportiv oferit de televiziuni, ne vorbeşte şi lămureşte autorul ultimului capitol al celei de-a treia secţiuni a cărţii.

Aşa cum o sugerează şi titlul - „Alte aspecte ale AP sportive" - următoarea secţiune, alcătuită din 9 capitole, abordează o mare diversitate de teme şi subiecte ale tehnologiei AP în sport. Astfel, utilitatea şi utilizarea AP în obiectivarea eficienţei tehnice (cap. 19), a tacticii şi strategiei (cap. 20), dar şi a unor variabile situaţionale mai mult sau mai puţin specifice diverselor discipline sportive (cap. 21), reprezintă chestiuni ce ţin de bazele AP, şi nu aveau cum să lipsească dintr-o asemenea lucrare. Ele nu sunt tratate însă doar dintr-o perspectivă „tradiţionalistă", „clasică", ci sunt completate-actualizate cu cele mai recente viziuni, noţiuni şi concepte, în acest scop apelându-se la, şi utilizând instrumente ce-şi au sorgintea în domeniul atât de promiţător şi „la modă", al aşa-numitelor reţele neurale artificiale (self-organizing maps = SOMs). Facem referire aici la cap. 18 (Reţelele neurale în analiza tehnicii sportive) şi 19 (Reţelele neurale aplicate la analiza jocurilor sportive), în care ne sunt prezentate idei şi încercări dintre cele mai îndrăzneţe şi ingenioase, de utilizare a „hărţilor auto-organizate", un tip specific de reţele neurale artificiale, de către specialiştii ce analizează performanţele tehnice ale sportivilor. De o abordare mai particulară, inovativă se bucură şi tactica sportivă. Astfel, în cap. 24, prof. Daniel Memmert – de la Deutsche Sporthochschule, Köln, poate cel mai de seamă

exponent al unui domeniu emergent din ştiinţele sportului (ne referim la creativitatea în sport) - discută modelele şi paradigmele actuale ale creativităţii tactice, circumscriind cadrul teoretic al analizei performanţelor sportivilor, în planul acesteia. Acordând, cum este şi de aşteptat, o atenţie specială comportamentului creativ tactic al practicanţilor sporturilor de echipă, el subliniază şi implicaţiile unor factori precum atenţia şi motivaţia, şi scoate în evidenţă plusurile şi minusurile diferitelor modalităţi de „cuantificare" a respectivului comportament.

Secţiunea de încheiere - „Analiza performanţelor sportive, aplicată" - conţine nu mai puţin de 12 capitole, fiecare dintre ele ocupându-se de un anumit sport, sau de o grupă de sporturi. Celor mai populare discipline sportive, ca număr de practicanţi şi/sau spectatori/telespectatori - bineînţeles din perspectivă anglo-saxonă (vezi cricket-ul !) - le sunt alocate capitole speciale: fotbal (cap. 26), rugby (27), baschet (28), volei în sală şi pe plajă (29), handbal (30), cricket (31). Urmează grupe de sporturi: sporturile cu racheta (32), cele de contact (33) şi de ochire a unei ţinte (34), o grupă de discipline în care intră înotul, alergările, ciclismul şi triatlonul (35), şi atletismul (36). Ultimul capitol fiind dedicat aşa-numitelor sporturi tehnice şi de compoziţie, exemplificate prin gimnastica ritmică.

Având un conţinut atât de specializat şi exhaustiv, şi beneficiind de o multitudine de atu-uri, din care noi am scos în evidenţă doar câteva, putem spune fără nici un fel de ezitare că această foarte recentă apariţie de la Routledge se constituie într-o carte esenţială, „de căpătâi", pentru orice student, cercetător sau profesionist-practician al domeniului AP şi, desigur, pentru orice antrenor/manager care activează deja, sau care îşi propune să activeze în sportul de performanţă.

Gheorghe Dumitru
gdumitru@seanet.ro

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 183−187

SCIENTIFIC MEETINGS
MANIFESTĂRI ŞTIINŢIFICE

The 3rd National Conference of Medicine Applied to Physical Education and Sports, a successful edition

A treia Conferinţă Naţională de Medicină Aplicată la Educaţia Fizică şi Sport, ediţie de succes

Cluj city, through the Romanian Medical Society of Physical Education and Sport, was again host to the National Conference of Medicine Applied to Physical Education and Sport, held under the auspices of the "Iuliu Haţieganu" University of Medicine and Pharmacy. This third edition was organized under special conditions at Grand Hotel Napoca, in the beautiful and comfortable Vienna and Athens conference rooms.

This meeting was the occasion for doctors, trainers, physical education teachers, psychologists, sociologists and other specialists to present scientific papers related to the topic of the conference, which were grouped in six sections, like in the previous edition, and eight workshops.

At the opening ceremony, hosted by the Athens room, on behalf of the organizers, Prof. Dr. Traian Bocu gave the floor to Prof. Dr. Valentin Cernea, Pro-Rector of the "Iuliu Haţieganu" UMPh, who transmitted the message of the university and declared the Conference proceedings open.

In the Athens room, in Section I, *School and university physical education and sport, School and university medicine, Social pediatrics*, moderated by Assist. Prof. Dr. Tudor Pop and Assist. Prof. Dr. Maria Aluaş, the paper *Importance of the temporal factor in the detection and correction of physical deficiencies in children and adolescents* by Adriana Silvia Surd and Emilia Florina Grosu gained particular notice. In the same section, the paper *Role of motion games in the child's physical and mental development* by Professor Kecskes Izabella Margareta, from Sărmaş, Sălaj county, the only paper presented by a representative of pre-university education in this conference, deserves special attention.

After the coffee break, Assoc. Prof. Dr. Gheorghe Dumitru and Assoc. Prof. Dr. Adriana Albu moderated Section II, *High performance sport, Sports medicine, Sports cardiology, Post-exercise recovery, Selection in sport*. As usual, the first moderator captured the audience and incited special comments. A special lecture was that of Prof. Dr. Dumitru Zdrenghea on the *Physiology of exercise in athletes*, and the paper *Cardiac screening guidelines in female athletes* by Prof. Dr. Dana Pop also gained particular attention.

In parallel, the Foyer and the Vienna room hosted three workshops: *Strategies for the prevention of adolescent obesity*, which highlighted the work of the research team including Assist. Prof. Dr. Rodica Cornean, Assoc. Prof. Dr. Mira Florea, Dr. Daniela Rajka, Prof. gr. I Drd. Cristian Potora, Assist. Prof. Dr. Lucia Lotrean, Instructor Dr. Bianca Simionescu, Instructor Dr. Carmen Culciţchi; *Occupational stress. Therapy and prevention* – organized by Prof. Dr. Doina Cosman, with the participation of Principal psychiatrist Dr. Voichiţa Dumitru and Dr. Călin Dumitru; and *Current issues in sports medicine* - organizer Assoc. Prof. Dr. Vasile Negrean and the team of doctors of the Medical Clinic IV: Instructor Dr. Teodora Alexescu, Assist. Prof. Dr. Olga Hilda Oraşan, Drd. Maria-Victoria Ruţa, Instructor Dr. Lorena Ciumărnean, Instructor Dr. Codruţa Claudia Lencu, Assist. Prof. Dr. Ioana Para, Assist. Prof. Dr. Angela Cozma.

The second day of the Conference started with section III and workshops.

In Section III, *Physical activities, Sport for all, Physiology of physical exercise, Stress*, held in the Athens room and moderated by Prof. Dr. Dana Bădău and Assoc. Prof. Dr. Mihai Cucu, the paper *Characteristics of somesthetic evoked potentials in high performance athletes* by Denisa Enescu Bieru, Mihai Dragomir, Mihnea Marin, Ligia Rusu stood out.

Section IV, *Risks in sports activity, Treatments*, moderated by Assoc. Prof. Dr. Ioan Onac, Assist. Prof. Dr. Rodica Ungur, Prof. Dr. Ghoerghe Tomoaia, approached issues of sports traumatology, evaluation of muscle tone, rehabilitation problems. The moderators highlighted the paper *Laparoscopic approach to acute appendicitis in high performance athletes* by Adrian Cotîrleţ, Laura Gavrilă, Eduard Popa, Raluca Cosa.

The proceedings of Section V held in the afternoon, *Rehabilitation and kinesiotherapy, Psychosomatic medicine*, moderated by Prof. Dr. Emilia Grosu and Prof. Dr. Sorin Riga, were conducted in a particularly pleasant and exigent atmosphere. The authors Ramona and Ioana Jurcău distinguished themselves by an attractive presentation for the audience of the paper *The relation between ballet, stress and lesion in PubMed publications*.

The plenary proceedings were concluded by Section VI, *Quality of life, Nutrition and hygiene, Psychology of physical activities, Psychology of sport, Public health – mental health*, whose moderators were Prof. Dr. Dan Riga, Assoc. Prof. Dr. Valeria Laza and Assoc. Prof. Dr. Cristian Bârsu. As expected, the twins Dan and Sorin Riga (sons of the distinguished Prof. Dr. Ilie Th. Riga) represented each other, and their paper *Social determinants of health-longevity in terms of prophylaxis, therapy and medical rehabilitation, work, mental reconstruction and physical activity* was highly praised and extensively commented by the audience.

