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2

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Contents

Cuprins

Palestrica of the third millennium – Civilization and Sport
Vol. 18, no. 2, April-June 2017, 67–68

EDITORIAL

Project to set up a *Local Center for Sports Selection and Guidance*

Proiect de înfiinţare a unui *Centru local de selecţie şi orientare în sport*

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Place of the project

The creation of a Local Center for Sports Selection and Guidance in Cluj-Napoca is proposed. This will be implemented through the agreed collaboration between the Local Council Cluj-Napoca, Cluj County School Inspectorate, the Authority for Sport and Youth Cluj, "Iuliu Haţieganu" University of Medicine and Pharmacy, the Romanian Medical Society of Physical Education and Sport, the Ambulatory Sports Medicine Clinic Cluj, school medicine doctors, with the support of the Local Civic Council Cluj and other organizations.

Duration of the project

The project will be carried out over a period of 5 school years (October 2017 - June 2022), during which the first sports results can be obtained.

Aim and objectives

The aim of the project is to streamline the activity of sports clubs and implicitly, to increase sports performance among juniors and seniors, by improving the quality of human resources who practice high performance sports activities.

The main objectives are as follows:

- application of scientific selection methods;
- optimization of sports selection by improving prediction;
- reduction of sport and school dropout rates during the training process;
- selection of overgifted athletes who also possess other skills so as not to affect school performance.

Abstract

The project is necessary because of the precarious situation of high performance sport in Romania in general and in Cluj in particular. The project is aimed at optimizing the quality of high performance sport in Cluj-Napoca, a Romanian city with an important population, based on scientific criteria that are easy to apply.

Selection refers to sports that share a common core with athletics, is conducted at the age of 10-11 years (4th grade), and involves those sports which are based on the identification of exceptional motor skills that are difficult to perfect, as well as exceptional biomedical skills.

The relatively young age at which sports selection is performed, 10-11 years, generates a contradiction, due to the fact that selection precedes sports guidance, in a reversed order compared to the theory of selection and guidance in other fields of activity. For this reason, the entire sports selection and guidance action should be based on scientific criteria, applied by specialists, in order to ensure a high degree of prediction and avoid potential negative phenomena, of which dropping out of school and sport is the most serious. The selection criteria are designed so that the whole selection process spans a given, realistic time period, is feasible and as scientifically rigorous as possible. These criteria are as follows: motor, biomedical and psychological. In the system designed by us, the first two criteria are decisive, while the third one is a guiding criterion.

Presentation of the project

Methodology

a) The motor stage (specific tests)

- Organization of mobile selection teams with the necessary selection equipment, each including 2 specialized persons from sports schools.
- Scheduling of classes for the performance of motor tests based on a 50-minute teaching hour.
- Exclusion of students with medical problems from the selection system, on the teacher's recommendation.

b) The psychopedagogical stage (specific tests)

- Organization of psychopedagogical tests based on a 50-minute teaching hour.

c) The biomedical stage (subjective ex., objective ex., history, data on parents, etc.)

Scheduling of students selected based on motor and psychopedagogical criteria at the end of the daily program for a medical examination by sports doctors, in the medical offices of the schools concerned, with the support of school

doctors and of the two teachers members of the mobile selection teams.

d) Further monitoring of students participating in selection (both selected and non-selected), through the ISJ Center of Statistics, which will be created on this occasion.

NB

Sports initiated at very early ages such as gymnastics, swimming, figure skating, etc. which require special criteria are not subjected to selection.

* * *

Locul de desfăşurare

Se propune înfiinţarea la Cluj-Napoca a unui *Centru local de selecţie* şi *orientare* în *sport*. Acesta ar urma să funcţioneze într-o formă de colaborare agreată, între Consiliului Local Cluj-Napoca, Inspectoratul Şcolar Judeţean, Direcţia pentru sport şi tineret Cluj, Universitatea de Medicină şi Farmacie *Iuliu Haţieganu*, Societatea Medicală Română de Educaţie Fizică şi Sport, Ambulatorul pentru sportivi Cluj, medici de medicină şcolară, cu sprijinul Consiliului Civic Local Cluj şi alte organizaţii necesare.

Durata proiectului

Proiectul este preconizat să se desfăşoare pe o perioadă de 5 ani şcolari (octombrie 2017-iunie 2022), perioadă în care pot apărea primele rezultate sportive.

Scopul şi obiectivele

Scopul proiectului îl reprezintă creşterea randamentului cluburilor sportive, implicit a performanţelor sportive, la juniori şi seniori, prin îmbunătăţirea calităţii materialului uman care practică activităţile sportive de performanţă.

Principalele obiective sunt următoarele:

- aplicarea unor metode ştiinţifice de selecţie;
- optimizarea selecţiei în sport prin ridicarea gradului de predicţie;
- scăderea pierderilor pe parcursul procesului de antrenament, prin abandon sportiv şi şcolar;
- selecţionarea elementelor supradotate pentru sport, în combinaţie cu alte abilităţi pentru a nu deranja performanţele şcolare.

Rezumat

Proiectul este necesar datorită situaţiei precare în care se află în general sportul de performanţă din România şi în special cel clujean. Acesta vizează optimizarea calităţii sportului de performanţă, în Cluj-Napoca, municipiu din România cu un număr important de locuitori, pe bază de criterii ştiinţifice, uşor de aplicat în teren.

Selecţia se referă la sporturile care au trunchi comun cu atletismul, se aplică la vârsta de 10-11 ani (clasa a IV-a) şi vizează acele sporturi care se bazează pe identificarea calităţilor motrice de excepţie greu perfectibile şi a calităţilor biomedicale de excepţie.

Vârsta relativ timpurie la care se preconizează efectuarea selecţiei în sport, 10-11 ani, creează situaţia unei contradicţii, datorită faptului că selecţia se desfăşoară înaintea orientării în sport, în ordine inversă faţă de cum prevede teoria selecţiei şi orientării în alte domenii de activitate. Din acest motiv întreaga acţiune de selecţie şi orientare trebuie să beneficieze de criterii ştiinţifice, aplicate de specialişti, pentru a avea un grad de predicţie ridicat şi a evita fenomenele negative care pot apărea: abandonul sportiv şi abandonul şcolar care sunt cele mai grave. Criteriile de selecţie stabilite sunt astfel concepute, încât întregul proces de selecţie abordat să se încadreze într-un timp dat, realist, posibil de realizat în teren şi să aibă un caracter cât se poate de riguros ştiinţific. Aceste criterii sunt următoarele: motric, biomedical şi psihologic. În sistemul preconizat de noi, primele două au caracter decisiv, iar al treilea are caracter orientativ.

Prezentarea proiectului

Metodologia

a) Etapa motrică (Teste specifice)

- Organizarea echipelor mobile de selecţie, dotate cu aparatura de selecţie necesară, formate din câte 2 persoane specializate, de la unităţile cu profil sportiv.
- Programarea claselor în vederea efectuării probelor motrice (testele motrice) pe structura unei ore didactice de 50 minute.
- Eliminarea din sistemul de selecţie a elevilor cu probleme medicale, la recomandarea învăţătoarelor.

b) Etapa psihopedagogică (Teste specifice)

- Organizarea testărilor psiho-pedagogice pe structura orelor didactice de 50 minute

c) Etapa biomedicală (ex. subiectiv, ex. obiectiv, anamneza, date despre părinţi etc.)

Programarea elevilor selecţionaţi din punct de vedere motric şi psihopedagogic, la sfârşitul programului zilnic, în vederea efectuării unei examinări medicale, de către medicii sportivi, în cabinetele medicale ale şcolilor respective, cu sprijinul medicilor şcolari şi al celor doi profesori care fac parte din echipele mobile de selecţie.

d) Monitorizarea elevilor participanţi la selecţie (atât a celor selecţionaţi cât şi a celor neselecţionaţi momentan), în continuare prin centrul de statistică al ISJ care se înfiinţează cu această ocazie.

NB

Nu fac obiectul selecţiei sporturile cu iniţiere foarte timpurie, ca gimnastica, înotul, patinajul artistic etc., care necesită adaptări de specialitate şi speciale.

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Palestrica of the third millennium – Civilization and Sport
Vol. 18, no. 2, April-June 2017, 69–74

ORIGINAL STUDIES

Burnout syndrome in medical rehabilitation physicians working in Romania

Sindromul de burn-out în rândul medicilor de reabilitare medicală

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Abstract

Background. Burnout syndrome is a condition characterized by three dimensions: Emotional Exhaustion (EE), Depersonalization (DEP), and low Personal Accomplishment (PA).

Aims. We investigated the degree of burnout and influencing factors in Romanian rehabilitation physicians working in the public and private sectors. The design of the study was observational and cross-sectional.

Methods. The Romanian Society of Rehabilitation platform was used, where 50 registered rehabilitation medicine physicians affiliated to the Romanian Society of Rehabilitation Medicine completed the burnout inventory. The Maslach Burnout Inventory was chosen to measure burnout.

Results. Of the 50 participants, 62% (31/50) scored high levels of EE, 28% (14/50) scored average EE, while 10% (5/50) indicated low EE. Regarding DEP, 66% (33/50) scored high levels, while 34% (17/50) proved average level. PA level was high in 88% (44/50) and average in 12% (6/50). Our study suggested men were prone to higher levels of EE and DEP than women (EE: p=0.006<0.05; DEP: p=0.008<0.05). Regarding the work place, physicians working in outpatient clinics had higher EE scores then those working in a state hospital (p=0.003<0.005).

Conclusions. Burnout syndrome should be seen as a priority, as its impact on physicians also has direct negative consequences on the quality of provided healthcare services.

Key words: rehabilitation, physicians, burnout, Romania.

Rezumat

Premize. Sindromul de burn-out se caracterizează prin trei dimeniuni: epuizare emoţională (EE), depersonalizare (DEP) şi senzaţie de neîmplinire profesională (PA).

Obiective. Am evaluat dimensiunea sindromului de burn-out şi a factorilor favorizanţi în rândul medicilor de Reabilitare Medicală atât în domeniul privat, cât şi în cel de stat. Design-ul studiului a fost unul observaţional, transversal.

Metode. A fost utilizată platforma Societăţii Române de Reabilitare, unde 50 de medici de medicină de reabilitare, afiliaţi Societăţii Române de Medicină de Reabilitare, au completat chestionarul pentru sindromul de burn-out. Maslach Burnout Inventory a fost ales pentru a măsura acest sindrom.

Rezultate. Dintre cei 50 de participanţi, 62% (31/50) au înregistrat un nivel ridicat de EE, 28% (14/50) au obţinut un nivel mediu de EE, în timp ce la 10% (5/50) s-au constat valori reduse ale EE. În ceea ce priveşte DEP, 66% (33/50) au înregistrat niveluri ridicate, în timp ce 34% (17/50) s-au dovedit a fi cu nivele medii. Nivelul PA a fost ridicat în 88% (44/50) şi mediu în 12% (6/50). Studiul nostru a sugerat că bărbaţii erau predispuşi la niveluri mai ridicate de EE şi DEP decât femeile (EE: p = 0,006 <0,05; DEP: p = 0,008 <0,05). În ceea ce priveşte locul de muncă, medicii care lucrează în ambulatoriu aveau scoruri EE mai mari decât cei care lucrau pe o secţie clinică (p = 0,003 <0,005).

Concluzii. Sindromul de burnout trebuie privit ca o prioritate, deoarece impactul său asupra medicilor are consecinţe negative directe asupra calităţii serviciilor medicale furnizate.

Cuvinte cheie: reabilitare, medici, burn-out, România.

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Introduction

Burnout syndrome first gained attention in 1974, when Freudenberger referred to it as a psychosomatic condition characterized by exhaustion, interpersonal detachment and lack of the sense of accomplishment (Hillert, 2008). These defining traits have been described by Maslach and Jackson as the three component dimensions of the burnout syndrome, as follows: Emotional Exhaustion (EE), incorporating a feeling of being drained by human interaction, Depersonalization (DEP), manifesting as indifference and detachment from people, such as coworkers, clients or patients, and low Personal Accomplishment (PA), resulting in a low perception of personal professional competence and value. These dimensions are viewed as a response to the inability of coping with excessive work-related strain. A reliable evaluation of the burnout syndrome is possible using the Maslach Burnout Inventory (MBI), consisting of 22 items designed to quantify the degree of the syndrome's three inherent dimensions (Maslach & Jackson, 1986).