The Vienna room hosted two workshops in the morning, starting at 9 am: *Physical exercise in osteoporosis*, organized by Assoc. Prof. Dr. Ioan Onac and Assist. Prof. Dr. Rodica Ungur, with the participation of Assist. Prof. Dr. László Irsay, Assist. Prof. Dr. Viorela Ciortea, Assist. Prof. Dr. Monica Ileana Borda; and *Nutrition - Medicine of the future,* organized by Prof. Dr. Doina Miere and Assoc. Prof. Dr. Lorena Filip, with the participation of Instructor Dr. Laura Gavrilaş. In the afternoon, the workshop *Science in the service of football: a multidisciplinary perspective* was held, which was organized by Assoc. Prof. Dr. Gheorghe Dumitru, with the participation of Assoc. Prof. Dr. Dan Monea, Assist. Prof. Dr. Marius Crăciun and Instructor Dr. Minodora Manea; the presentations by Assist. Prof. Dr. Marius Crăciun, *Positive training, motivation and exercise*, and by Instructor Dr. Minodora Manea, *Depression or addiction in sports training – a case study*, won high praise.

On Saturday 27 May, at the "Iuliu Haţieganu" University of Medicine and Pharmacy sports facility, two workshops stood out. The first, *Ballroom dance for the promotion and maintenance of health*, consisted of interactive presentations by Assoc. Prof. Dr. Mihai Kiss and Prof. Dr. Viorel Năstase, with the participation of cheerleaders and the interested public. The second workshop consisted of a football championship of the Cluj clinics, organized by Instructor Drd. Sergiu David and Prof. Sandu Negrean. These events were followed by a barbecue.

The active presence in all conference proceedings of the teaching staff of Mureş and Harghita counties should be mentioned (Prof. Mihály Anna-Mária - Odorheiu Secuiesc, Prof. László Rebekka Orsolya - Gurghiu, Prof. Nagy Elemér - Odorheiu Secuiesc and Prof. Kovacs Annamária - Tg. Mureş).

In addition to the special quality of the presented materials, this third edition of the Conference was remarkable by the fact that more than 60 papers were presented, which were highly appreciated by the many participants, so this was a very successful meeting.

* * *

Din nou Clujul, prin Societatea Medicală Română de Educaţie Fizică şi Sport, sub egida Universităţii de Medicină şi Farmacie "Iuliu Haţieganu" a găzduit Conferinţa Naţională de Medicină Aplicată la Educaţia Fizică şi Sport. Această a treia ediţie a fost organizată în condiţii deosebite la Grand Hotel Napoca, în frumoasele şi confortabilele săli de conferinţe Viena şi Atena.

Această manifestare a dat ocazia medicilor, antrenorilor, profesorilor de educaţie fizică, psihologilor, sociologilor şi altor specialişti să prezinte lucrări ştiinţifice legate de tema conferinţei, lucrările fiind structurate în şase secţiuni, ca şi la sesiunea precedentă şi opt workschopuri.

La festivitatea de deschidere, găzduită de sala Atena, din partea organizatorilor, Prof. Dr. Traian Bocu a dat cuvântul D-lui Prof. Dr. Valentin Cernea, prorectorul UMF "Iuliu Haţieganu", care a transmis mesajul universităţii şi a declarat deschise lucrările Conferinţei.

În sala Atena, la Secţiunea I, *Educaţie fizică şi sport şcolar şi universitar, Medicină şcolară şi universitară, Pediatrie socială*, moderată de Şef. Lucr. Dr. Tudor Pop şi Şef. Lucr. Maria Aluaş s-a remarcat lucrarea *Importanţa factorului temporal în depistarea şi corectarea deficienţelor fizice la copii şi adolescenţi,* realizată de Adriana Silvia Surd şi Emilia Florina Grosu. Tot la această secţiune s-a evidenţiat lucrarea *Rolul jocului de mişcare în dezvoltarea fizică şi psihică a copilului,* autoare fiind profesoara Kecskes Izabella Margareta, din Sărmaş judeţul Sălaj, singura reprezentantă a învăţământului preuniversitar, care s-a prezentat cu o lucrare la această conferinţă.

După pauza de cafea, Conf. Univ. Dr. Gheorghe Dumitru şi Conf. Dr. Adriana Albu au moderat Secţiunea a II-a, *Sport de performanţă, Medicină sportivă, Cardiologie sportivă, Refacerea după efort, Selecţia în sport*, la care aşa cum ne-a obişnuit primul moderator a captat sala şi a provocat comentarii deosebite. O prelegere specială a fost cea a Prof. Dr. Dumitru Zdrenghea *Fiziologia efortului la sportivi,* remarcată fiind şi lucrarea *Ghiduri de screening cardiac la sportive* de Prof. Dr. Dana Pop.

În paralel, în Foyer şi în sala Viena s-au desfăşurat trei workshopuri: *Strategii de prevenţie a obezităţii adolescentului*, organizat de Şef. Lucr. Dr. Rodica Cornean şi Conf. Dr. Mira Florea, cu participarea Dr. Daniela Rajka, Prof. gr. I Drd. Cristian Potora, Şef. Lucr. Dr. Lucia Lotrean, Asist. Dr. Bianca Simionescu, Asist. Dr. Carmen Culciţchi, *Stresul Ocupaţional. Terapie şi prevenţie* - organizat de Prof. Dr. Doina Cosman, cu participarea Psih. Principal Dr. Voichiţa Dumitru şi Dr. Călin Dumitru şi *Actualităţi în medicina sportivă* - organizator Conf. Dr. Vasile Negrean şi colectivul de medici de la Clinica Medicală IV: Asist. Dr. Teodora Alexescu, Şef Lucr. Dr. Olga Hilda Oraşan, Drd. Maria-Victoria Ruţa, Asist. Dr. Lorena Ciumărnean, Asist. Dr. Codruţa Claudia Lencu, Şef Lucr. Dr. Ioana Para, Şef Lucr. Dr. Angela Cozma.

Ziua a doua a conferinţei a debutat cu secţiunea a III-a şi workshopuri.

La Secţiunea a III-a, *Activităţi fizice, Sport pentru toţi, Fiziologia efortului fizic, Stresul,* desfăşurată în sala Atena şi moderată de Prof. Dr. Dana Bădău şi Conf. Dr. Mihai Cucu, a ieşit în evidenţă lucrarea *Caracteristicile potenţialelor evocate somestezice la sportivii de*

performanţă, de Denisa Enescu Bieru, Mihai Dragomir, Mihnea Marin, Ligia Rusu.

A urmat Secţiunea a IV-a, *Riscuri în activitatea sportivă, Tratamente*, moderată de Conf. Dr. Ioan Onac, Şef Lucrări Dr. Rodica Ungur, Prof. Dr. Gheorghe Tomoaia, în cadrul căreia au fost abordate probleme de traumatologie sportivă, evaluarea tonusului muscular, probleme de recuperare, a fost remarcată de către moderatori lucrarea *Abordul laparoscopic al apendicitei acute la sportivii de performanţă,* aceasta fiind realizată de către Adrian Cotîrleţ, Laura Gavrilă, Eduard Popa, Raluca Cosa.

Secţiunea a V-a de după masă, *Recuperare şi kinetoterapie, Medicină psihosomatică*, moderată de Prof. Dr. Emilia Grosu şi Prof. Dr. Sorin Riga s-a desfăşurat într-o atmosferă deosebit de plăcută şi exigentă. Autoarele Ramona şi Ioana Jurcău s-au distins printr-o prezentare atrăgătoare pentru auditoriu a lucrării *Relaţia balet - stres - leziune în publicaţiile site-ului PubMed.*

Lucrările în plen au fost încheiate de Secţiunea a VI-a *Calitatea vieţii, Nutriţie şi igienă, Psihoologia activităţilor fizice, Psihologia sportului, Sănătate publică - Sănătate mintală,* ai cărei moderatori au fost Prof. Dr. Dan Riga, Conf. Dr. Valeria Laza şi Conf. Dr. Cristian Bârsu. După cum ne-au obişnuit profesorii Dan şi Sorin Riga (fiii distinsului Prof. Dr. Ilie Th. Riga), s-au reprezentat reciproc şi de data aceasta lucrarea domniilor lor *Determinanţi sociali ai sănătăţii-longevităţii, ca profilaxie, terapeutică şi recuperare medicală, munca, reconstrucţia psihică şi activitatea fizică,* a fost apreciată laudativ şi comentată amplu de către auditoriu.

În sala Viena s-au desfăşurat două Workshopuri înainte de masă începând de la ora 9,00: *Exerciţiul fizic în osteoporoză*, organizat de Conf. Dr. Ioan Onac şi Şef Lucr. Dr. Rodica Ungur, cu participarea Şef Lucr. Dr. László Irsay, Şef Lucr. Dr. Viorela Ciortea, Şef Lucr. Dr. Monica Ileana Borda şi *Nutriţia - Medicina viitorului* organizat de Prof. Dr, Doina Miere şi Conf. Dr. Lorena Filip, cu participarea Asist. Dr. Laura Gavrilaş. După masă a avut loc Workshopul *Ştiinţa în slujba fotbalului: o perspectivă multidisciplinară*, organizat de Conf. Dr. Gheorghe Dumitru, cu participarea Conf. Dr. Dan Monea, Lector Dr. Marius Crăciun şi Asist. Dr. Minodora Manea, în cadrul căruia s-au distins prezentările făcute de Marius Crăciun, *Antrenamentul pozitiv, motivaţie şi mişcare,* precum şi Minodora Manea, *Depresie sau aducţie în antrenamentul sportiv - studiu de caz*.