The causality of burnout is multifactorial. Although genetic predisposition has been hypothesized and subsequently proven to be of etiological relevance, long-term strain-inducing environmental factors, pertaining to the work place, account for the majority of cases (Bloom et al., 2012). As opposed to depression, which generally infiltrates every aspect of a person's life, burnout will tend to limit itself to a work-related context, being generated by work-related factors and manifesting mostly in a work-related setting. In this regard, occupations at risk have been identified as including work with the public, work involving extreme responsibility and severe potential consequences, as well as jobs that employees would consider to be socially stigmatizing (Maslach et al., 2001; Felton et al., 1998).

Medical personnel is particularly susceptible to burnout, with numerous studies having explored high prevalence in practicing nurses, physiotherapists and physicians (Embriaco et al., 2007; Kowalski et al., 2010; Shahriari et al., 2017). A balanced emotional state, focus, empathy, as well as willingness to improve professionally are traits that are necessary for physicians in all fields. The close and sustained interaction with patients, the unique type of responsibility, decision-making and management pertaining to the medical career offer viable premises for the development of burnout syndrome.

The field of medical rehabilitation gathers many such prerequisites and stressors that would lead to burnout. Rehabilitation is defined as "the physical restoration of a sick or disabled person by therapeutic measures and reeducation to participation in the activities of a normal life within the limitations of the person's physical disability" (***, 2015). Thus, it involves a lengthy process in which challenges regard both the medical-clinical as well as the psychological nature. The burden associated to these challenges, which directly affects patients and their caregivers, will consistently have an impact on the medical personnel as well. Whereas high income countries would strive to sustain and improve the efficiency of rehabilitation programs and benefits for people with disabilities, many other countries still exhibit a gap in efficient implementation of such incentives (Kaltenbrunner Bernitz et al., 2013). It is reasonable to assume that social, economic and legal matters, contextually specific and relatively unique to each country, have their say in the potential development of burnout in healthcare employees, as poor legislation and state support in the management of people suffering from disability will leave its mark on the workload and professional struggles of the medical staff. In this regard, it is noteworthy that factors such as high workload, low implication in decision making, poor social support from supervisors and co-workers, and a negative perception of the employing organization have all been proven to be significant risk factors for the development of burnout syndrome (Pavlakis et al., 2010; Gil-Monte et al., 1998).

The aim of our study is to investigate the prevalence and degree of burnout in Romanian registered physical rehabilitation physicians working in the public and private sectors, and to assess personal and social circumstances that might relate to our findings. Awareness of the existence and impact of burnout on the quality of medical services as well as on the health of medical personnel should lead to implementation of prevention strategies as well as therapeutic programs.

Materials and methods

The present study is observational, cross-sectional. The Maslach Burnout Inventory – Human Services Survey (MBI-HSS) was chosen to measure burnout, and a permission agreement was obtained, granting its use and delivery to the participants through the Internet. MBI-HSS comprises 22 items, and respondents mark the frequency with which they relate to each item on a 7 point Likert scale. Of the 22 items, 9 items evaluate EE, 5 items pertain to DEP and 8 items measure PA. The resulting scores for each of these three dimensions assess the level at which they manifest, as "High", "Average" or "Low", as shown in Table I (Queally, 2003).

Table I

Suggested cutoff points for MBI based on a normative sample

Level	EE Scale	DEP Scale	PA Scale
High	27-54	13-30	0-31
Average	17-26	7-12	38-32
Low	0-16	0-6	39-48

Alongside the MBI-HSS, data was collected through a survey regarding age, gender, marital status, number of children, and type of work place. Both surveys were made accessible to registered physical rehabilitation medicine physicians affiliated to the Romanian Society of Rehabilitation Medicine through the Society's online platform between September 17th 2009 and January 1st 2010. Participants gave their informed consent for their submitted results to be used in the study, anonymously. 50 surveys were completed and returned. The results of the MBI-HSS together with the survey were analyzed using SPSS, and statistical tests Kruskal-Wallis and Mann-Whitney were used to determine possible burnout differences regarding the participants' age, gender, marital status, number of children and type of employment.

Results

Of the 50 participants who completed and returned the MBI-HSS, 62% (31/50) had scores indicating a high level of EE, 28% (14/50) provided scores for a medium level of EE, while 10% (5/50) displayed results showing low EE. Regarding DEP, 66% (33/50) had scores indicating a high level of DEP, while 34% (17/50) revealed a medium level of DEP. PA was found to have a high level in 88% (44/50) and a medium level in 12% (6/50). No low levels regarding DEP and PA were identified.

Concerning gender, 76% (38/50) of participants were female, and the remaining 24% (12/50) were male. Marital status revealed that 64% (32/50) were married, whereas 36% (18/50) were not. Age was assessed using four categories: 8% (4/50) were aged between 20-29 years, 54% (27/50) were aged between 30-39 years, 30% (15/50) were aged between 40-49 years and 8% (4/50) were aged between 50-59 years. Regarding the number of children, participants with no children represented a majority of 52% (26/50), those with one child were 28% (14/50), and those with two children accounted for the remaining 20% (10/50). There were five categories describing the work place for medical rehabilitation practice, with participants being employed as follows: 28% (14/50) working in a university clinic, 36% (18/50) being employed by a state hospital, 12% (6/50) working in a balneoclimatic resort, 12% (6/50) practicing medicine in outpatient clinics and 12% (6/50) working in a private practice.

Regarding gender differences, the mean EE score for women, 27.08 ± 9.178 , was significantly lower than the mean EE score for men, which was 36.33 ± 5.914 (Mann-Whitney U test, U=107, p=0.006 <0.05). The mean DEP score for women was 14.68 ± 3.565, significantly lower than the 17.92 ± 4.122 mean DEP score for men (Mann-Whitney U test, U=111.5, p=0.008<0.05). No statistical difference was found between genders according to the PA score (Mann-Whitney U test, U=196, p=0.462>0.05). Fig. 1 shows the relationship between the participants' PA level and gender.

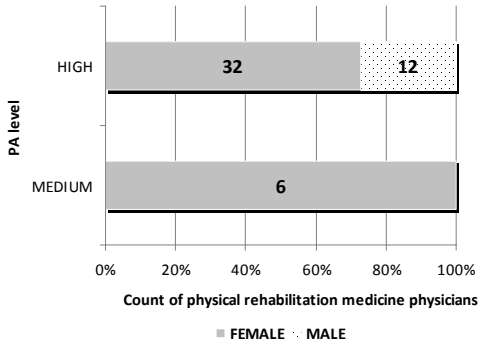

Fig. 1 – Distribution of participants according to their PA level and gender.

Regarding marital status, no statistically significant differences were found between the scores of participants who were married and those who were not married for EE (Mann-Whitney U test, U=258, p=0.542 >0.05) and DEP (Mann-Whitney U test, U=234, p=0.271>0.05). However, in the case of married participants, the mean PA score value was 27.56 ± 3.445 and proved significantly higher than the 24.44 ± 2.007 mean PA score value for those who were not married (Mann-Whitney U test, U=131.5, p=0.001 <0.05).

There were no statistically significant differences in the scores for EE (Kruskal-Wallis test, $\chi2(3)=3.232$, p=0.357>0.05), DEP (Kruskal-Wallis test, $\chi2(3)=0.918$, p=0.821>0.05) and PA (Kruskal-Wallis test, $\chi2(3)=3.232$, p=0.357>0.05) between participants belonging to the four age groups.

The number of children each participant had did not influence the total EE score (Kruskal-Wallis test, $\chi2(2)=2.498$, p=0.288>0.05) and DEP score (Kruskal-Wallis test, $\chi2(2)=4.643$, p=0.098 >0.05), but it had statistical significance in the case of PA score (Kruskal-Wallis test, $\chi2(2)=7.636$, p=0.022<0.05), as shown in Fig. 2.

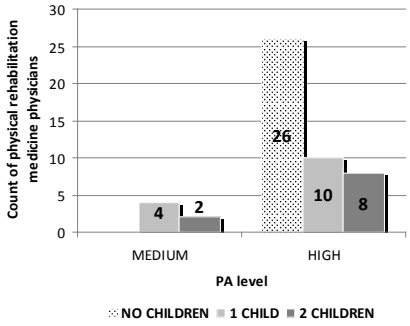

Fig. 2 – Distribution of participants according to their PA level and number of children

The mean value for PA score was 25.46 ± 4.467 in the group who had no children, 27.43 ± 3.886 in the group with one child, and 27.6 ± 3.098 for participants with two children. Comparing pairs showed that differences in PA scores were most notable between participants who had no children and those who had one or two children, as shown in Fig. 3.

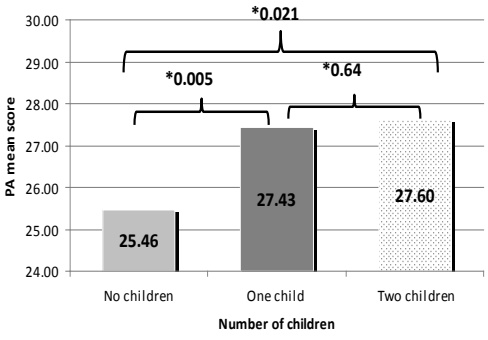

Fig. 3 – Comparison of mean PA scores according to the participants' number of children (*Mann-Whitney test: p value)

When testing for EE score differences between the five types of work place, the mean EE score for physicians working in a university clinic was 31.71 ± 8.730, it was 28.72 ± 8.910 for those working in a state hospital, 26.67 ± 5.989 for participants practicing in a balneoclimatic

resort, and 39 ± 5.404 in the case of those employed in outpatient clinics. Physicians working in a private practice had a mean value of 18.33 ± 6.346 for the EE score. Fig. 4 illustrates the distribution of participants according to their work place, based on EE levels.

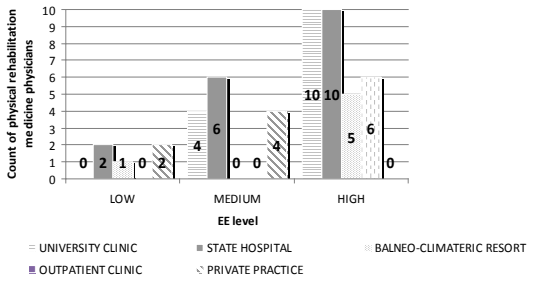

Fig. 4 – Distribution of participants according to the EE level and type of work place

There were statistically significant differences between these five groups regarding the EE score (Kruskal-Wallis test, $\chi2(4)=17.990$, $p=0.001<0.05$), more specifically for physicians working in state hospitals compared to those working in outpatient clinics, with a higher score for the latter (Mann-Whitney U test, $U=9$, $p=0.003<0.005$). Similarly, the EE score varied significantly between participants employed by university clinics versus private practices, with values indicating a greater emotional strain for the first category (Mann-Whitney U test, $U=8$, $p=0.004<0.005$). Comparing EE scores between physicians working in private practice as opposed to outpatient clinics revealed significantly higher values for the latter group (Mann-Whitney U test, $U=0$, $p=0.003<0.005$).The type of work place did not influence DEP (Kruskal-Wallis test, $\chi2(4)=5.859$, $p=0.21>0.05$) and PA scores significantly (Kruskal-Wallis test, $\chi2(4)=8.394$, $p=0.078>0.05$). These results are detailed in Table II.

Discussion

The impact of burnout is related to high absenteeism rates, increased periods of sick leave and a significant decline in job performance, thus having a negative economic impact on institutions offering healthcare. Insomnia and insufficient sleep, as well as behavioral changes, may predict onset of the syndrome (Söderström et al., 2012). Burnout is a proven risk factor for developing a number of non-communicable diseases (NCDs), such as: depression, cardiovascular disease (CVD), type 2 diabetes and other metabolic dysregulations (Pranjic et al., 2014; Melamed et al., 2006a; Toker et al., 2012; Melamed et al., 2006b; Kitaoka-Higashiguchi et al., 2009). An increase of proinflammatory cytokines as well as elevated cortisol levels in burnout patients imply that the negative consequences of burnout extend to the immune system (Mommersteeg et al., 2006; Melamed et al., 1999).

Burnout syndrome has been studied in various healthcare professionals across many fields of medical practice, with the aim of identifying risk factors and prevention strategies (Tremolada et al., 2015; Rø et al., 2008). Oncology, surgery and fields dealing with acute pathology were most sought after in investigating burnout prevalence, with relevant results. An Australian study suggests that 60% of emergency medicine professionals manifest burnout, in comparison to 38% of general physicians (Arora et al., 2013).

It is important to keep in mind that particular differences in social circumstances and medical systems between different countries will have a say in burnout prevalence, as the level of strain physicians encounter will vary according to factors that are considered to be consequences of a bigger picture including economic and geopolitical aspects. It would not be realistic to assume that a practicing physician in an ill-equipped and understaffed hospital would have a similar burnout level to that of one who is not confronted with these professional shortcomings. Burnout levels should be assessed in close relation to potential risk factors, which are not limited to the particularities of different medical fields, but extend to mirror a much broader perspective.

Our findings reveal an overall high level of burnout in physical rehabilitation medicine physicians practicing in Romania. More than half of participants had high EE, DEP, PA burnout levels, the last affecting 88% (44/50). These results should be interpreted as a warning signal, considering the health risks associated with burnout, as well as the deterioration of patient care to which it leads. Similar studies also identify burnout in physicians, but with variable frequencies and levels. An Italian study investigating burnout in healthcare professionals identified overall medium levels of EE and DEP and a low PA burnout level in physical rehabilitation physicians, values which contrast with our findings (Li Calzi et al., 2006). A more similar perspective to our own is offered by a

Table II

Comparison of EE scores according to the participants' type of work place.

Different work places for EE score	First work place type Mean value (Standard deviation)	Second work place type Mean value (Standard deviation)	Mann-Whitney test: p value (U value)
University clinic - state hospital	31.71 (8.73)	28.72 (8.91)	0.220 (94)
University clinic - balneoclimatic resort	31.71 (8.73)	26.67 (5.98)	0.132 (24)
University clinic - outpatient clinic	31.71 (8.73)	39 (5.4)	0.056 (20)
University clinic - private practice	31.71 (8.73)	18.33 (6.34)	**0.004 (8)**
State hospital - balneoclimatic resort	28.72 (8.91)	26.67 (5.98)	0.688 (48)
State hospital - outpatient clinic	28.72 (8.91)	39 (5.4)	**0.003 (9)**
State hospital - private practice	28.72 (8.91)	18.33 (6.34)	**0.023 (20)**
Balneoclimatic resort - outpatient clinic	26.67 (5.98)	39 (5.4)	**0.014 (3)**
Balneoclimatic resort - private practice	26.67 (5.98)	18.33 (6.34)	**0.024 (4)**
Outpatient clinic - private practice	39 (5.4)	18.33 (6.34)	**0.003 (0)**

Croatian study which identifies high levels of EE in 43.6%, DEP in 33.5% and PA burnout in 49.1% of the participating hospital physicians. The same study signals that moderate to severe depression was present in 12.2% of the group, drawing attention to the possible causal links between the two and the need for further investigations (Tomljenovic et al., 2014). A study in the context of a healthcare system having undergone a demanding transition through reform reflects comparable results to our own. Research conducted on hospital physicians in Bosnia and Herzegovina shows high levels of EE in 37.4%, DEP in 45.6 and PA burnout in 50.3 of participants (Selmanovic et al., 2011). Change is known to be a stress factor, as it requires adapting to a new system, and confronting the rigidity of habit.

The statistically significant gender differences found for EE and DEP levels showed that even though both men and women had high levels, the mean score for women tended to have moderate values, suggesting that men would be more prone to higher levels of EE and DEP than women. This is in contrast with an analysis stating the opposite regarding gender and also presenting young age and negative marital status as a predictive factor for burnout (Amoafo et al., 2015). Although we did not identify significant differences between age groups regarding burnout scores, negative marital status was found to be linked to a higher PA burnout level, with no significance regarding EE and DEP, showing that physicians who were not married experienced a greater degree of low esteem regarding their professional accomplishments.

The type of work place among the studied group was found to be related to the EE burnout level, but not to DEP and PA levels. This difference was significant, showing that physicians working in outpatient practice had higher levels of EE compared to those working in university clinics and private practice. This may be due to the workload pertaining to Romanian outpatient clinics. The impact of EE on physicians practicing in university clinics was higher compared to private practice. Of the five types of work place, private practice was less affected by high burnout levels. It is possible that the different management of the physicians' schedules and workload acted as a protective factor. Literature reviews have had divergent opinions regarding the impact of the work place on burnout levels. One meta-analysis would indicate lower EE levels in physicians working in inpatient compared to outpatient specialties, while another would not find any significant link between burnout and inpatient versus outpatient practice (Lee et al., 2013; Roberts et al., 2013).

The analysis of the participants' number of children with regard to the burnout level showed significant differences only regarding PA scores, with no influence on EE and DEP scores. Even though the PA burnout level was overall high, it was of statistical significance that physicians with no children had a lower score, and thus a higher level, than those with one child. This is in contradiction with the results found in a German study which suggests that the risk of EE is highest among female senior physicians who have children.

Romania ranks among the upper middle income group, according to the 2013 World Bank criteria, with a mean life expectancy of 74 years for both sexes (***, 2015b; ***, 2013). Regarding the mortality rate, a World Health Organization report (***, 2014; ***, 2005) states that NCDs account for 92%, 2% more than previously reported in 2002, with cardiovascular diseases representing a majority of 58% (***, 2015c; ***, 2014). Taking into account the very high and increasing mortality rate of NCDs and particularly CVD in Romania with the overall economic burden posed by NCDs, it is understandable why prevention strategies are needed to reduce NCD risk factors, including burnout (Kankeu et al., 2013; Bloom et al., 2011). From an economic standpoint, leading strong prevention programs to minimize risk factors of developing NCDs ensures subsequent economic growth. From the perspective of burnout syndrome affecting physicians, such prevention will also be for the benefit of patients.

Conclusions

1. The high levels of burnout found in the majority of physical rehabilitation physicians practicing in Romania draw important attention to the subsequent health risks predicted by burnout.
2. A more thorough inquiry regarding work stressors could identify key points that, if changed, could lower burnout prevalence among medical rehabilitation physicians.
3. Further studies should also focus on identifying and comparing burnout prevalence in other medical fields, as well as on investigating prevention and treatment strategies.
4. Assessing protective factors against burnout syndrome will further help implement prevention programs.
5. The issue of burnout syndrome should be seen as a priority, as its proven impact on physicians has direct consequences on the health of those affected, as well as on the quality of provided healthcare services.

Conflicts of interest

Nothing to declare.

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Estimates of dietary acrylamide exposure among Romanian kindergarten children

Estimări ale expunerii la acrilamidă dietetică în rândul copiilor din grădiniţele din România

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Abstract

Background. Acrylamide is one of the contaminants resulting from thermal processing of food products which is known to cause cancer in animals and adversely affect health in humans.

Aims. The aim of this paper is to estimate the daily intake of acrylamide (AA) in a child community and identify/quantify the major sources of dietary exposure.

Methods. A cross-sectional study was performed in one kindergarten from Cluj-Napoca, Romania, which comprised 78 children aged 4 to 6. Information regarding their food consumption in kindergarten was collected by means of food records performed 10 days/month in 6 different months (3 months in spring and three months in autumn), leading to 60 days for the assessment period.

Results. Calculated based on mean acrylamide concentrations in foods and mean consumed food amounts, the total dietary acrylamide exposure among kindergarten children evidenced a mean of 41.65 μg/day (2.22 μg/kg body weight/day) and could increase up to 136.15 μg/day (7.27 μg/kg body weight/day) for a consumer at a high percentile of the distribution (95th to 97.5th). The major foods contributing to the mean level of total dietary exposure were cereals (representing 31.1%), especially white bread (10.7%) and cream of wheat flour (9.2%), and vegetables (30.8 % of total exposure) with potatoes being the major contributor (13.9% of total exposure). The other food groups (meat, fish, meat products, sweets, oil and fats and dairy) represented one third of the mean level of daily acrylamide exposure (contributing 37.7%).

Conclusions. The results underline the importance of increasing awareness with regard to food selection and preparation techniques of food products for children in order to decrease their exposure to acrylamide.

Key words: acrylamide, dietary intake, children, dietary assessment

Rezumat

Premize. Acrilamida este unul dintre contaminanţii care rezultă din prelucrarea termică a produselor alimentare, despre care se ştie că provoacă cancer la animale şi afectează negativ sănătatea oamenilor.

Obiective. Scopul acestei lucrări este de a estima aportul zilnic de acrilamidă (AA) într-o comunitate de copii şi de a identifica/cuantifica principalele surse de expunere alimentară.

Metode. A fost realizat un studiu transversal într-o grădiniţă din Cluj-Napoca, care a inclus 78 de copii cu vârsta cuprinsă între 4 şi 6 ani. Informaţiile privind consumul lor alimentar în grădiniţă au fost colectate prin intermediul unor înregistrări ale consumului alimentar efectuate 10 zile/lună în 6 luni diferite (3 luni de primăvară şi 3 luni de toamnă), ceea ce a condus la 60 de zile pentru perioada de evaluare.

Rezultate. Calculată pe baza concentraţiilor medii de acrilamidă în alimente şi a cantităţilor medii de alimente consumate, expunerea totală a acrilamidei la copiii din grădiniţă are o valoare medie de 41,65 μg/zi (2,22 μg/kg greutate corporală/zi) şi poate creşte până la 136,15 μg/zi (7,27 μg/kg greutate corporală/zi) pentru un consumator la un percentil ridicat al distribuţiei (de la 95 la 97,5). Alimentele principale care au contribuit la media nivelului expunerii totale la alimente au fost cerealele (reprezentând 31,1%), în special pâinea albă (10,7%) şi sosul făcut din făină (9,2%) şi legumele (30,8% din expunerea totală), cartoful fiind contribuabilul major (13,9% din expunerea totală). Celelalte grupe de alimente (carne, peşte, produse din carne, dulciuri, uleiuri şi grăsimi şi produse lactate) reprezintă o treime din nivelul mediu al expunerii zilnice la acrilamidă (contribuind cu 37,7%).

Concluzii. Rezultatele subliniază importanţa creşterii nivelului de conştientizare în ceea ce priveşte selecţia alimentelor şi tehnicile de preparare a produselor alimentare pentru copii, pentru a reduce expunerea lor la acrilamidă.

Cuvinte cheie: acrilamidă, aport alimentar, copii, evaluare dietetică.

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Introduction

Acrylamide (AA) is known as an important organic compound used in the production of polacrylamides in chemical industry. It is a component of tobacco smoke and in 2002, researchers at the Swedish National Food Administration and Stockholm University reported its production as a result of high-temperature cooking (120^0C or higher) in a variety of fried and oven-baked plant-based foods which are high in carbohydrates (***, 2005).

The main route of acrylamide formation in heated food is the Maillard reaction, which also forms color and flavor. Upon heating, free asparagine reacts with reducing sugars or other carbonyl compounds to form acrylamide. Formation from wheat gluten is also possible, but it is not enough investigated (4). Concentrations are likely to represent a balance of complex competing processes of formation and destruction of AA. Most AA is accumulated during the final stages of baking, grilling or frying processes as the moisture content of the food falls and the surface temperature rises, with the exception of coffee where levels fall considerably at later stages of the roasting process. AA seems to be stable in the large majority of the affected foods, again with the exception of ground coffee for which levels can decline during storage over months (***, 2005; Sirbu, 2007; Borda & Alexe, 2011).

Neurotoxicity, adverse effects on male reproduction, developmental toxicity and carcinogenicity were identified as possible critical endpoints for AA toxicity from experimental animal studies (***, 2005; ***, 2015).

Today, AA is classified as a "probable human carcinogen" (IARC Group 2A) by the International Agency for Research on Cancer (*** 1994; ***, 2015; Rice, 2005). Dutch cohort studies have shown a significant increase in risk for ovarian and endometrial cancers (daily dietary exposure to 21 μg acrylamide or 0.32 μg/kg body weight/day) and a marginally significant increase in risk for renal cell cancer (daily dietary exposure to 21.8 μg acrylamide or 0.30 μg/kg body weight) (Hogervorst et al., 2007; Hogervorst et al., 2008).

Typically, dietary intake or exposure assessments estimate the intake of chemical contaminants by combining data from measurements of this chemical compound in various foods with data on dietary patterns in a particular region or community. In this regard, special attention should be given to specific vulnerable groups, such as infants and young children (***, 2010) (1). As their bodies are developing and they generally consume more food than adults, on a body weight basis, children are at particular risk of illness from exposure to chemical hazards including acrylamide in food (Miller, 2003). Unacceptably high exposures can be avoided when the levels of hazardous substances in food are monitored.