Sâmbătă 27 mai, la baza sportivă a Universităţii de Medicină şi Farmacie ”Iuliu Haţieganu” două workshopuri au atras atenţia. Primul *Dansul de societate în promovarea şi menţinerea stării de sănătate,* a constat în prezentări interactive ale autorilor Conf. Dr. Mihai Kiss şi Prof. Dr. Viorel Năstase, la care au participat majorete şi auditoriul interesat. Al doilea wokshop a constat în desfăşurarea Campionatului de fotbal între clinicile din Cluj, organizat de Asist. Drd. Sergiu David şi Prof. Sandu Negrean. Aceste acţiuni au fost urmate de bargeque.

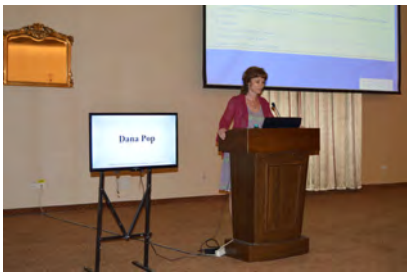
De remarcat prezenţa activă la toate lucrările conferinţei a cadrelor didactice din judeţele Mureş şi Harghita: Prof. Mihály Anna-Mária - Odorheiu Secuiesc, Prof. László Rebekka Orsolya - Gurghiu, Prof. Nagy Elemér - Odorheiu Secuiesc şi Prof. Kovacs Annamária - Tg. Mureş.

În afară de calitatea deosebită a materialelor prezentate, la această a treia ediţie a conferinţei s-a constatat şi faptul că au fost prezentate peste şaizeci de lucrări, a căror apreciere a fost făcută de numeroşii participanţi din ţară (Bucureşti, Constanţa, Craiova, Tg. Mureş) şi din Republica Moldova.

Mihai Cucu
cumihai2001@yahoo.com

Image of the opening ceremony.

Physiology of exercise in athletes - Prof. Dr. Dumitru Zdrenghea



Cardiac screening guidelines in female athletes - Prof. Dr. Dana Pop

Physical exercise in osteoporosis - Assoc. Prof. Dr. Ioan Onac

Physical exercise and bone health - Assist. Prof. Dr. Rodica Ungur

Nutrition – medicine of the future - Instructor Dr. Laura Gavrilaş

"Gheorghe Moceanu" Symposium, 20th June 2015 (7)
Simpozionul „ Gheorghe Moceanu", 20 iunie 2015 (7)

The 7th edition of the *Gheorghe Moceanu* Symposium was organized under the new auspices of the Mayor's Office of Iclod (Cluj county), a commune to which the Orman village, where Gheorghe Moceanu was born, belongs. This time, the Cluj County School Inspectorate, in a more extensive collaboration than in previous years with the Cluj County Authority for Sport and Youth, the Faculty of Physical Education and Sport of the Babeş-Bolyai University and the Romanian Medical Society of Physical Education and Sport, with the participation of the Palestrica of the Third Millennium journal, organized the symposium in direct cooperation with the Iclod Mayor's Office. Thus, the Symposium was held in the Community Center Hall, which is adequately equipped for such events.

The Symposium gathered the members of the Methodical Circles of physical education teachers from all over the county (Cluj-Napoca, Dej, Turda, Câmpia Turzii, Gherla, Huedin).

The following special guests were present: Prof. Gr. I. Ioan Mureşan, former director of the Liviu Rebreanu School and former chairman of the Methodical Circle of physical education teachers in Cluj county, Prof. Octavian Vidu, former inspector of the Cluj County Authority for Sport and Youth, and Prof. Dr. Traian Bocu, editor-in-chief of the Palestrica of the Third Millennium – Civilization and Sport journal.

The Symposium was opened by the school inspector for physical education and sport, Prof. Drd. Cristian Potora, who gave the floor to the personalities of the presidium: the mayor of the Iclod commune, Ioan Emil Pârţoc, the school general vice-inspector, Török Zoltan, the school inspector for special education, Crina Laura Ionescu, and the Pro-Dean of the Faculty of Physical Education and Sport of UBB Cluj-Napoca, Assoc. Prof. Dr. Leon Gomboş.

The following selected papers were presented in the plenary session:

- Angelo Ionel Alexa, "Ana Ipătescu" Theoretical High School, Gherla. Development of the *speed* motor skill in children with SEN through dynamic games.
- Claudiu Conţiu, "Poiana" Vocational School, Turda. Project-based learning. The "Swimming lesson" swimming competition.
- Cornel Roş, Technical College, Turda, and Onela Şanta, "Onisifor Ghibu" Theoretical High School, Cluj-Napoca. Improvement of the *speed* motor skill in middle school children through motion games.
- Robert VIăduţu, Cluj-Napoca. Steroids, the poison behind the body of a god.
- Daniel Gall, "Someş" Technological High School, Dej. Study on the improvement of actions of attack in the football game at junior high school level.
- Mihaela Tamas, "Bobâlna" Middle School. Methodology for the use of motion games in the acquisition of technical football elements for the 5th and 6th grades.
- Gabriel Mocean, Middle School of Viişoara. Methodical approach to the acquisition of technique in the football game in primary school.
- Maria Baias, "Transilvania" Special Middle School, Baciu. Respiratory gymnastics by swimming in children with psychoneuromotor deficiencies.
- Flaviu Panfilie, "Teodor Murăşanu" Middle School, Turda. Motivation and satisfaction of middle school teaching staff.
- Cristian Potora, Cluj County School Inspectorate. Physical exercise capacity in junior handball players.
- Crina Laura Ionescu, Cluj County School Inspectorate. Empathy in the teacher-pupil relation and its role in improving education.
- Sorina Marilia Pop, "George Coşbuc" National College, Cluj-Napoca. The effective teacher.
- Armand Dimitriu, "Alexandru Papiu lIarian" Theoretical High School, Dej. Relationship between attack and defense in the junior volleyball game.

Finally, some positive appreciations were made by the participating personalities. The symposium was followed by wrestling demonstrations in the new sports hall of the Iclod Middle School, with the support of DJST Cluj and of the Cluj County Wrestling Association.

* * *

Cea de a şaptea ediţie a Simpozionului *Gheorghe Moceanu* a fost organizată sub noi auspicii, cele ale Primăriei din Comuna Iclod judeţul Cluj, în arondarea căreia se află localitatea (satul) Orman, locul unde s-a născut Gheorghe Moceanu. De data aceasta, Inspectoratul Şcolar Judeţean Cluj într-o colaborare mai largă decât în anii precedenţi cu Direcţia pentru Sport şi Tineret a Judeţului Cluj, Facultatea de educaţie fizică şi sport din cadrul Universităţii Babeş-Bolyai şi Societatea Medicală Română de Educaţie Fizică şi Sport, prin implicarea revistei Palestrica Mileniului III, a reuşit organizarea simpozionului în cooperare directă cu Primăria Iclod. Astfel, Simpozionul s-a desfăşurat în sala căminului cultural, dotată cu toată infrastructura necesară unor astfel de manifestări.

Simpozionul a reunit membrii Cercurilor metodice ale profesorilor de educaţie fizică din întreg judeţul Cluj (Cluj-

Napoca, Dej, Turda, Câmpia Turzii, Gherla, Huedin).

Ca invitaţi speciali au fost: Prof. Gr. I Ioan Mureşan, fostul director al Şcolii Liviu Rebreanu şi fost şef al Cercului metodic al profesorilor de educaţie fizică din judeţul Cluj, Prof. Octavian Vidu, fost Inspector la Direcţia Judeţeană pentru Sport şi Tineret Cluj şi Prof. Dr. Traian Bocu, Redactor şef al revistei Palestrica Mileniului III-Civilizaţie şi sport.

Deschiderea Simpozionului a fost făcută de inspectorul şcolar pentru educaţie fizică şi sport Prof. Drd. Cristian Potora care a dat cuvântul personalităţilor care au făcut parte din prezidiu: Primarul comunei Iclod Ioan Emil Pârţoc, inspectorul şcolar general adjunct Török Zoltan, inspectorul şcolar pentru învăţământul special Crina Laura Ionescu şi Prodecanul Facultăţii de Educaţie Fizică şi Sport din cadrul UBB Cluj-Napoca, Conf. Dr. Leon Gomboş.

Au fost susţinute lucrările selectate pentru a fi prezentate în plen. Acestea au fost următoarele:

- Angelo Ionel Alexa, Liceul Teoretic „Ana Ipătescu" Gherla. Dezvoltarea calităţii motrice *viteza* la copiii cu CES prin intermediul jocurilor dinamice.
- Claudiu Conţiu, Şcoala Profesională „Poiana" Turda. Învăţarea bazată pe proiecte. Competiţia de natație „Ora de înot".
- Cornel Roş, Colegiul Tehnic Turda şi Onela Şanta, Liceul Teoretic „Onisifor Ghibu" Cluj-Napoca Imbunătăţirea calităţii motrice *viteza* la elevii din ciclul gimnazial prin intermediul jocurilor de mişcare.
- Robert VIăduţu, Cluj-Napoca. Steroizii otrava din spatele unui trup de zeu.
- Daniel Gall, Liceul Tehnologic „Someş" Dej. Studiu privind perfecţionarea acţiunilor de atac în jocul de fotbal la nivelul ciclului inferior al liceului.
- Mihaela Tamas, Şcoala Gimnazială „Bobâlna". Metodologia aplicării jocurilor de mişcare privind învăţarea elementelor tehnice din fotbal la nivelul claselor a V-a şi a VI-a.
- Gabriel Mocean, Şcoala Gimnazială Viişoara. Demers metodic privind învăţarea tehnicii în jocul de fotbal în ciclul primar.
- Maria Baias, Şcoala Gimnazială Specială „Transilvania" Baciu. Gimnastica respiratorie prin înot la copiii cu deficienţe psihoneuromotorii.
- Flaviu Panfilie, Şcoala Gimnazială „Teodor Murăşanu" Turda. Motivaţia şi satisfacţia cadrelor didactice în învăţământul gimnazial.
- Cristian Potora, Inspectorul Şcolar Judeţean Cluj. Capacitatea de efort fizic la jucătorii de handbal juniori.
- Crina Laura Ionescu, Inspectoratul-Şcolar Judeţean Cluj. Empatia în relaţia profesor - elev şi rolul acesteia în ameliorarea procesului educativ.
- Sorina Marilia Pop, Colegiul Naţional „George Coşbuc" Cluj-Napoca. Profesorul eficient.
- Armand Dimitriu, Liceul Teoretic „Alexandru Papiu lIarian" Dej. Relaţia dintre atac şi apărare în jocul de volei băieţi juniori.

În final au fost făcute aprecieri pozitive din partea personalităţilor care au participat. După simpozion, au urmat demonstraţii de lupte în sala nouă de sport a Şcolii Gimnaziale Iclod, cu sprijinul DJST Cluj şi a Asociaţiei Judeţene de lupte Cluj.

Cristian Potora
cristianpotora@gmail.com
Traian Bocu
traian_bocu@yahoo.com

First row, from the left: Prof. Octavian Vidu, Prof. Gr. I. Ioan Mureşan, Prof. Voichiţa Rus, Prof. Daniel Gall.
Second row, from the left: Assoc. Prof. Dr. Mihai Cucu, Assoc. Prof. Dr. Ioan Burcă from UMPh Tg. Mureş, Prof. Ilie Dragotă from Câmpia Turzii.

From the left: school inspector for physical education and sport Prof. Drd. Cristian Potora, school inspector for special education Crina Laura Ionescu, mayor of the Iclod commune Ioan Emil Pârţoc, Pro-Dean Assoc. Prof. Dr. Leon Gomboş, and school general vice-inspector Török Zoltan.

Prof. Daniel Gall – Study on the improvement of actions of attack in the football game at junior high school level.

Dr. Robert VIăduţu – Steroids, the poison behind the body of a god.

Prof. Maria Baias – Respiratory gymnastics by swimming in children with psychoneuromotor deficiencies.

Mayor Emil Pârţoc handing the participation diploma to the youngest participant in the wrestling demonstrations.

Palestrica of the third millennium – Civilization and Sport
Vol. 16, no. 2, April-June 2015, 188–190

EVENTS
EVENIMENTE

MINISTERUL EDUCAȚIEI NAȚIONALE
Inspectoratul Școlar Județean Cluj

The "Gelu Românul" Cross Country Running Cup, 3rd edition, Dăbâca, 6 June 2015

Crosul Cupa „Gelu Românul", Dăbâca, ediţia a 3-a, 6 iunie 2015

On 6 June 2015, the third edition of the inter-county school cross country running race was held in Dăbâca commune, Cluj county. Organized under the auspices of the Cluj County School Inspectorate, of the Middle School of Dăbâca, with the support of the Mayor's Office and the Local Council (the mayor represented by his councilor Aurel Chidean), the event gathered more than 150 pupils, grouped in representative teams of schools, mainly from the North-Eastern area of the Cluj county. Having the sanogenetic mission to involve large numbers of school children in a simple physical activity accessible to the school population at minimum costs, the "Gelu Românul" spring cross country running race in Dăbâca attained its objective. The team rankings in the competition were as follows: 1st place - Răchiţele, 2nd place - Dăbâca, 3rd place - Râşca, but in fact all participants who understood the important part played by sport in everyone's life were winners.

The winners by age categories were the following: girls, 3rd-4th grades – Kutaş Kristina – School of Borşa; boys, 3rd-4th grades – Ticoş Andrei – School of Apahida; girls, 5th-6th grades, 11-12 years – Gligan Adriana – School of Râşca; boys, 5th-6th grades, 11-12 years – Balint Vasile – School of Livada; girls, 7th-8th grades, 13-14 years – Vlaşin Iulia – School of Dăbâca; boys, 7th-8th grades, 13-14 years – Potra Ioan – School of Răchiţele.

* * *

În ziua de sâmbătă 6 iunie 2015 s-a desfăşurat în comuna Dăbâca, Jud. Cluj, cea de a III-a ediţie a crosului şcolar intrajudeţean zonal. Organizat sub egida Inspectoratului Şcolar Judeţean Cluj, Şcoala Gimnazială din localitate cu sprijinul Primăriei şi Consiliului local Dăbâca (Primarul prin consilierul său Aurel Chidean), crosul a adunat la start peste 150 elevi, constituiţi în echipe reprezentative ale şcolilor preponderent din zona de nord-est a judeţului Cluj. Având misiunea sanogenetică de a angrena un număr cât mai mare de şcolari într-o activitate fizică simplă, accesibilă populaţiei şcolare şi cu costuri minime, crosul de primăvară „Gelu Românul" de la Dăbâca, şi-a atins obiectivul. În urma competiţiei, clasamentul pe echipe a fost următorul: Locul I - Răchiţele, locul II - Dăbâca, locul III - Râşca, dar de fapt câştigători sunt toţi elevii participanţi care au înţeles rolul important pe care îl ocupă sportul în viaţa fiecăruia.

Câştigătorii pe categorii de vârstă au fost următorii: fete cl. III-IV – Kutaş Kristina - Şcoala Borşa; băieţi cl. III-IV – Ticoş Andrei - Şcoala Apahida; fete cl. V-VI, 11-12 ani – Gligan Adriana - Şcoala Râşca; băieţi cl. V-VI, 11-12 ani – Balint Vasile - Şcoala Livada; fete cl. VII-VIII, 13-14 ani – Vlaşin Iulia - Şcoala Dăbâca; băieţi cl. VII-VIII, 13-14 ani – Potra Ioan - Şcoala Răchiţele.

Cristian Potora
cristianpotora@gmail.com

Right after the start of the boys' race, young age category

Image during the girls' race, 13-14 year category

Arrival of girls, young age category

The 23rd International Conference on Health Promoting Hospitals and Health Services

A 23-a Conferinţă internaţională privind promovarea sănătăţii în spitale şi servicii de sănătate

The 23rd International Conference on Health Promoting Hospitals and Health Services (HPH conference) was held from 10 to 12 June 2015 in Oslo, Norway. The Conference was hosted by the Norwegian Health Promoting Hospitals Network (HPH network). This network was founded in 1998 and has valuably contributed to the international HPH network. The International HPH network consists of more than 40 national/regional HPH networks, collaborating to reorient health care towards active promotion of health.

Upon the suggestion of the local hosts, the Scientific Committee decided to focus the HPH conference 2015 on „Person-oriented health promotion in a rapidly changing world" - a timely topic in light of global changes. With this general theme, the conference paid special attention to the comprehensive somato-psycho-social health needs of patients and their families, but also those of health care staff and community members. There were four sub-themes:

- Addressing people's comprehensive health needs.
- Co-producing health – health care for people by people.
- Continuing health care for people by strengthening individuals and improving cooperation between health care services and other institutions.
- Using new technologies & different media to address people's health needs.

The conference included plenary sessions, workshops, oral and poster presentations, being an excelent platform for knowledge exchange and establishment of new contacts for future cooperation in the field of health promotion. Further information about the conference can be obtained from the web page of the conference-http://www.hphconferences.org/oslo2015.html.

Several sessions (e.g. Strategies for tackling obesity or Addressing lifestyles and stress management of hospital staff) focused on the role of physical activity in health promotion.

The scientific program included one poster presentation from Romania „Internet searching for lifestyle related information and intention to use a computer tailored smoking cessation program among Romanian patients from general practitioners" (Authors: Lucia Maria Lotrean, Roxana Ailoaiei, Monica Popa, Hein De Vries).

Participation in the conference was possible due to the project "Improving cooperation between Norway and Romania in the field of health promoting hospitals" funded by the Fund for Bilateral Relations at National Level within the EEA and Norway Grants 2009-2014. The EEA and Norway grants represent the contribution of Iceland, the Principality of Liechtenstein and of the Kingdom of Norway to reduce social and economic disparities within the European Economic Area and to strengthen bilateral relations with the 16 beneficiary states in southern and central Europe. The purpose of the Fund for Bilateral Relations at National Level is to support various bilateral cooperation initiatives between entities in Romania and entities in Iceland, the Principality of Liechtenstein and the Kingdom of Norway.

The next HPH conference will be held on 8-10 June 2016 in Connecticut, USA, and will be hosted by Yale University and Griffin Hospital (http://www.hphconferences.org/connecticut2016.html).