Hypothesis

This study aims to estimate the mean acrylamide dietary exposure per day among preschool children in Cluj-Napoca, Romania, and to identify which food categories contribute significantly to acrylamide exposure among the study sample.

Material and methods

a) Period and place of the research

A cross-sectional study was performed in one kindergarten from Cluj-Napoca, Romania. The study was approved by the management of the kindergarten.

Information regarding the food offered to the children during their program in the kindergarten (breakfast, lunch, snacks) was collected by means of food records performed 10 days/month in 6 different months (3 months in spring and three months in autumn), leading to 60 days for the assessment period.

b) Subjects and groups

The study focused on daily food consumption in the kindergarten included in the study, which comprised 78 children aged 4 to 6.

c) Tests applied

Data were drawn from food lists containing information about the food products purchased and used daily by the kindergarten canteen in order to prepare the daily menu. The daily food intake of one person for different products from different food groups was calculated by dividing the purchased quantity of each food product to the number of portions of food that were prepared daily. The daily mean consumption over the investigated period for each child was calculated by summing the values obtained for each day/person and dividing the result to the number of days of the investigation (***, 2001; Ionut et al., 2001; Coulston & Boushey, 2008).

The body weight of the children was obtained from their medical records. The mean body weight (bw) of the children was 18.73 kg (16.03 kg the lowest value and 21.43 kg the highest value).

d) Statistical processing

The mean dietary acrylamide exposure was calculated by applying a deterministic model using average food consumption levels and average AA concentrations in the relevant food products.

Due to the lack of acrylamide determination in national food, information on AA levels in food items was obtained from databases reported by the European Food Safety Authority (EFSA) based on 43,419 analytical results from food commodities collected and analyzed since 2010 and reported by 24 European countries and six food associations - including 206 samples from Romania (***, 2015) - and by The Joint FAO/WHO Expert Committee on Food Additives (based on national occurrence data on acrylamide reported by 31 countries, including 22 European countries some of which from Central and Eastern Europe) (4). The analytical determination of AA in food products reported in these two databases was performed by high-performance liquid chromatographic (HPLC) or gas chromatographic (GC) separation methods (***, 2015).

Starting from the general equation (1) for assessing dietary exposure to chemical substances, recommended by the literature (***, 2008; Kim et al., 2015), the estimated daily dietary AA intake was calculated for the main food categories: animal food (dairy, meat/poultry/fish and eggs), vegetable food groups (vegetables, fruits, cereals and pulses), sweets and dietary fats, according to the equation (2).

Dietary Exposure = Σ (Daily Food Intake × Chemical Concentration in Food) (1)

DI_{AA} = DFI X $Conc_{AA}$ /1000 (2)

DI_{AA} is the estimated daily AA intake in µg/day

DFI is the individual mean daily food intake in g/day

$Conc_{AA}$ is the mean AA concentration per food item in µg/kg

1000 for converting *kg* in *g* of food.

Chronic exposure to AA was assessed at individual level by multiplying the mean daily consumption for each food by the corresponding mean occurrence level, summing up the respective intakes throughout the diet, and finally dividing the results by the individual's body weight.

Total daily intake of AA (TDI_{AA}) summed up individual data across all food items and was expressed in µg/day as well as in µg/kg body weight/day.

Results

In Tables I, II and III the descriptive statistics for DFI (mean food intake in g/day), DI_{AA} (daily intake in µg/day) and TDI_{AA} (total daily exposure to acrylamide) data are given by food and by food subgroup.

Table I summarizes the results obtained for estimated acrylamide exposure from animal foods. The mean concentration of AA in animal food is 7.08 µg/day, but it could increase in some products according to the cooking technique, so the high percentile 95th to 97.5th corresponds to 33.28 µg/day. The main source of AA (77.68%) is represented by meat (fried or oven-roasted chicken and pork), fish (breaded fried fish) and some meat products.

Table II summarizes the results obtained for estimated acrylamide exposure from plant-based food groups (vegetables and fruits, cereals and pulses).

The mean value of AA is 25.79 µg/day, while the high percentile 95th to 97.5th is 67.29 µg/day. The main sources are: cereals 11.41 µg/day (21.77 µg/day for the high percentile 95th to 97.5th), potatoes 5.8 µg/day (19.31 µg/day for the high percentile 95th to 97.5th), fried, boiled or canned vegetables - 5.05 µg/day (11.48 µg/day for the high percentile 95th to 97.5th), and fruits (baked or canned) - 2.0 µg/day (11.75 µg/day for the high percentile 95th to 97.5th).

Table III gives the acrylamide exposure characteristics by daily intake of sweets and dietary oils and fats. The mean AA intake values for these food groups ranged between 8.78 and 35.58 µg/day (at the high percentile 95th to 97.5th), 5.55 - 16.9 µg/day for sweets with the highest values for sugar (2.89 - 9.87 µg/day), and from 3.28 to 18.68 µg/day for dietary oils and fats.

Table IV presents AA exposure per day as well as per kg of body weight for the main food groups from the children's diet, based on an average child weight of 18.73 kg. The mean exposure per day was estimated to be 41.65 µg/day, while depending on the cooking technique the amount could increase to 136.15 µg/day at high (95th to 97.5th) percentiles. This means that the mean exposure per kg of body weight was 2.22 µg/kg bw/day, while high exposure corresponding to the high (95th to 97.5th) percentiles was 7.26 µg/kg bw/day.

In Table IV and Fig. 1, food groups are also expressed as percent of total AA exposure (TDI_{AA}). Cereals and pulses (18.2% - 31.1% of TDI_{AA}) and vegetables and fruits (30.8% - 31.2% of TDI_{AA}) are the main contributor food groups to AA exposure in children. These are followed by meat, fish and meat products (13.2 % - 20.7% of TDI_{AA}), sweets (13.2% - 12.4% of TDI_{AA}), oils and fat (7.9% - 13.7% of TDI_{AA}) and dairy products (3.4 % - 3.6% of TDI_{AA}). Eggs account for low percentages (0.4 - 0.2 % of TDI_{AA}).

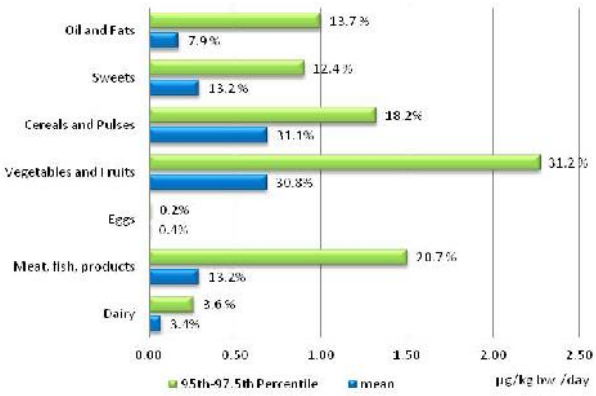

Fig. 1 – Food group contributors to estimated AA exposure (mean value and high percentile of distribution – expressed as % of TDI_{AA}).

Table I

Mean daily food intake (DFI) and estimated daily exposure (DI_{AA}) to acrylamide from animal food groups.

Food category	DFI Mean food intake (g/day)	$Conc_{AA}$* (µg/kg) Mean	$Conc_{AA}$* (µg/kg) P95th - 97.5th	DI_{AA} (µg/day) Mean	DI_{AA} (µg/day) P95th - 97.5th
Dairy	**232.1**			**1.4**	**4.87**
Milk	169.4	6	21	1.01	3.55
Yogurt	44.2	6	21	0.26	0.92
Cheese	18.5	6	21	0.11	0.38
Meat/poultry/fish	**130**			**5.5**	**28.13**
Chicken (fried, oven-roasted)	50.0	42	217	2.1	10.86
Chicken (nuggets)	13.0	42	217	0.55	2.82
Pork (oven-roasted, boiled)	31.5	42	217	1.32	6.83
Fish (breaded, fried)	2.0	64	179	0.13	0.35
Organs (liver, fried)	11.0	42	217	0.46	2,39
Meat products (sausages, ham, salami)	22.5	42	217	0.95	4.88
Eggs	**10.0**	18	28	**0.18**	**0.28**
DI_{AA} from animal food				**7.08**	**33.28**

*$Conc_{AA}$ (µg/kg) as mean and high distribution percentile (95th to 97.5th) (***, 2015) (4)

Table II

Mean daily food intake (DFI) and estimated daily AA exposure (DI_{AA}) from plant-based foods.

Food category	DFI Mean food intake (g/day)	$Conc_{AA}$* (µg/kg) Mean	$Conc_{AA}$* (µg/kg) $P95^{th}$ - 97.5^{th}	DI_{AA} (µg/day) Mean	DI_{AA} (µg/day) $P95^{th}$ - 97.5^{th}
Vegetables and fruits				12.85	42.54
Potatoes	**120.8**			**5.8**	**19.31**
French fries	8.0	308	971	2.46	7.77
Baked (with peel)	6.0	147	696	0.88	4.18
Boiled (without peel)	106.8	23	69	2.46	7.37
Vegetables (fried/boiled/canned)	**75.5**				
Cabbage	14.4				
Carrots	26.4				
Parsley	5.2				
Cauliflower	2.3				
Celery	6.4				
Eggplant	0.7	67**	152**	**5.05**	**11.48**
Green beans	3.5				
Frozen mixed vegetables	1.3				
Onion	6.7				
Garlic	0.8				
Pepper	5.3				
Spinach	2.5				
Fruits (baked/canned)	**37.2**				
Apples	36.5	54**	316**	**2.0**	**11.75**
Plums (from compote)	0.7				
Cereals and pulses				12.94	24.75
Cereals	**161.64**			**11.41**	**21.77**
White breads	106.4	42	156	4.47	16.59
Biscuits	3.34	201	810	0.67	2.7
Wheat flour (cream)	13.5	284	-	3.83	-
Corn flour	4.5	133	-	0.59	-
Crackers	2.0	231	590	0.46	1.18
Breakfast cereals	3.5	117	367	0.40	1.28
Rice	8.6	83	-	0.71	-
Pasta	19.8	13	-	0.26	-
Pulses	**6.7**			**1.53**	**2.98**
Dry beans	2.5	40	179	0.1	0.45
Peas	4.2	349	617	1.43	2.53
TDI_{AA} from the vegetable food group				**25.79**	**67.29**

*$Conc_{AA}$ (µg/kg) as mean and high distribution percentile (95^{th} to 97.5^{th}) (***, 2015) (4)

** $Conc_{AA}$ is given for the whole vegetable and fruit group because of the available information in the literature

(-) = Information not available in the literature

Table III

Mean daily food intake (DFI) and estimated daily exposure (DI_{AA}) to acrylamide from sweets ant dietary fats

Food category	DFI Mean food intake (g/day)	$Conc_{AA}$* (µg/kg) Mean	$Conc_{AA}$* (µg/kg) $P95^{th}$ - 97.5^{th}	DI_{AA} (µg/day) Mean	DI_{AA} (µg/day) $P95^{th}$ - 97.5^{th}
Sweets	**64.6**			**5.55**	**16.9**
Sugar, white, granulated	33.7	86	293	2.89	9.87
Honey	1.7	86	293	0.15	0.49
Syrup	2.4	86	293	0.20	0.7
Waffles	2.3	201	810	0.46	1.86
Muffins/sponge cake	18.1	66	219	1.19	3.96
Nesquik Chocolate Flavour	0.7	104	-	0.07	-
Plum jam	1.2	89	-	0.10	-
Chocolate	4.5	104	-	0.47	-
Dietary oils and fats	**60.2**			**3.28**	**18.68**
Vegetable oil	25.0	131	747	3.28	18.68
Butter/margarine	14.5	-	-	-	-
Cream	20.7	-	-	-	-
TDI_{AA} from sweets and fats				**8.78**	**35.58**

*$Conc_{AA}$ (µg/kg) as mean and high distribution percentile (95^{th} to 97.5^{th}) (***, 2015) (4)

(-) = Information not available in the literature

Table IV

Food group contributors to total daily exposure to acrylamide (TDI_{AA})

Food category	DI_{AA} Mean			DI_{AA} 95th – 97.5th percentile		
	µg/day	µg/kg bw/day	% of TDI_{AA}	µg/day	µg/kg bw/day	% of TDI_{AA}
Dairy	1.4	0.075	3.4	4.87	0.26	3.6
Meat, fish, products	5.5	0.293	13.2	28.13	1.50	20.7
Eggs	0.18	0.009	0.4	0.28	0.01	0.2
Vegetables/fruits	12.85	0.686	30.8	42.54	2.27	31.2
Potatoes	5.8	0.31	13.9	19.31	1.03	14.2
Cereals/pulses	12.94	0.690	31.1	24.75	1.32	18.2
White bread	4.47	0.238	10.7	16.59	0.885	12.2
Wheat flour	3.83	0.204	9.2	-	-	-
Sweets	5.5	0.293	13.2	16.9	0.90	12.4
Oil and fats	3.28	0.175	7.9	18.68	1.00	13.7
TDI_{AA}	**41.65**	**2.22**	100	**136.15**	**7.27**	100

TDI_{AA} = Total AA daily exposure

Discussions

This study focuses on the estimation of acrylamide in the diet of Romanian kindergarten children aged 4-6, because of its possible influences on their nutrition and health. Several studies worldwide have started to assess this issue, but little information is available with regard to this issue in Romania (Kim, 2015; ***, 2008; Vogt et al., 2012; ***, 2010; ***, 2015) (3). Total diet studies are designed to assess chronic dietary exposure to food chemicals (AA) actually ingested by population subgroups (***, 1992; ***, 2008). The majority of total diet studies worldwide use the point estimate (deterministic) approach to assess mean dietary exposure for a whole population. Estimates for specific population subgroups (e.g. infants or young children) can also be determined if food consumption data are available.