* * *

În perioada 10-12 Iunie 2015 în Oslo, Norvegia a fost organizată A 23-a Conferinţă internaţională privind promovarea sănătăţii în spitale şi servicii de sănătate. Conferinţa a fost găzduită de Norwegian Health Promoting Hospitals Network (Reţeaua norvegiană de promovare a sănătăţii în spitale). Această reţea a fost înfiinţată în 1998 şi a avut contribuţii importante în cadrul reţelei internaţionale de promovare a sănătăţii în spitale. Reţeaua internaţională cuprinde mai mult de 40 de reţele naţionale sau regionale, care colaborează pentru a stimula în mod activ promovarea sănătăţii în spitale.

La sugestia gazdelor, comitetul ştiinţific a hotărât ca tema conferinţei să fie Promovarea sănătăţii orientată la nivel individual într-o lume în continuă schimbare, o temă în concordanţă cu schimbările globale care au loc. În cadrul acestei teme, conferinţa a acordat o atenţie specială sănătăţii somato-spiho-sociale a pacienţilor şi familiilor lor, dar şi a cadrelor medicale precum şi a membrilor

comunităţii.

Conferinţa a avut 4 sub-teme:

- Vizarea nevoilor complexe de sănătate ale persoanelor.

- Co-producerea sănătăţii- servicii de sănătate pentru oameni oferite de către oameni.

- Asistenţă medicală continuă prin încurajarea participanţilor şi prin cooperare între serviciile de sănătate şi alte instituţii.

- Utilizarea de noi tehnologii şi diferite forme media pentru a viza nevoile de sănătate ale oamenilor

Conferinţa a inclus sesiuni plenare, workshop-uri, prezentări orale şi poster, constituindu-se într-o platformă excelentă pentru încurajarea schimbului de cunoştinţe şi stabilirea de noi contacte care să permită cooperarea în domeniul promovării sănătăţii. Informaţii suplimentare despre conferinţă pot fi obţinute la adresa http://www.hphconferences.org/oslo2015.html.

Diferite sesiuni (ex. sesiunea Strategii pentru combaterea obezităţii sau Îmbunătăţirea stilului de viaţă şi managementul stresului în rândul personalului medical) au abordat aspecte legate de rolul activităţii fizice în promovarea sănătăţii

Programul ştiinţific a inclus o prezentare poster din România „Utilizarea internetului pentru căutarea de informaţii privind stilul de viaţă şi intenţia de a utiliza un program personalizat pentru renunţarea la fumat asistat de calculator în rândul pacienţilor români care se adresează medicilor de familie" (Autori: Lucia Maria Lotrean, Roxana Ailoaiei, Monica Popa, Hein De Vries).

Participarea la conferinţă a fost posibilă datorită proiectului Îmbunătăţirea cooperării dintre Norvegia şi România în domeniul promovării sănătăţii în spitale finanţat de Fondul pentru Relaţii Bilaterale la Nivel Naţional în cadrul granturilor EEA şi Norway 2009-2014. Acest tip de granturi reprezintă contribuţia Islandei, Principatului Liechtenstein şi a regatului Norvegiei pentru a reduce diferenţele sociale şi economice în spaţiul economic european şi îmbunătăţirea relaţiilor bilaterale cu 16 state beneficiare in Europa Centrală şi de Sud. Scopul Fondului pentru Relaţii Bilaterale la Nivel Naţional este de a sprijini diferite iniţiative de cooperare bilaterală între instituţii din România, Islanda, Principatul Liechtenstein şi regatul Norvegiei.

Viitoarea conferinţă va avea loc între 8-10 Iunie 2016 în Connecticut, USA şi va fi găzduită de Yale University şi Griffin Hospital, (http://www.hphconferences.org/connecticut2016.html).

Lucia Maria Lotrean
Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania
llotrean@umfcluj.ro

Palestrica of the third millennium – Civilization and sport
Vol. 16, no. 2, April-June 2015, 191–193

FOR THE ATTENTION OF CONTRIBUTORS

The subject of the Journal

The journal has a multidisciplinary nature oriented toward biomedical, health, exercise, social sciences fields, applicable in activities of physical training and sport, so that the dealt subjects and the authors belong to several disciplines in these fields. The main rubrics are: "Original studies" and "Reviews".

Regarding "Reviews" the main subjects that are presented are: oxidative stress in physical effort; mental training; psychoneuroendocrinology of sport effort; physical culture in the practice of the family doctor; extreme sports and risks; emotional determinatives of performance; the recovery of patients with spinal column disorders; stress syndromes and psychosomatics; olympic education, legal aspects of sport; physical effort in the elderly; psychomotricity disorders; high altitude sportive training; fitness; biomechanics of movements; EUROFIT tests and other evaluation methods of physical effort; adverse reactions of physical effort; sport endocrinology; depression in sportsmen/women; classical and genetic drug usage; Olympic Games etc.

Among articles devoted to original studies and researches we are particularly interested in the following: the methodology in physical education and sport; influence of some ions on effort capacity; psychological profiles of students regarding physical education; methodology in sport gymnastics; the selection of performance sportsmen.

Other articles approach particular subjects regarding different sports: swimming, rhythmic and artistic gymnastics, handball, volleyball, basketball, athletics, ski, football, field and table tennis, wrestling, sumo.

The authors of the two rubrics are doctors, professors and educators, from universities and preuniversity education, trainers, scientific researchers etc.

Other rubrics of the journal are: the editorial, editorial news, reviews of the latest books in the field and others that are presented rarely (inventions and innovations, universitaria, preuniversitaria, forum, memories, competition calendar, portraits, scientific events).

We highlight the rubric "The memory of the photographic eye", where photos, some very rare, of sportsmen in the past and present are presented.

Articles signed by authors from the Republic of Moldova regarding the organization of sport education, variability of the cardiac rhythm, the stages of effort adaptability and articles by some authors from France, Portugal, Canada must also be mentioned.

The main objective of the journal is highlighting the results of research activities as well as the permanent and actual dissemination of information for specialists in the field. The journal assumes an important role regarding the achievement of necessary scores of the teaching staff in the university and preuniversity education as well as of doctors in the medical network (by recognizing the journal by the Romanian College of Physicians), regarding didactic and professional promotion.

Another merit of the journal is the obligatory publication of the table of contents and an English summary for all articles. Frequently articles are published in extenso in a language with international circulation (English, French).

The journal is published quarterly and the works are accepted for publication in the Romanian and English language. The journal is sent by e-mail or on a floppy disk (or CD-ROM) and printed, by mail at the address of the editorial staff. The works of contributors that are resident abroad and of Romanian authors must be mailed to the Editorial staff at the following address:

„Palestrica of the third millennium – Civilization and sport"
Chief Editor: Prof. dr. Traian Bocu
Contact address: palestrica@gmail.com or traian_bocu@yahoo.com
Mail address: Clinicilor street no. 1 postal code 400006, Cluj-Napoca, România
Telephone:0264-598575
Website: www.pm3.ro

Objectives

Our intention is that the journal continues to be a route to highlight the research results of its contributors, especially by stimulating their participation in project competitions. Articles that are published in this journal are considered as part of the process of promotion in one's university career (accreditation that is obtained after consultation with the National Council for Attestation of Universitary Titles and Diplomas).

We also intend to encourage the publication of studies and research, that include original relevant elements especially from young people. All articles must bring a minimum of personal contribution (theoretical or practical), that will be highlighted in the article.

In the future we propose to accomplish criteria that would allow the promotion of the journal to superior levels according international recognition.

THE STRUCTURE AND SUBMISSION OF ARTICLES

The manuscript must be prepared according to the stipulations of the International Committee of Medical Journal Editors (http://www.icmjee.org).

The number of words for the electronic format:

– 4000 words for original articles;

– 2000 words for case studies;
– 5000-6000 words for review articles.

Format of the page: edited in WORD format, A4. Printed pages of the article will be numbered successively from 1 to the final page.

Font: Times New Roman, size 11 pt.; it should be edited on a full page, with diacritical marks, double spaced, respecting equal margins of 2 cm.

Illustrations:

The images (graphics, photos etc.) should be numbered consecutively in the text, with arabic numbers. They should be edited with EXCEL or SPSS programs, and sent as distinct files: „figure 1.tif", „figure 2. jpg", and at the editors demanding in original also. Every graphic should have a legend, written **under** the image.

The tables should be numbered consecutively in the text, with roman numbers, and sent as distinct files, accompanied by a legend that will be put **above** the table.

PREPARATION OF THE ARTICLES

1. Title page: – includes the title of article (maximum 45 characters), the name of authors followed by surname, work place, mail address of the institute and mail adress and e-mail address of the first author. It will follow the name of article in the English language.

2. Summary: For original articles a summary structured like this is necessary: (Premize-Background, Obiective-Aims, Metode-Methods, Resultate-Results, Concluzii-Conclusions), in the Romanian language, of maximum 250 words, followed by 3-8 key words (if its possible from the list of established terms). All articles will have a summary in the English language. Within the summary (abstract) abbreviations, footnotes or bibliographic references should not be used.

Premises and objectives. Description of the importance of the study and explanation of premises and research objectives.

Methods. Include the following aspects of the study:

Description of the basic category of the study: of orientation and applicative.