The estimate of mean dietary exposure to AA in the study sample was 2.22 µg/kg bw per day and for consumers at the high (95th - 97.5th) percentile the estimate of dietary exposure was 7.27 µg/kg bw per day. The European Food Safety Authority (EFSA) reports mean and 95th percentile dietary AA exposures in different countries based on several surveys performed among different age groups, which are estimated at 0.4 to 1.9 µg/kg body weight (bw) per day and 0.6 to 3.4 µg/kg bw per day, respectively (***, 2015). It can be seen that the mean dietary exposure in our sample was slightly higher than the values reported by EFSA (2.22 µg/kg bw per day vs 1.9 µg/kg bw per day), while dietary exposure at the high percentiles (P95th - 97.5th), which appears in the case of more intense cooking time and temperature, was double the values reported by EFSA (7.27 µg/kg bw per day vs 3.4 µg/kg bw per day) (***, 2015).

The Environmental Protection Agency in USA proposes the reference dose <0.002 mg/kg bw/day for oral intake of acrylamide (2). The mean exposure of our study sample was lower than this value, but for consumers at the high (95th - 97.5th) percentile the estimate of dietary exposure was more than three times higher.

The main groups of food products contributing to the mean level of acrylamide exposure are vegetal food with 1.376 µg AA/kg bw/day (61.9% of TDI_{AA}), with quite equal contributions of cereals and pulses (0.690 µg/kg bw/day), and vegetables and fruits (0.686 µg/kg bw/day). The main representatives of this group are: potatoes (13.9% of TDI_{AA}), white bread (10.7% of TDI_{AA}) and wheat flour cream (9.2% of TDI_{AA}). Bread is frequently and widely consumed (106.4 g/day), accounting for 4.47 µg AA/day (representing 10.7% of TDI_{AA}), followed by wheat flour cream with 3.83 µg AA/day. These data indicate that for frequent consumers, cream of wheat may be a substantial source of exposure to AA in the diet (0.204 µg/kg bw/day representing 9.2% of TDI_{AA}).

In the case of intense cooking time and temperature (at a high percentile of the distribution - 95th to 97.5th percentile), the highest values are registered for vegetables and fruits (especially potatoes, where a 3 times higher value is found).

Many ready-to-eat cereals are toasted, roasted or fried, and the majority of ready-to-eat cereals contain measurable levels of AA (117-367 µg/kg). In our study, the daily food intake for ready-to-eat cereals was only 3.5 g/day with a DI_{AA} between 0.40-1.28 µg/day. These data indicate that some ready-to-eat cereals can be a substantial source of exposure to AA in the diet if daily consumption is higher.

With regard to animal food groups, it can be observed that dairy products and eggs are not important sources of AA, but meat and fish provide 13.2-20.7% of the mean daily AA intake (0.293-1.5 µg/kg bw/day).

Sweets contribute 0.293 µg/kg bw/day of AA, representing 13.2% of the TDI_{AA}, while fats contribute 0.175 µg/kg bw/day, representing 7.9 % of the TDI_{AA}.

The study is subject to limitations. In our study, the food record method was applied only to diet from the canteen (the morning meal, lunch and one snack), food consumption data missing from the family environment (snacks and dinner), so we can say that the data obtained by us cannot be applied to the whole day. Moreover, the mean content of food products is based on literature data and was not determined by chemical methods in the sample of food from the kindergarten. On the other hand, given that waste at the kindergarten or individual level is not taken into account, food record data tend to slightly overestimate consumption.

Conclusions

1. The study estimates AA exposure from food intake during meals at kindergarten in Romanian children.

2. The results underline the importance of increasing awareness with regard to food selection and preparation techniques of food products for children in order to decrease their content in AA.

3. Future studies should try to monitor AA presence in different types of foods according to their preparation technique, as well as exposure of different population groups to AA in Romania.

Conflicts of interest

The authors have no conflict of interest.

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The effect of branched-chain amino acid and curcumin supplementation on exercise capacity

Efectul suplimentării cu aminoacizi cu catenă ramificată și curcumină asupra capacității de efort fizic

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Abstract

Background. Our experimental results regarding the effect of supplementation with a complex of branched-chain amino acids (BCAA) on aerobic exercise capacity as well as on serum and tissue indicators of the oxidant/antioxidant balance led us to study the effect of a BCAA and curcumin (CCR) supplement under the same conditions.

Aims. The increase in oxidative stress (OS) during intense physical exercise and the increase in antioxidant (AO) defense during moderate physical exercise led us to study the effect of BCAA and CCR supplementation on aerobic exercise capacity (AEC) and biochemical redox profile.

Methods. The research was performed in 7 groups (n=10 animals/group): group I – controls, group II – controls + exercise (5% load), group III – controls + exercise (10% load), group IV – CCR, group V – CCR + BCAA, group VI – CCR + BCAA + exercise (5% load), group VII – CCR + BCAA + exercise (10% load). AEC was determined by the swimming test; for the O/AO balance, malondialdehyde (MDA) and total sulfhydryl groups (SH) were determined.

Results. BCAA+CCR supplementation induces an increase in AEC after 28 days of BCAA and CCR administration. BCAA+CCR supplementation in sedentary animals has modulating effects on the O/AO balance, with an increase in serum and muscle OS, a stimulation of serum AO defense, and a decrease in muscle and liver AO defense. BCAA+CCR supplementation in exercise trained animals with a 5% load induces a decrease in serum and liver OS and an increase in muscle OS and AO defense, while in animals with a 10% load, it results in a decrease in muscle OS and an increase in liver OS.

Conclusions. The BCAA+CCR complex has ergotropic, trophotropic and OS reducing effects in exercise trained animals.

Key words: curcumin, amino acids, aerobic exercise capacity, oxidant/antioxidant balance, oxidative stress.

Rezumat

Premize. Rezultatele noastre experimentale privind efectul suplimentării cu un complex de aminoacizi cu catenă ramificată (BCAA) asupra capacității aerobe de efort și indicatorilor serici și tisulari ai balanței oxidanți/antioxidanți ne-au determinat să studiem și efectul unui supliment de BCAA și curcumină (CCR) în aceleași condiții.

Obiective. Creșterea stresului oxidativ (SO) în cursul efortului fizic intens și creșterea apărării antioxidante (AO) în efortul fizic moderat ne-au determinat să studiem efectul suplimentării cu BCAA și CCR asupra capacității aerobe de efort (CAE) și profilului biochimic redox.

Metode. Cercetările au fost efectuate pe 7 loturi (n=10 animale/lot): lotul I - martori, lotul II - martori + efort (încărcare 5%), lotul III - martori + efort (încărcare 10%), lotul IV - CCR, lotul V – CCR + BCAA, lotul VI - CCR + BCAA + efort (încărcare 5%), lotul VII CCR + BCAA + efort (încărcare 10%). CAE s-a determinat prin proba de înot, pentru balanța O/AO s-au determinat malondialdehida (MDA) și grupările sulfhidril totale (SH).

Rezultate. Suplimentarea cu BCAA+CCR determină creșterea CAE după administrarea timp de 28 zile cu complexul de BCAA și CCR. Suplimentarea cu BCAA+CCR la animalele sedentare are efecte modulatoare asupra balanței O/AO, cu creșterea SO la nivel seric și muscular, stimularea apărării AO la nivel seric și scăderea apărării AO la nivel muscular și hepatic. Suplimentarea cu BCAA+CCR la animalele antrenate la efort determină la animalele cu încărcare 5% scăderea SO la nivel seric și hepatic și creșterea SO și apărării AO la nivel muscular, iar la animalele cu încărcare de 10% scăderea SO la nivel muscular și creșterea SO la nivel hepatic.

Concluzii. Complexul BCAA+CCR are efecte ergotrope, trofotrope și de atenuare a SO la animalele antrenate la efort fizic.

Cuvinte cheie: curcumină, aminoacizi, capacitate aerobă de efort, balanța oxidanți/antioxidanți, stres oxidativ.

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Introduction

Curcumin (CCR) is the main active principle in the perennial plant Curcuma longa, whose rhizome has been used in Chinese and Indian medicine for more than 5000 years, the plant also being known as turmeric or Indian saffron. Curcumin extract (diferuloylmethane) is a yellow-orange water-insoluble, acetone, ethanol and dimethyl sulfoxide-soluble phytochemical component, which is present along with two other curcuminoids, demethoxycurcumin and bisdemethoxycurcumin, in the Curcuma longa rhizome.

Curcuminoids are exogenous natural antioxidants present as polyphenols in diet, in the form of a yellow pigment (Yilmaz Savcun G et al., 2013; Menon & Sudheer, 2007; Hemeida & Mohafez, 2008).

Curcumin has been used for hundreds of years as a spice (it is also known as the king of spices), a food colorant, a preservative, a source of industrial starch, a textile colorant, and in some cosmetic preparations.

Ayurvedic (traditional Indian) medicine and scientific studies over the past 20 years confirm and recommend curcumin for the prevention and treatment of many disorders.

Curcumin is considered to be the strongest natural anti-inflammatory agent, by regulation of many factors: cytokines, protein kinases, adhesion molecules, redox molecules and pro-inflammatory enzymes. Inflammation in its turn can aggravate cancer, cardiovascular diseases, diabetes, arthritis, autoimmune disorders, neurological diseases and pulmonary diseases (1).

Curcumin is a strong anticancer agent, preventing the formation and growth of tumor cells and metastasis (Kuttan et al., 2007; Tang, 2015; Sharna et al., 2004; Chen et al., 2016; Cheng et al., 2001; Shabana et al., 2015; Hadisaputri et al., 2015; Boyanapalli & Tony Kong, 2015; Guan et al., 2016).

Curcumin:

- reduces the effects of degenerative diseases, particularly Alzheimer's disease (Chen et al., 2013; Liu et al., 2014; Zhang et al., 20 06; Pulido-Moran et al., 2016; Goozee et al., 2016)
- has an anti-hyperalgesic effect (Singh & Vinayak, 2015)
- has an anti-parasitic effect (Novaes, 2016)
- protects and detoxifies hepatic cells (Hemeida & Mohafez, 2008; Pulido-Moran et al., 2016; Moghadan et al., 2015; Wang et al., 2005; Kim et al., 2016)
- has an antidepressant effect (Sanmukhani et al., 2009)
- plays a role in metabolic syndrome (Shabana et al., 2015; Boyanapalli et al., 2015; Yang et al., 2014)
- plays a role in cardiovascular disorders and reduces the risk of heart attack (Wongcharoen et al., 2012; Pulido-Moran et al., 2016)
- plays a role in digestive, gastrointestinal and hepatobiliary diseases (He et al., 2015)
- has an anti-allergic effect (Altintoprack et al., 2016; Chong et al., 2014)
- has an antifungal effect (Kim et al., 2003)

Hypothesis

Our experimental results regarding the effect of BCAA supplementation on aerobic exercise capacity as well as on serum and tissue indicators of the oxidant/antioxidant balance led us to study the effect of a BCAA and curcumin (CCR) complex under the same conditions.

We experimentally monitored the effect of supplementation with a BCAA + curcumin complex on:

- aerobic exercise capacity
- serum as well as muscle and liver tissue oxidant/antioxidant balance

Material and methods

Research protocol

a) Period and place of the research

The experimental study was performed in male Wistar rats from the Biobase of the "Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca. The rats had a mean weight of 180-190 grams and were aged 16 weeks. The study was approved by the Ethics Committee, according to the Good Practice Guidelines. It complied with the requirements of the Declaration of Helsinki, Amsterdam Protocol, Directive 86/609/EEC and the regulations of the Bioethics Committee of the "Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca. The studies were conducted in the Experimental Research Laboratory of the Physiology Department of the "Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca.

b) Subjects and groups

The determinations were performed in 7 groups of rats (n =10 animals/group):

Group I – controls
Group II – controls + exercise (5% load)
Group III – controls + exercise (10% load)
Group IV – curcumin
Group V – curcumin + BCAA
Group VI – curcumin + BCAA + exercise (5% load)
Group VII – curcumin + BCAA + exercise (10% load)

Curcumin was administered in doses of 30 mg/kg body weight/day for 28 days, by oropharyngeal gavage. The administered curcumin is produced by Secom, and the product is found under the name of "Curcumin 95" – 500 mg.

BCAA (Natural plus preparation) was administered by oropharyngeal gavage, in a dose of 0.1 ml per rat, the dose being calculated in relation to the daily dose recommended for humans. The ratio between amino acids (AA) in the preparation is 2:1:1 (1000 mg L-leucin, 500 mg L-isoleucin and 500 mg L-valin). The administered amount was 30 mg/animal/day for 28 days.

c) Tests applied

Aerobic exercise capacity (AEC) was determined by the swimming test, which was performed in a plastic pool, using the Nayanatara method (2005).

The AEC value was calculated by measuring the time period, expressed in seconds, from the introduction of the animals in the pool until their exhaustion (refusal to swim).

Exercise intensity was changed by loading the animals with different weights, 5% and 10% of the animal's weight, in the standard linear loading variant.

The duration of the experiment was 28 days. The studied days were day 1 (T1), day 14 (T14) and day 28 (T28).

Biochemical determinations were performed in the Laboratory for the Study of Oxidative Stress of the Physiology Department of "Iuliu Haţieganu" University of Medicine and Pharmacy Cluj-Napoca. For determination of the indicators of the blood O/AO balance, venous blood samples were collected from the retro-orbital sinus. From the collected blood, serum was separated by centrifugation, for the measurement of indicators.

Malondialdehyde (MDA) was measured using the fluorescence method, according to Conti et al., (1991). Concentration values were expressed in nmol/ml. Total sulfhydryl groups (SH) were determined using the Hu method (1994). Concentration values were expressed in µmol/ml.

d) Statistical processing

Statistical processing was performed with the StatsDirect v.2.7.2 software, using the OpenEpi 3.03 application and the Excel application (Microsoft Office 2010). The results were graphically represented using the Excel application (Microsoft Office 2010).

Results

a) Aerobic exercise capacity (Table I)

The statistical analysis of exercise capacity values, considering all groups, evidenced highly statistically significant differences between at least two of the groups at the time points T1, T14 and T28 ($p < 0.001$).

The statistical analysis of exercise capacity values, considering all time points, showed highly statistically significant differences between at least two of the studied time points in all groups ($p < 0.001$).

The statistical analysis of exercise capacity values for unpaired samples revealed the following:

- at T1

o highly statistically significant differences between groups III-VII ($p < 0.001$)

o statistically significant differences between groups VI-VII ($p < 0.05$)

- at T14 and T28 – highly statistically significant differences between groups III-VI, III-VII ($p < 0.001$).

The statistical analysis of exercise capacity values for paired samples evidenced the following:

- in group VI

o highly statistically significant differences between time points T1-T14 ($p < 0.001$)

o very statistically significant differences between time points T1-T28 and T14-T28 ($p < 0.01$)

- in group VII

o highly statistically significant differences between time points T1-T14 ($p < 0.001$)

o very statistically significant differences between time points T1-T28 and T14-T28 ($p < 0.01$).

b) Serum O/AO balance (Tables II and III).

The statistical analysis of MDA values, considering all groups with curcumin administration (with or without BCAA), showed very statistically significant differences between at least two of the groups ($p < 0.01$).

The statistical analysis of MDA values, considering all groups with curcumin and BCAA administration, evidenced very statistically significant differences between at least two of the groups ($p < 0.01$).

The statistical analysis of MDA values for unpaired samples indicated the following:

- highly statistically significant differences between groups IV-VI, I-V, I-IV, III-VII ($p < 0.001$)
- very statistically significant differences between groups II-VI ($p < 0.01$)
- statistically significant differences between groups V-VI, VI-VII ($p < 0.05$).

The statistical analysis of SH values, considering all groups with curcumin administration (with or without BCAA), indicated no statistically significant differences between the groups ($p > 0.05$).

The statistical analysis of SH values, considering all groups with curcumin and BCAA administration, revealed no statistically significant differences between the groups ($p > 0.05$).

The statistical analysis of SH values for unpaired samples evidenced the following:

- highly statistically significant differences between groups I-IV ($p < 0.001$)
- very statistically significant differences between groups I-V, II-VI, III-VII ($p < 0.01$).

Table I

Comparative analysis of exercise capacity values (measured in sec) in the studied groups and statistical significance.

Time point	Group	Mean	SE	Median	SD	Min.	Max.	Statistical significance (p)		
T1	II	321	10.7703	310	34.0588	290	385	T1-T14-T28	II	< 0.001
	III	292	7.0427	292.5	22.2711	255	325		III	< 0.001
	VI	329	5.1403	324	16.2549	306	358		VI	< 0.001
	VII	346	5.1876	340	16.4046	329	375		VII	< 0.001
T14	II	428	11.0000	420	34.7851	385	482	II	T1-T14	< 0.01
	III	382	11.3490	385	35.8887	335	430		T1-T28	< 0.01
	VI	442	4.6857	444	14.8174	423	465		T14-T28	< 0.001
	VII	451	4.1740	450.5	13.1993	434	475	III	T1-T14	< 0.001
T28	II	525	8.2476	524.5	26.0811	495	560		T1-T28	< 0.001
	III	503	4.8120	504	15.2169	469	520		T14-T28	< 0.001
	VI	668	15.8808	654.5	50.2195	615	780	VI	T1-T14	< 0.001
	VII	678	7.6522	679	24.1983	640	710		T1-T28	< 0.01
Statistical significance (p)	Time point	II-III-VI-VII	II-III	VI-VII	II-VI	III-VII			T14-T28	< 0.01
	T1	< 0.001	NS	< 0.05	NS	< 0.001	VII		T1-T14	< 0.001
	T14	< 0.001	< 0.01	NS	NS	< 0.001			T1-T28	< 0.01
	T28	< 0.001	< 0.05	NS	< 0.001	< 0.001			T14-T28	< 0.01

Table II

Comparative analysis of malondialdehyde values (measured in nmol/ml) in the studied groups and statistical significance.

Group	Mean	SE	Median	SD	Min.	Max.	Statistical significance (p)			
I	1.467	0.0875	1.476	0.2768	1.002	1.944	VII-V-VI-VII	< 0.01	VI-VII	< 0.05
II	1.717	0.1675	1.545	0.5298	0.979	2.697	V-VI-VII	< 0.01	II-VI	< 0.01
III	2.023	0.0676	2.130	0.2138	1.712	2.238	IV-V	NS	III-VII	< 0.001
IV	3.349	0.2197	3.397	0.6948	2.133	4.194	IV-VI	< 0.001	I-IV	< 0.001
V	2.949	0.2269	3.043	0.7175	2.051	4.046	IV-VII	NS	I-V	< 0.001
VI	2.291	0.0557	2.308	0.1762	2.050	2.546	V-VI	< 0.05	nmol/ml	
VII	3.421	0.3445	3.207	1.0895	2.297	5.316	V-VII	NS		

Table III

Comparative analysis of SH values (measured in µmol/ml) in the studied groups and statistical significance.

Group	Mean	SE	Median	SD	Min.	Max.	*Statistical significance (p)*			
I	0.128	0.0123	0.124	0.0388	0.083	0.197	IV-V-VI-VII	NS	VI-VII	NS
II	0.150	0.0076	0.154	0.0239	0.111	0.179	V-VI-VII	NS	II-VI	< 0.01
III	0.166	0.0044	0.163	0.0140	0.143	0.192	IV-V	NS	III-VII	< 0.01
IV	0.198	0.0101	0.205	0.0320	0.144	0.239	IV-VI	NS	I-IV	< 0.001
V	0.188	0.0105	0.189	0.0333	0.139	0.238	IV-VII	NS	I-V	< 0.01
VI	0.193	0.0106	0.188	0.0337	0.136	0.234	V-VI	NS	µmol/ml	
VII	0.189	0.0051	0.185	0.0160	0.175	0.224	V-VII	NS		

c) Statistical correlation analysis (Table IV) between the values of the studied indicators showed the following:

• in group VI, an acceptable positive correlation between AEC-MDA;

• in group VII, an acceptable negative correlation between AEC-MDA.

Table IV

Statistical correlation analysis between the values of the serum indicators of the O/AO balance

Items		Group VI		Group VII	
AEC	MDA	0.2675	**	-0.3567	**
	SH	0.2188	*	-0.2371	*

Correlations: **** very good, *** good, ** acceptable, * weak

Discussions

The effect of BCAA and CCR supplementation on AEC. Chronic supplementation with a BCAA and CCR complex induced at 28 days (T28): a significant increase in AEC in group VII compared to group II, and in group VII compared to group III.

BCAA and CCR supplementation in sedentary animals (group V) compared to controls (group I) induced a significant increase in MDA and SH groups.

BCAA and CCR supplementation in exercise trained animals compared to supplemented sedentary animals induced a decrease in serum MDA in group VI compared to group V.

BCAA and CCR supplementation in exercise trained animals determined the following significant changes in redox homeostasis compared to unsupplemented trained animals:

- in group VI compared to group II, an increase in serum MDA and SH was evidenced;

- in group VII compared to group III, an increase in serum MDA and SH was observed.

The comparative effect of BCAA+CCR supplementation compared to BCAA supplementation on AEC in exercise trained animals:

- in group VI compared to group V, significant increases were found at 14 days (T14) compared to initial values (T1), and at 28 days (T3) compared to values at 14 days (T2);

- in group VII compared to group VI, significant increases were found at 14 days (T2) compared to initial values (T1), and at 28 days (T3) compared to values at 14 days (T2).

The comparative effect of BCAA and CCR supplementation compared to BCAA supplementation on serum redox homeostasis in exercise trained animals:

- in group VI compared to group V, a significant increase in MDA and SH was observed;

- in group VII compared to group VI, a significant increase in MDA was detected.

The dual effect of curcumin in redox homeostasis.

Curcumin has a strong antioxidant effect by:

a) fighting oxidative stress in two ways:

- by preventing the formation of free radicals;

- by suppressing/removing the formed free radicals, particularly superoxide anion and hydroxyl radical (Thiyagarajan & Charma, 2004; Epstein et al., 2010; Jagetia & Rajanikant, 2015; Farooqui, 2016);

b) modulating AO enzymes: superoxide dismutase, catalase, glutathione peroxidase, reductase and transferase (Singh, 2015; Altintopbrak et al., 2016; El-Bahr, 2015; Panahi et al., 2016).

The pro-oxidant effect of curcumin consists of rapid production of free radicals, a dose-dependent effect (Marathe et al., 2011).

Literature data on CCR supplementation and physical exercise are available.

In athletes, an increase in physical strength and performance (Franceshi et al., 2016), no exercise-induced changes in serum and muscle OS markers (Drobnic et al., 2014); and a decrease in OS (Takashi et al., 2014; Kawanishi et al., 2013) were observed.

In animals, a protective effect against muscle damage during eccentric exercise was evidenced, independently of

redox homeostasis (Boz et al., 2014), as well as a reduction of OS (Roshan et al., 2011; Dabidi, 2013).

Although the AO effect of some complex preparations based on CCR in pathological situations is well demonstrated, under physiological physical exercise conditions, we found no evidence in this respect.

Conclusions

1. The BCAA+CCR complex induces an increase in AEC in exercise trained animals.

2. BCAA+CCR supplementation in sedentary animals has modulating effects on the O/AO balance, with an increase in serum OS levels and a stimulation of AO defense.

3. BCAA+CCR supplementation determines a decrease in serum OS in exercise trained animals with a 5% load.

4. The BCAA+CCR complex has ergotropic, trophotropic and OS reducing effects in exercise trained animals.

Conflicts of interest

Nothing to declare.