Localization and the period of study. Description and size of groups, sex (gender), age and other socio-demographic variables should be given.

Methods and instruments of investigation that are used.

Results. The descriptive and inferential statistical data (with specification of the used statistical tests): the differences between the initial and the final measurement, for the investigated parameters, the significance of correlation coefficients are necessary. The specification of the level of significance (the value ***p*** or the dimension of effect ***d***) and the type of the used statistical test etc are obligatory.

Conclusions. Conclusions that have a direct link with the presented study should be given.

Orientation articles and case studies should have an unstructured summary (without respecting the structure of experimental articles) to a limit of 150 words.

3. Text

Original articles should include the following chapters which will not be identical with the summary titles: Introduction (General considerations), Hypothesis, Materials and methods (including ethical and statistical informations), Results, Discussing results, Conclusions and suggestions. Other type of articles, as orientation articles, case studies, Editorials, do not have an obligatory format. Excessive abbreviations are not recommended. The first abbreviation in the text is represented first *in extenso*, having its abbreviation in parenthesis, and thereafter the short form should be used.

Authors must undertake the responsibility for the correctness of published materials.

4. Bibliography

The bibliography should include the following data:

For articles from journals or other periodical publications the international Vancouver Reference Style should be used: the name of all authors as initials and the surname, the year of publication, the title of the article in its original language, the title of the journal in its international abbreviation (italic characters), number of volume, pages.

Articles: Pop M, Albu VR, Vişan D et al. Probleme de pedagogie în sport. Educaţie Fizică şi Sport 2000; 25(4):2-8.

Books: Drăgan I (coord.). Medicina sportivă, Editura Medicală, 2002, Bucureşti, 2002, 272-275.

Chapters from books: Hăulică I, Bălţatu O. Fiziologia senescenţei. In: Hăulică I. (sub red.) Fiziologia umană, Ed. Medicală, Bucureşti, 1996, 931-947.

Starting with issue 4/2010, every article should include a minimum of 15 bibliographic references and a maximum of 100, mostly journals articles published in the last 10 years. Only a limited number of references (1-3) older than 10 years will be allowed. At least 20% of the cited resources should be from recent international literature (not older than 10 years).

Peer-review process

In the final stage all materials will be closely reviewed by at least two competent referees in the field (Professors, and Docent doctors) so as to correspond in content and form with the requirements of an international journal. After this stage, the materials will be sent to the journal's referees, according to their profiles. After receiving the observations from the referees, the editorial staff shall inform the authors of necessary corrections and the publishing requirements of the journal. This process (from receiving the article to transmitting the observations) should last about 4 weeks. The author will be informed if the article was accepted for publication or not. If it is accepted, the period of correction by the author will follow in order to correspond to the publishing requirements.

Conflict of interest

The authors must mention all possible conflicts of interest including financial and other types. If you are sure that there is no conflict of interest we ask you to mention this. The financing sources should be mentioned in your work too.

Specifications

The specifications must be made only linked to the people outside the study but which have had a substantial contribution, such as some statistical processing or review of the text in the English language. The authors have the responsibility to obtain the written permission from the mentioned persons with the name written within the respective chapter, in case the readers refer to the interpretation of results and conclusions of these persons. Also it should be specified if the article uses some partial results from certain projects or if these are based on master or doctoral theses sustained by the author.

Ethical criteria

The Editors will notify authors in due time, whether their article is accepted or not or whether there is a need to modify texts. Also the Editors reserve the right to edit articles accordingly. Papers that have been printed or sent for publication to other journals will not be accepted. All authors should send a separate letter containing a written statement proposing the article for submission, pledging to observe the ethics of citation of sources used (bibliographic references, figures, tables, questionnaires).

For original papers, according to the requirements of the Helsinki Declaration, the Amsterdam Protocol, Directive 86/609/EEC, and the regulations of the Bioethical Committees from the locations where the studies were performed, the authors must provide the following:

- the informed consent of the family, for studies in children and juniors;
- the informed consent of adult subjects, patients and athletes, for their participation;
- malpractice insurance certificate for doctors, for studies in human subjects;
- certificate from the Bioethical Committees, for human study protocols;
- certificate from the Bioethical Committees, for animal study protocols.

The data will be mentioned in the paper, in the section Materials and Methods. The documents will be obtained before the beginning of the study. Will be mentioned also the registration number of the certificate from the Bioethical Committees.

Editorial submissions will be not returned to authors, whether published or not.

FOR THE ATTENTION OF THE SPONSORS

Requests for advertising space should be sent to the Editors of the "Palestrica of the Third Millennium" journal, 1, Clinicilor St., 400006, Cluj-Napoca, Romania. The price of an A4 full colour page of advertising for 2012 will be EUR 250 and EUR 800 for an advert in all 4 issues. The costs of publication of a logo on the cover will be determined according to its size. Payment should be made to the Romanian Medical Society of Physical Education and Sports, CIF 26198743. Banca Transilvania, Cluj branch, IBAN: RO32 BTRL 0130 1205 S623 12XX (RON).

SUBSCRIPTION COSTS

The "Palestrica of the Third Millennium" journal is printed quarterly. The subscription price is 100 EUR for institutions abroad and 50 EUR for individual subscribers outside Romania. For Romanian institutions, the subscription price is 120 RON, and for individual subscribers the price is 100 RON. Note that distribution fees are included in the postal costs.

Payment of subscriptions should be made by bank transfer to the Romanian Medical Society of Physical Education and Sports, CIF 26198743. Banca Transilvania, Cluj branch, IBAN: RO32 BTRL 0130 1205 S623 12XX (RON), RO07 BTRL 01,304,205 S623 12XX (EUR), RO56 BTRL 01,302,205 S623 12XX (USD). SWIFT: BTRLRO 22

Please note that in 2010 a tax for each article submitted was introduced. Consequently, all authors of articles will pay the sum of 150 RON to the Romanian Medical Society of Physical Education and Sport published above. Authors who have paid the subscription fee will be exempt from this tax. Other information can be obtained online at www.pm3.ro "Instructions for Authors", at our e-mail address palestrica@gmail.com or at the postal address: 1, Clinicilor St., 400006, Cluj-Napoca, Romania, phone: +40264-598575.

INDEXING

Title of the journal: Palestrica of the third millennium – Civilization and sport

pISSN: 1582-1943; eISSN: 2247-7322; ISSN-L: 1582-1943

Profile: a Journal of Study and interdisciplinary research

Editor: "Iuliu Haţieganu" University of Medicine and Pharmacy of Cluj-Napoca and The Romanian Medical Society of Physical Education and Sports in collaboration with the Cluj County School Inspectorate

The level and attestation of the journal: a journal rated B+ by CNCSIS in the period 2007-2011 and certified by CMR since 2003

Journal indexed into International Data Bases (IDB): EBSCO, Academic Search Complete, USA and Index Copernicus, Journals Master List, Poland; DOAJ (Directory of Open Access Journals), Sweden.

Year of first publication: 2000

Issue: quarterly

The table of contents, the summaries and the instructions for authors can be found on the internet page: http://www.pm3.ro. Access to the table of contents and full text articles (in .pdf format) is free.

Palestrica Mileniului III – Civilizaţie şi Sport
Vol. 16, no. 2, Aprilie-Iunie 2014, 194–196

ÎN ATENŢIA COLABORATORILOR

Tematica revistei

Ca tematică, revista are un caracter multidisciplinar orientat pe domeniile biomedical, sănătate, efort fizic, ştiinţe sociale, aplicate la activităţile de educaţie fizică şi sport, astfel încât subiectele tratate şi autorii aparţin mai multor specialităţi din aceste domenii. Principalele rubrici sunt: „Articole originale" şi „Articole de sinteză".

Exemplificăm rubrica „Articole de sinteză" prin temele importante expuse: stresul oxidativ în efortul fizic; antrenamentul mintal; psihoneuroendocrinologia efortului sportiv; cultura fizică în practica medicului de familie; sporturi extreme şi riscuri; determinanţi emoţionali ai performanţei; recuperarea pacienţilor cu suferinţe ale coloanei vertebrale; sindroame de stres şi psihosomatică; educaţia olimpică, aspecte juridice ale sportului; efortul fizic la vârstnici; tulburări ale psihomotricităţii; pregătirea sportivă la altitudine; fitness; biomecanica mişcărilor; testele EUROFIT şi alte metode de evaluare a efortului fizic; reacţii adverse ale eforturilor; endocrinologie sportivă; depresia la sportivi; dopajul clasic şi genetic; Jocurile Olimpice etc.

Dintre articolele consacrate studiilor şi cercetărilor experimentale notăm pe cele care vizează: metodica educaţiei fizice şi sportului; influenţa unor ioni asupra capacităţii de efort; profilul psihologic al studentului la educaţie fizică; metodica în gimnastica sportivă; selecţia sportivilor de performanţă.

Alte articole tratează teme particulare vizând diferite sporturi: înotul, gimnastica ritmică şi artistică, handbalul, voleiul, baschetul, atletismul, schiul, fotbalul, tenisul de masă şi câmp, luptele libere, sumo.

Autorii celor două rubrici de mai sus sunt medici, profesori şi educatori din învăţământul universitar şi preuniversitar, antrenori, cercetători ştiinţifici etc.

Alte rubrici ale revistei sunt: editorialul, actualităţile editoriale, recenziile unor cărţi - ultimele publicate în domeniu, la care se adaugă şi altele prezentate mai rar (invenţii şi inovaţii, universitaria, preuniversitaria, forum, remember, calendar competiţional, portrete, evenimente ştiinţifice).

Subliniem rubrica "Memoria ochiului fotografic", unde se prezintă fotografii, unele foarte rare, ale sportivilor din trecut şi prezent.

De menţionat articolele semnate de autori din Republica Moldova privind organizarea învăţământului sportiv, variabilitatea ritmului cardiac, etapele adaptării la efort, articole ale unor autori din Franţa, Portugalia, Canada.

Scopul principal al revistei îl constituie valorificarea rezultatelor activităţilor de cercetare precum şi informarea permanentă şi actuală a specialiştilor din domeniile amintite. Revista îşi asumă şi un rol important în îndeplinirea punctajelor necesare cadrelor didactice din învăţământul universitar şi preuniversitar precum şi medicilor din reţeaua medicală (prin recunoaşterea revistei de către Colegiul Medicilor din România), în avansarea didactică şi profesională.

Un alt merit al revistei este publicarea obligatorie a cuprinsului şi a câte unui rezumat în limba engleză, pentru toate articolele. Frecvent sunt publicate articole în extenso într-o limbă de circulaţie internaţională (engleză, franceză).

Revista este publicată trimestrial iar lucrările sunt acceptate pentru publicare în limba română şi engleză. Articolele vor fi redactate în format WORD (nu se acceptă articole în format PDF). Expedierea se face prin e-mail sau pe dischetă (sau CD-ROM) şi listate, prin poştă pe adresa redacţiei. Lucrările colaboratorilor rezidenţi în străinătate şi ale autorilor români trebuie expediate pe adresa redacţiei:

Revista «Palestrica Mileniului III»
Redactor şef: Prof. dr. Traian Bocu
Adresa de contact: palestrica@gmail.com sau traian_bocu@yahoo.com
Adresa poştală: Str. Clinicilor nr.1 cod 400006, Cluj-Napoca, România
Telefon:0264-598575
Website: www.pm3.ro

Obiective

Ne propunem ca revista să continue a fi o formă de valorificare a rezultatelor activităţii de cercetare a colaboratorilor săi, în special prin stimularea participării acestora la competiţii de proiecte. Menţionăm că articolele publicate în cadrul revistei sunt luate în considerare în procesul de promovare în cariera universitară (acreditare obţinută în urma consultării Consiliului Naţional de Atestare a Titlurilor şi Diplomelor Universitare).

Ne propunem de asemenea să încurajăm publicarea de studii şi cercetări, care să cuprindă elemente originale relevante mai ales de către tineri. Toate articolele vor trebui să aducă un minimum de contribuţie personală (teoretică sau practică), care să fie evidenţiată în cadrul articolului.

În perspectivă ne propunem îndeplinirea criteriilor care să permită promovarea revistei la niveluri superioare cu recunoaştere internaţională.

STRUCTURA ŞI TRIMITEREA ARTICOLELOR

Manuscrisul trebuie pregătit în acord cu prevederile Comitetului Internaţional al Editurilor Revistelor Medicale (http://www.icmjee.org).

Numărul cuvintelor pentru formatul electronic:

– 4000 cuvinte pentru articolele originale,
– 2000 de cuvinte pentru studiile de caz,
– 5000–6000 cuvinte pentru articolele de sinteză.

Format pagină: redactarea va fi realizată în format A4. Paginile listate ale articolului vor fi numerotate succesiv de la 1 până la pagina finală.

Font: Times New Roman, mărime 11 pt.; redactarea se va face pe pagina întreagă, cu diacritice, la două rânduri, respectând margini egale de 2 cm pe toate laturile.

Ilustraţiile:

Figurile (grafice, fotografii etc.) vor fi numerotate consecutiv în text, cu cifre arabe. Vor fi editate cu programul EXCEL sau SPSS, şi vor fi trimise ca fişiere separate: „figura 1.tif", „figura 2. jpg", iar la solicitarea redacţiei şi în original. Fiecare grafic va avea o legendă care se trece **sub** figura respectivă.

Tabelele vor fi numerotate consecutiv în text, cu cifre romane, şi vor fi trimise ca fişiere separate, însoţite de o legendă ce se plasează **deasupra** tabelului.

PREGĂTIREA ARTICOLELOR

1. Pagina de titlu: – cuprinde titlul articolului (maxim 45 caractere), numele autorilor urmat de prenume, locul de muncă, adresa postală a instituţiei, adresa poştală şi adresa e-mail a primului autor. Va fi urmat de titlul articolului în limba engleză.

2. Rezumatul: Pentru articolele experimentale este necesar un rezumat structurat (Premize-Background, Obiective-Aims, Metode-Methods, Rezultate-Results, Concluzii-Conclusions), în limba română, de maxim 250 cuvinte (20 de rânduri, font Times New Roman, font size 11), urmat de 3–5 cuvinte cheie (dacă este posibil din lista de termeni consacraţi). Toate articolele vor avea un rezumat în limba engleză. Nu se vor folosi prescurtări, note de subsol sau referinţe.

Premize şi obiective: descrierea importanţei studiului şi precizarea premizelor şi obiectivelor cercetării.

Metodele: includ următoarele aspecte ale studiului:

Descrierea categoriei de bază a studiului: de orientare sau aplicativ.

Localizarea şi perioada de desfăşurare a studiului. Colaboratorii vor prezenta descrierea şi mărimea loturilor, sexul (genul), vârsta şi alte variabile socio-demografice.

Metodele şi instrumentele de investigaţie folosite.

Rezultatele vor prezenta datele statistice descriptive şi inferenţiale obţinute (cu precizarea testelor statistice folosite): diferenţele dintre măsurătoarea iniţială şi cea finală, pentru parametri investigaţi, semnificaţia coeficienţilor de corelaţie. Este obligatorie precizarea nivelului de semnificaţie (valoarea ***p*** sau mărimea efectului ***d***) şi a testului statistic folosit etc.

Concluziile care au directă legătură cu studiul prezentat.

Articolele de orientare şi studiile de caz vor avea un rezumat nestructurat (fără a respecta structura articolelor experimentale) în limita a 150 cuvinte (maxim 12 rânduri, font Times New Roman, font size 11).

3. Textul

Articolele experimentale vor cuprinde următoarele capitole: Introducere, Ipoteză, Materiale şi Metode (inclusiv informaţiile etice şi statistice), Rezultate, Discutarea rezultatelor, Concluzii (şi propuneri). Celelalte tipuri de articole, cum ar fi articolele de orientare, studiile de caz, editorialele, nu au un format impus.

Răspunderea pentru corectitudinea materialelor publicate revine în întregime autorilor.

4. Bibliografia

Bibliografia va cuprinde:

Pentru articole din reviste sau alte periodice se va menţiona: numele tuturor autorilor şi iniţialele prenumelui, anul apariţiei, titlul articolului în limba originală, titlul revistei în prescurtare internaţională (caractere italice), numărul volumului, paginile

Articole: Pop M, Albu VR, Vişan D et al. Probleme de pedagogie în sport. Educaţia Fizică şi Sportul 2000; 25(4):2-8.

Cărţi: Drăgan I (coord.). Medicina sportivă aplicată. Ed. Editis, Bucureşti 1994, 372-375.

Capitole din cărţi: Hăulică I, Bălţatu O. Fiziologia senescenţei. În: Hăulică I. (sub red.) Fiziologia umană. Ed. Medicală, Bucureşti 1996, 931-947.

Începând cu revista 4/2010, fiecare articol va trebui să se bazeze pe un minimum de 15 şi un maximum de 100 referinţe bibliografice, în majoritate articole nu mai vechi de 10 ani. Sunt admise un număr limitat de cărţi şi articole de referinţă (1-3), cu o vechime mai mare de 10 ani. Un procent de 20% din referinţele bibliografice citate trebuie să menţioneze literatură străină studiată, cu respectarea criteriului actualităţii acesteia (nu mai vechi de 10 ani).

Procesul de recenzare (peer-review)

Într-o primă etapă toate materialele sunt revizuite riguros de cel puţin doi referenţi competenţi în domeniu respectiv (profesori universitari doctori şi doctori docenţi) pentru ca textele să corespundă ca fond şi formă de prezentare cerinţelor unei reviste serioase. După această etapă materialele sunt expediate referenţilor revistei, în funcţie de profilul materialelor. În urma observaţiilor primite din partea referenţilor, redacţia comunică observaţiile autorilor în vederea corectării acestora şi încadrării în cerinţele de publicare impuse de revistă. Acest proces (de la primirea articolului până la transmiterea observaţiilor) durează aproximativ 4 săptămâni. Cu această ocazie se comunică autorului daca articolul a fost acceptat spre publicare sau nu. În situaţia acceptării, urmează perioada de corectare a articolului de către autor în vederea încadrării în criteriile de publicare.

Conflicte de interese

Se cere autorilor să menţioneze toate posibilele conflicte de interese incluzând relaţiile financiare şi de alte tipuri. Dacă sunteţi siguri că nu există nici un conflict de interese vă rugăm să menţionaţi acest lucru. Sursele de finanţare ar trebui să

fie menţionate în lucrarea dumneavoastră.