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Components of health-related fitness among children in middle school within the Bihor - Hajdú-Bihar Euroregion

Componentele de sănătate ale fitnessului fizic la elevi de gimnaziu din Euroregiunea Bihor - Hajdú-Bihar

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Abstract

Background. According to studies, young people with a high level of physical fitness present a lower risk of cardiovascular diseases, type 2 diabetes and abdominal adiposity. The reference standards of health-related components of physical fitness are directly connected to the risk of developing metabolic diseases.

Aims. We aim to assess the components of health-related fitness among middle school children in relation to their residential area.

Methods. The sample group was made up of 934 children from the Bihor-Hajdú-Bihar Euroregion (525 from the urban area and 409 from the rural area), aged between 10-15 years. The components of health-related fitness were measured using the Hungarian National Student Fitness Test (NETFIT) test battery. For comparing the frequency of the cases we used the Chi-squared test.

Results. Regarding body composition and nutritional status, in Bihor county the number of children with values within the" healthy fitness" zone - body mass index of 7.27% and percent of adipose tissue of 8.14% - was higher in the rural area than in the urban area. In Bihor county, in the case of three motor fitness tests: endurance shuttle run (10.33%), handgrip test (7.12%) and paced push-ups (0.19%), the percentage of those with values within the "healthy fitness" zone was higher among children from the rural area. In Hajdú-Bihar county, in the case of four motor fitness tests: endurance shuttle run (7.32%), trunk lift test (33.45%), standing broad jump (0.48%) and back-saver sit and reach test (15.24%), the percentage of children with values within the "healthy fitness" zone was higher among those living in the rural area.

Conclusions. In Bihor county there is a significant difference between the results from the "healthy fitness" zone and the residential environment regarding body composition ($X^2 = 4.51$, $p < 0.05$), aerobic fitness ($X^2 = 5.83$, $p < 0.05$), the paced curl-up test ($X^2 = 8.70$, $p < 0.01$) and the handgrip test ($X^2 = 3.70$, $p = 0.05$). In Hajdú-Bihar there is a significant difference between the results from the "healthy fitness" zone and the residential environment regarding the back-saver sit and reach test ($X^2 = 11.36$, $p < 0.01$), the paced curl-up test ($X^2 = 38.053$, $p < 0.01$) and the trunk lift test ($X^2 = 51.38$, $p < 0.01$).

Key words: health-related physical fitness, urban and rural, NETFIT, fitness assessment among young people

Rezumat

Premize. Potrivit studiilor, persoanele tinere cu un nivel al fitnessului fizic ridicat prezintă risc scăzut de apariție a unor boli cardiovasculare, diabet zaharat de tip 2 și a adipozității abdominale. Standardele de referință ale componentelor de sănătate ale fitnessului fizic au o legătură directă cu riscul apariției unor boli metabolice.

Obiective. Ne-am propus să evaluăm nivelul componentelor de sănătate ale fitnessului fizic la elevi din ciclul gimnazial raportat la mediul lor de reședință.

Metode. Eșantionul a fost format din 934 de copii din Euroregiunea Bihor-Hajdú-Bihar (525 din mediul urban și 409 din mediul rural), cu vârsta cuprinsă între 10-15 ani. Componentele de sănătate ale fitnessului fizic au fost măsurate cu ajutorul bateriei de teste Nemzeti Egységes Tanulói Fittségi Teszt (NETFIT). Pentru compararea frecvenței cazurilor s-a utilizat testul Chi pătrat.

Rezultate. În ceea ce privește compoziția corporală și starea de nutriție, în județul Bihor, cu 7.27% - indicele de masă corporală și cu 8.14% - procentul țesutului adipos, mai mulți elevi din mediul rural s-au situat în zona de sănătate decât cei din mediul urban. În județul Bihor, în cazul a trei teste motrice: cursa navetă de rezistență (10.33%), dinamometrie manuală (7.12%) și flotări ritmice (0.19%), procentul celor din zona de sănătate a fost mai mare la elevii din mediul rural. În județul Hajdú-Bihar, în cazul a patru teste motrice: cursa navetă de rezistență (7.32%), extensia trunchiului (33.45%), săritura în lungime fără elan (0.48%) și testul de suplețe (15.24%), procentul celor din zona de sănătate a fost mai mare la elevii din mediul rural.

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Concluzii. În județul Bihor există o diferență semnificativă între rezultatele din zona de sănătate și mediul de reședință în cazul compoziției corporale ($X^2 = 4.51$, $p < 0.05$) fitnessului aerob ($X^2 = 5.83$, $p < 0.05$) ridicărilor ritmice de trunchi din culcat dorsal ($X^2 = 8.70$, $p < 0.01$) și dinamometriei manuale ($X^2 = 3.70$, $p = 0.05$). În județul Hajdú-Bihar, există o diferență semnificativă între rezultatele din zona de sănătate și mediul de reședință în cazul testului de suplețe ($X^2 = 11.36$, $p < 0.01$), ridicărilor ritmice de trunchi din culcat dorsal ($X^2 = 38.053$, $p < 0.01$) și extensiei trunchiului ($X^2 = 51.38$, $p < 0.01$).

Cuvinte cheie: fitnessul fizic aflat în relație cu starea de sănătate, urban & rural, NETFIT, evaluarea fitnessului la tineret.

Introduction

The benefits of doing physical exercises by different categories of people are often presented in the specialized literature. Insufficient physical activity and low levels of health-related fitness among adults are associated with high levels of morbidity and mortality (Blair & Brodney, 1999).

According to the National Institute of Statistics, Romania has the lowest life expectancy, ranking 25th on the list of all 28 member states of the European Union (***, 2013a).

Epidemiological studies show that people with a high level of health-related fitness have 50% less chances to be exposed to non-communicable diseases compared to those with low levels of physical fitness (Myers et al., 2004). Teenagers with low levels of health-related fitness present a higher risk for certain cardiovascular diseases, type 2 diabetes (Moreira el al., 2011) and abdominal adiposity (Ortega et al., 2008b). Physical exercises improve self-esteem, cognitive functions and health by reducing anxiety, depression and negative emotional states (Callaghan, 2004).

According to Plowman & Meredith (2013), the duration of running a distance of 1 mile by a child offers information regarding his/her aerobic capacity, and the results can help determine whether he/she presents a low, medium or high risk of developing a cardiovascular disease. According to the same authors, adults with higher aerobic capacity are at a lower risk of developing cardiovascular diseases. The World Health Organization (***, 2013a) warns that within the last 30 years obesity among children has doubled, and one out of three children in Europe is overweight or obese.

A study of Brug et al. (2012) shows that the distribution of health-related physical fitness of students aged 10-12 is not uniform, and it is different depending on gender, ethnicity, economic status and residential environment. Other studies found that there is no significant difference of physical fitness parameters between students from urban areas and students from rural areas (Krombholz, 1997; Tsimeas et al., 2005), as well as that the living standards of students from the urban environment influence the increase of physical fitness in a positive way, to the detriment of students living in the rural environment (Reyes et al., 2003; Bathrellou et al., 2007).

Chillon et al. (2011) consider that among young people, the relation between physical fitness and their residential environment is specific to each country and region. The level of health-related fitness during childhood and preadolescence is important for adapting the interventions of public health institutions. According to Ujević et al. (2013), for youth the lack of intense physical exercises may cause the development of a sedentary lifestyle and a high health risk.

In 2013, the Cooper Institute in the USA signed a partnership agreement with the Hungarian School Sport Federation regarding the implementation of a test battery for measuring the level of health-related fitness among children in pre-university education, named the Hungarian National Student Fitness Test (NETFIT). This was created based on the Fitnessgram model, the criterion-referenced youth fitness standards that depend on age and gender offering an objective assessment of the students' fitness level.

The NETFIT test battery was developed in April-July 2013, with the contribution of 53 schools, involving 2602 students in the 5th-12th grades. According to Csányi et al. (2014), the study had the following aims:

- to determine, using Fitnessgram tests, the health-related physical fitness level for a representative sample group selected randomly from schools in Hungary;
- to clinically identify metabolic syndrome based on lab analyses concerning body composition and the risk of developing cardiovascular diseases;
- to assess the validity of the Fitnessgram test battery;
- to assess the validity of the Fitnessgram test battery using field measurements and lab measurements;

Kaj et al. (2014) have proposed that depending on the results of the measurements, interpretation should be performed by distributing them into two or three action zones: the "healthy fitness" zone (HFZ), the "to be improved" zone (TIZ) and the "to be strongly improved" zone (SIZ) (high risk of developing diseases).

According to the Cooper Institute, in the case of the NETFIT test battery, the interpretation of motor fitness results must use a criterion-referenced standard, named health standard, according to age and gender. These health standards correspond to a minimum motor performance necessary to avoid some risks of developing diseases that occur as a result of physical inactivity.

Kaj et al. (2014) describe 4 NETFIT components of health-related fitness: body composition and nutrition status, aerobic fitness, musculoskeletal fitness, and flexibility (Table I).

Although in some countries there are studies regarding the relation between physical fitness and health (Ortega et al., 2008b; Milne et al., 2016), these are absent in Romania. Based on the study performed by Lukács & Hanțiu (2017) during the 2014-2015 academic year, as a result of the closeness of the obtained motor values in subjects from the Euroregion, we considered that based on the fitness values that were found, the subjects can be included into different action zones, just like in the case of applying NETFIT in Hungary or the Fitnessgram model in more than 14 countries all over the world.

Aims

The goal of this study was to assess the components of health-related fitness among middle school students from the Bihor - Hajdú-Bihar Euroregion using the NETFIT test battery, and to compare the obtained results according to their residential environment.

Hypothesis

The hypothesis of our research was that among middle school students from this Euroregion there are differences between the components of health-related fitness depending on the students' residential environment.

Material and methods

The study was approved by the Bihor County School Inspectorate (approval no. 13973/04.11.2014) and written requests were sent to six educational institutions from Hajdú-Bihar county. At the same time, the Hungarian School Sport Federation consented verbally to the use of the NETFIT test battery in both counties.

The performed measurements represent a component of the doctoral study program. The parents/custodians of the subjects gave their consent for the subjects to participate in the study.

Research protocol

a) Period and place of the research

The transversal study took place from February to May during the 2014-2015 academic year, according to the following schedule: February: 5th graders, March: 6th graders, April: 7th graders, and May: 8th graders. The measurements in six schools from Hajdú-Bihar county: "Benedek Elek" Elementary School in Debrecen, "Svetits" Elementary School in Debrecen, "Karácsony Sándor" Elementary School in Debrecen, "II. Rákóczi Ferenc" Elementary School in Konyár, "Irinyi Károly" Elementary School in Esztár, and "Bessenyei György" Elementary School in Furta, were performed in collaboration with the teachers of the classes, and we considered that measurements should be performed simultaneously in nine institutions from Bihor county as well: "Iosif Vulcan" National College in Oradea, "Szent László" Roman Catholic Theological High School in Oradea, "Dimitrie Cantemir" School with 1st-8th Grades in Oradea, "Szalárdi János" Theological High School in Sălard, "Gáspár András" Middle School in Biharia, "Benedek Elek" Middle School in Cetariu, Middle School No.1 in Santandrei, Middle School No.1 in Nojorid, and Middle School No.1 in Tarian.

b) Subjects and groups

The received data show that the measurements were performed in 934 students (474 in Bihor county and 460 in Hajdú-Bihar county; 473 girls and 461 boys; 525 from urban environment and 409 from rural environment), aged between 10-15 years. The schools participating in the study were selected both from urban areas (3 from Bihor county and 3 from Hajdú-Bihar county) and rural areas (6 from Bihor county and 3 from Hajdú-Bihar county). Table II presents the numerical and percentage distribution of the subjects according to grade, gender and residential environment.

c) Tests applied

The assessment of the subjects from a somatic and motor point of view was performed using the NETFIT test battery, which is similar to EUROFIT. This consisted of 3 somatic measurements (height, weight, percentage of adipose tissue) and 7 motor tests (endurance shuttle run, paced curl-ups, trunk lifts, paced push-ups, handgrip, standing broad jump, back-saver sit and reach). All the obtained data were registered in records.