Precizări

Precizările trebuie făcute doar în legătură cu persoanele din afara studiului, care au avut o contribuţie substanţială la studiul respectiv, cum ar fi anumite prelucrări statistice sau revizuirea textului în limba engleză. Autorii au responsabilitatea de a obţine permisiunea scrisă din partea persoanelor menţionate cu numele în cadrul acestui capitol, în caz că cititorii se referă la interpretarea rezultatelor şi concluziilor acestor persoane. De asemenea, la acest capitol se vor face precizări în cazul în care articolul valorifică rezultate parţiale din anumite proiecte sau dacă acesta se bazează pe teze de masterat sau doctorat susţinute de autor, alte precizări.

Criterii deontologice

Redacţia va răspunde în timp util autorilor privind acceptarea, neacceptarea sau necesitatea modificării textului şi îşi rezervă dreptul de a opera modificări care vizează forma lucrărilor.

Nu se acceptă lucrări care au mai fost tipărite sau trimise spre publicare la alte reviste. Autorii vor trimite redacţiei odată cu articolul propus spre publicare, într-un fişier word separat, o declaraţie scrisă în acest sens, cu angajamentul respectării normelor deontologice referitoare la citarea surselor pentru materialele folosite (referinţe bibliografice, figuri, tabele, chestionare).

Pentru articolele originale, în conformitate cu îndeplinirea condiţiilor Declaraţiei de la Helsinki, a Protocolului de la Amsterdam, a Directivei 86/609/EEC şi a reglementărilor Comisiilor de Bioetică din locaţiile unde s-au efectuat studiile, autorii trebuie să prezinte:

- acordul informat din partea familiei, pentru studiile pe copii şi juniori;
- acordul informat din partea subiecţilor adulţi, pacienţi şi sportivi, pentru participare;
- adeverinţă de Malpraxis pentru medici, pentru cercetările/studiile pe subiecţi umani;
- adeverinţă din partea Comisiilor de Etică, pentru protocolul de studiu pe subiecţi umani;
- adeverinţă din partea Comisiilor de Bioetică, pentru protocolul de studiu pe animale.

Datele vor fi menţionate în articol la secţiunea Material şi metodă. Documentele vot fi obţinute înainte de începerea studiului. Se va menţiona şi numărul de înregistrare al adeverinţei din partea Comisiilor de Etică.

Materialele trimise la redacţie nu se restituie autorilor, indiferent dacă sunt publicate sau nu.

ÎN ATENŢIA SPONSORILOR

Solicitările pentru spaţiile de reclamă, vor fi adresate redacţiei revistei "Palestrica Mileniului III", Str. Clinicilor nr. 1, cod 400006 Cluj-Napoca, România. Preţul unei pagini de reclamă full color A4 pentru anul 2012 va fi de 250 EURO pentru o apariţie şi 800 EURO pentru 4 apariţii. Costurile publicării unui Logo pe coperţile revistei, vor fi stabilite în funcţie de spaţiul ocupat. Plata se va face în contul Societăţii Medicale Române de Educaţie Fizică şi Sport, CIF 26198743. Banca Transilvania, sucursala Cluj Cod IBAN: RO32 BTRL 0130 1205 S623 12XX (LEI).

ÎN ATENŢIA ABONAŢILOR

Revista "Palestrica Mileniului III" este tipărită trimestrial, preţul unui abonament fiind pentru străinătate de 100 Euro pentru instituţii, şi 50 Euro individual. Pentru intern, preţul unui abonament instituţional este de 120 lei, al unui abonament individual de 100 lei. Menţionăm că taxele de difuzare poştală sunt incluse în costuri.

Plata abonamentelor se va face prin mandat poştal în contul Societăţii Medicale Române de Educaţie Fizică şi Sport, CIF 26198743. Banca Transilvania, sucursala Cluj Cod IBAN: RO32 BTRL 0130 1205 S623 12XX (LEI); RO07 BTRL 01304205 S623 12XX (EURO); RO56 BTRL 01302205 S623 12XX (USD). SWIFT: BTRLRO 22

Precizăm că începând cu anul 2010 a fost introdusă taxa de articol. Ca urmare, toţi autorii semnatari ai unui articol vor achita împreună suma de 150 Lei, în contul Societăţii Medicale Române de Educaţie Fizică şi Sport publicat mai sus.

Autorii care au abonament vor fi scutiţi de această taxă de articol.

Alte informaţii se pot obţine online de pe www.pm3.ro „Pentru autori" sau pe adresa de mail a redacţiei palestrica@gmail.com sau pe adresa poştală: Str. Clinicilor nr.1 cod 400006, Cluj-Napoca, România, Telefon:0264-598575.

INDEXAREA

Titlul revistei: Palestrica Mileniului III – Civilizaţie şi sport

pISSN: 1582-1943; eISSN: 2247-7322; ISSN-L: 1582-1943

Profil: revistă de studii şi cercetări interdisciplinare

Editor: Universitatea de Medicină şi Farmacie „Iuliu Haţieganu" din Cluj-Napoca şi Societatea Medicală Română de Educaţie Fizică şi Sport, în colaborare cu Inspectoratul Şcolar al Judeţului Cluj

Nivelul de atestare al revistei: revistă acreditată în categoria B+ de CNCS în perioadele 2007-2011 şi atestată CMR din anul 2003 şi în prezent

Revistă indexată în Bazele de Date Internaţionale (BDI): EBSCO, Academic Search Complete, USA şi Index Copernicus, Journals Master List, Polonia, DOAJ (Directory of Open Access Journals), Sweden

Anul primei apariţii: 2000

Periodicitate: trimestrială

Cuprinsul, rezumatele şi instrucţiunile pentru autori se găsesc pe pagina de Internet: http://www.pm3.ro Accesul la cuprins şi articole in extenso (în format .pdf) este gratuit.

PALESTRICA MILENIULUI III – CIVILIZAŢIE ŞI SPORT
Redacţia revistei «Palestrica Mileniului III»
Str. Clinicilor nr.1, cod 400006, Cluj-Napoca, România,
Tel.: 0264-598575, e-mail: palestrica@gmail.com
Universitatea de Medicină și Farmacie „Iuliu Haţieganu" Cluj-Napoca,
Catedra de Fiziologie, str. Clinicilor 1, cod 400006 Tel. 0264 / 598575

TALON DE INDIVIDUAL DE ABONAMENT 2015

„PALESTRICA MILENIULUI III – CIVILIZAŢIE ŞI SPORT"
4 NUMERE / 2015 – 100 lei

NUMELE (INSTITUŢIA).....
ADRESA: Strada..... Nr..... Bloc..... Scara..... Etaj..... Ap.....
Sector..... Localitatea..... Judeţ.....
Cod poştal..... Tel. fix..... Tel Mobil.....
Fax..... E-mail.....

Plata se va face în contul Societăţii Medicale Române de Educaţie Fizică şi Sport, CIF 26198743, Banca Transilvania, Cluj, IBAN: RO32 BTRL 0130 1205 S623 12XX (LEI), SWIFT: BTRLRO 22, cu specificaţia „Abonament la revista Palestrica Mileniului III".
Vă rugăm anexaţi xerocopia dovezii de achitare a abonamentului, de talonul de abonament şi expediaţi-le pe adresa redacţiei, în vederea difuzării revistelor cuvenite.

„PALESTRICA MILENIULUI III – CIVILIZAŢIE ŞI SPORT"
este o revistă recunoscută de CNCSIS şi este luată în considerare în vederea avansării didactice. De asemenea, revista este acreditată de către Colegiul Medicilor din România. Un abonament anual beneficiază de 5 credite.

PALESTRICA MILENIULUI III – CIVILIZAŢIE ŞI SPORT
Redacţia revistei «Palestrica Mileniului III»
Str. Clinicilor nr.1, cod 400006, Cluj-Napoca, România,
Tel.: 0264-598575, e-mail: palestrica@gmail.com
Universitatea de Medicină și Farmacie „Iuliu Haţieganu" Cluj-Napoca,
Catedra de Fiziologie, str. Clinicilor 1, cod 400006 Tel. 0264 / 598575

TALON DE ABONAMENT 2015

„PALESTRICA MILENIULUI III – CIVILIZAŢIE ŞI SPORT"
4 NUMERE / 2015 – 100 lei

NUMELE (INSTITUŢIA).....
ADRESA: Strada..... Nr..... Bloc..... Scara..... Etaj..... Ap.....
Sector..... Localitatea..... Judeţ.....
Cod poştal..... Tel. fix..... Tel Mobil.....
Fax..... E-mail.....

Plata se va face în contul Societăţii Medicale Române de Educaţie Fizică şi Sport, CIF 26198743, Banca Transilvania, Cluj, IBAN: RO32 BTRL 0130 1205 S623 12XX (LEI), SWIFT: BTRLRO 22, cu specificaţia „Abonament la revista Palestrica Mileniului III".
Vă rugăm anexaţi xerocopia dovezii de achitare a abonamentului, de talonul de abonament şi expediaţi-le pe adresa redacţiei, în vederea difuzării revistelor cuvenite.

„PALESTRICA MILENIULUI III – CIVILIZAŢIE ŞI SPORT"
este o revistă recunoscută de CNCSIS şi este luată în considerare în vederea avansării didactice. De asemenea, revista este acreditată de către Colegiul Medicilor din România. Un abonament anual beneficiază de 5 credite.