Somatic measurements were performed using the Seca

Table I

NETFIT components of health-related fitness

Components of health-related fitness	Name of the test	Study area
Body composition and nutritional status	Weight measuring Height measuring	Body Mass Index
	Measuring the percentage of adipose tissue	Percentage of adipose tissue
Aerobic fitness	Endurance shuttle run (15 m or 20 m)	Aerobic capacity
Musculoskeletal fitness	Paced curl-ups	Abdominal muscle strength and endurance
	Trunk lift	Trunk muscle strength
	Paced push-ups	Upper body muscle strength
	Handgrip test	Handgrip strength
	Standing broad jump	Explosive leg strength
Flexibility	Back-saver sit and reach	Knee and hip mobility

(Kaj et al., 2014)

Table II

Distribution of subjects according to grade, gender and residential environment

Grade	Bihor								Hajdú-Bihar							
	Girls		Boys		Urban		Rural		Girls		Boys		Urban		Rural	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
5th	65	13.71	62	13.08	78	16.46	49	10.34	57	12.39	66	14.35	82	17.82	41	8.91
6th	73	15.41	64	13.50	76	16.03	61	12.87	68	14.78	68	14.78	81	17.61	55	11.96
7th	62	13.08	48	10.12	53	11.18	57	12.03	61	13.26	56	12.18	62	13.48	55	11.96
8th	49	10.34	51	10.76	54	11.39	46	9.70	38	8.26	46	10	39	8.48	45	9.78
Total	249	52.54	225	47.46	261	55.06	213	44.94	224	48.69	236	51.31	264	57.39	196	42.61

Table III

Action zones regarding body composition and nutritional status depending on age and gender.

Age	Body mass index (kg/m²)				Percentage of adipose tissue (%)			
	THN	HFZ	TIZ	SIZ	THN	HFZ	TIZ	SIZ
				Girls				
10	≤14.8	14.9-20.1	20.2-24.5	24.6≤	≤11.5	11.6-24.3	24.4-32.9	33.0≤
11	≤15.3	15.4-21.0	21.1-25.8	25.9≤	≤12.1	12.2-25.7	25.8-34.4	34.5≤
12	≤15.9	16.0-22.0	22.1-26.9	27.0≤	≤12.6	12.7-26.7	26.8-35.4	35.5≤
13	≤16.6	16.7-22.8	22.9-27.9	28.0≤	≤13.3	13.4-27.7	27.8-36.4	36.5≤
14	≤17.2	17.3-23.5	23.6-28.6	28.7≤	≤13.9	14.0-28.5	28.6-36.7	36.8≤
15	≤17.7	17.8-24.0	24.1-29.1	29.2≤	≤14.5	14.6-29.1	29.2-37.0	37.1≤
				Boys				
10	≤14.8	14.9-20.1	20.2-24.4	24.5≤	≤8.8	8.9-22.4	22.5-33.1	33.2≤
11	≤15.2	15.3-20.8	20.9-25.5	25.6≤	≤8.7	8.8-23.6	23.7-35.3	35.4≤
12	≤15.6	15.7-21.4	21.5-26.4	26.5≤	≤8.3	8.4-23.6	23.7-35.8	35.9≤
13	≤16.1	16.2-22.2	22.3-27.2	27.3≤	≤7.7	7.8-22.8	22.9-34.9	35.0≤
14	≤16.7	16.8-22.9	23.0-27.9	28.0≤	≤7.0	7.1-21.3	21.4-33.1	33.2≤
15	≤17.3	17.4-23.5	23.6-28.5	28.6≤	≤6.5	6.6-20.1	20.2-31.4	31.5≤

Key: THN = thin, HFZ = "healthy fitness" zone, TIZ = "to be improved" zone, SIZ = "to be strongly improved "zone

Table IV

Action zones for aerobic fitness according to age and gender

Age	SIZ		TIZ		HFZ	
	TD	VO_2max ml/kg/min	TD	VO_2max ml/kg/min	TD	VO_2max ml/kg/min
			Girls			
10	≤9	≤37.3	10-16	37.4-40.1	17≤	40.2≤
11	≤9	≤37.3	10-16	37.4-40.1	20≤	40.2≤
12	≤14	≤37.0	15-22	37.1-40.0	23≤	40.1≤
13	≤16	≤36.6	17-24	36.7-39.6	25≤	39.7≤
14	≤18	≤36.3	19-26	36.4-39.3	27≤	39.4≤
15	≤21	≤36.0	22-30	36.1-39.0	30≤	39.1≤
			Boys			
10	≤9	≤37.3	10-16	37.4-40.1	17≤	40.2≤
11	≤12	≤37.3	13-19	37.4-40.1	20≤	40.2≤
12	≤16	≤37.6	17-23	37.7-40.2	24≤	40.3≤
13	≤22	≤38.6	23-29	38.7-41.0	30≤	41.1≤
14	≤28	≤39.6	29-35	39.7-42.4	36≤	42.5≤
15	≤34	≤40.6	35-41	40.7-43.5	42≤	43.6≤

Key: TD = traveled distance x 20 meters

Table V

HFZ standards for musculoskeletal fitness and flexibility according to age and gender

Age	HG (kg)		SBJ (cm)		PP (no.rep.)		PCU (no.rep.)		TL (cm)		BSSR (cm)	
	G	B	G	B	G	B	G	B	G	B	G	B
10	14.5≤	18.0≤	125≤	128≤	7≤	7≤	12≤	12≤	23-30	23-30	23≤	20≤
11	15.0≤	18.5≤	130≤	135≤	7≤	8≤	15≤	15≤	23-30	23-30	25≤	20≤
12	15.5≤	19.0≤	133≤	148≤	7≤	10≤	18≤	18≤	23-30	23-30	25≤	20≤
13	16.0≤	20.0≤	135≤	160≤	7≤	12≤	18≤	21≤	23-30	23-30	25≤	20≤
14	16.5≤	23.5≤	137≤	171≤	7≤	14≤	18≤	24≤	23-30	23-30	25≤	20≤
15	17.5≤	27.5≤	139≤	180≤	7≤	16≤	18≤	24≤	23-30	23-30	31≤	20≤

Key: G = girls; B = boys; HG = handgrip; SBJ = standing broad jump; PP = paced push-ups; PCU = paced curl-ups; TL = trunk lift; BSSR = back-saver sit and reach; no.rep. = number of repetitions

213 (Marsden UK) height measure and the Omron BF511 monitor (Omron Corporation, Kyoto, Japan), which uses the BIA (bioelectrical impedance analysis) method to determine the weight and percentage of adipose tissue of the body.

The *endurance shuttle run test* and the *standing broad jump test* were similar to those of the Eurofit test battery. In order to perform these two tests we used the following instruments: measuring tape, chalk/poles, CD player, audio CD and speakers.

When measuring *handgrip strength*, the subjects had to squeeze the handle of the dynamometer twice with each hand, and the result was considered to be the average value of the two best attempts. The measurement was performed with a Takei dynamometer with adjustable handles (Scientific Instruments, Niigata, Japan).

The *paced curl-up test* measures the endurance and strength of the abdominal muscles. Each curl-up was

executed in three seconds: up-down-one, up-down-two, etc., and it was marked by an audio signal. Materials used: isoprene foam mattresses, guidance tapes, CD player, audio CD and speakers.

The *paced push-up test* measures the strength and endurance of the upper body muscles. The rhythm of execution is identical to that of the previous test. Materials used: CD player, audio CD and speakers.

The *trunk lift test* measures the strength of the back muscles. Materials used: mattress, chalk and ruler. The subject had to lie face down on the mattress with their arms stretched, hands under their thighs, legs and head stuck to the mattress, after which they had to execute a slight and controlled lift of their backs with their eyes focused on a point marked with chalk on the mattress (in order to avoid extension of the head). The distance between the subject's chin and the floor was measured in centimeters and noted down.

The *back-saver sit and reach test* is based on the mobility of the knee and hips. To measure this we used a metal box marked from 0 to 50 cm. The students had to bend their trunk forward three times keeping their backs straight, and at the fourth bending they had to place their fingers the farthest possible on the measuring instrument and maintain their position for a few seconds in order to note down the results. After the first execution, the stretched leg became the bent leg and the same measurement was performed again using the same method. Both results were read in centimeters, after which the average value of the two executions was calculated.

In NETFIT, the reference table by age and gender of the International Obesity Task Force (IOTF) was used to interpret the BMI, and according to Kaj et al. (2014), for analyzing the results regarding the percentage of adipose tissue of the body, the reference table of Laurson et al. (2011) was used.

In order to analyze the results regarding BMI values, the percentage of adipose tissue and the endurance shuttle run test, the authors propose the intervention in three action zones: HFZ, TIZ and SIZ by age and gender of the subjects (Tables III and IV).

For the motor tests regarding musculoskeletal fitness and flexibility, two action zones were proposed: HFZ and TIZ. Motor performances lower than those presented in Table V fall into TIZ.

d) Statistical processing

The data obtained from individual measurements were statistically processed, and based on the Chi-squared test with two nominal variables we compared the case frequencies of subjects with the frequencies depending on their residential environments. Case frequencies were analyzed separately for the two counties. The values of the Chi-squared test were determined using association tables that included the parameters: urban/rural and healthy/to be improved. A confidence interval of 95% was used.

Results

The registered data gathered from the measurements show that the numerical and percentage distribution of the resulting values, as well as the relationship between the residential environment and the action zones is as presented in Tables VI and VII.

Regarding *Body Mass Index*, it can be seen that in Bihor county 182 students (69.73%) from urban environment and 164 students (77%) from rural environment fall into the HFZ, while in Hajdú-Bihar county 187 students (70.83%) from urban environment and 138 students (70.41%) from rural environment fall into this zone. Based on the Chi-squared test, it can be established that regarding distribution in the two action zones, there are no significant differences between the observed frequencies and the expected frequencies in the case of students from urban environment and students from rural environment from Bihor ($X^2 = 2.85$, $p = 0.092$) and Hajdú-Bihar county ($X^2 = 0.0005$, $p = 0.981$).

Regarding the *percentage of adipose tissue*, in Bihor county 165 students (63.22%) from urban areas and 152 students (71.36%) from rural areas fall into the HFZ, while in Hajdú-Bihar county 185 students (70.07%) from urban areas and 129 students (65.82%) from rural areas fall into the same zone. Regarding the percentage of adipose tissue, in Bihor county there is a significant difference between the residential environment and the action zones ($X^2 = 4.51$, $p < 0.05$), while in the case of students from Hajdú-Bihar county this difference is insignificant ($X^2 = 1.29$, $p = 0.256$).

The information regarding the *endurance shuttle run test* shows that out of all 474 students from Bihor county, 174 students (66.67%) from urban environment and 164 (77%) from rural environment fell into the HFZ, while in Hajdú-Bihar 145 students (54.92%) from urban environment and 122 students (62.24%) from rural environment had values within this zone. Regarding the HFZ and aerobic capacity, in Bihor county there were significant differences between the observed frequencies and expected frequencies in the case of students from urban environment and students from rural environment ($X^2 = 5.83$, $p = 0.016$), while in the case of students from Hajdú-Bihar county, the difference was insignificant ($X^2 = 2.52$, $p = 0.112$).

In the *paced curl-up test*, 246 students (94.25%) from urban areas and 185 students (86.85%) from rural areas in Bihor county fell within the HFZ, while in Hajdú-Bihar county, 243 students (92.04%) from urban areas and 137 students (69.90%) from rural areas had values within this zone. Regarding the classification of the results into action zones, in both counties there was no significant association between the observed and the expected frequencies in the case of students from urban and rural environment: Bihor county: ($X^2 = 8.70$, $p = 0.003$); Hajdú-Bihar county ($X^2 = 38.05$, $p < 0.001$).

For the *trunk lift* test, the distribution of HFZ students was as follows: in Bihor 188 students (72.03%) from urban areas and 153 students (71.83%) from rural areas, while in Hajdú-Bihar, 107 students (40.53%) from urban areas and 145 students (73.98%) from rural areas. In Bihor county there was no significant association ($X^2 = 0.0003$, $p = 0.986$), while in Hajdú-Bihar county there was a significant association ($X^2 = 51.38$, $p < 0.001$) between the residential environment and the results of the trunk lift test.

There were 149 students (57.09%) from urban environment and 122 students (57.28%) from rural environment in Bihor county versus 182 students (68.94%)

from urban environment and 129 students (65.82%) from rural environment in Hajdú-Bihar county with values within the HFZ in the *paced push-up* test. There was no significant association between the residential environment and the results of the paced push-up test either in Bihor county ($X^2 = 0.0006$, $p = 0.98$), or in Hajdú-Bihar county ($X^2 = 0.57$, $p = 0.449$).

In the *handgrip test*, 213 students (81.61%) from urban environment and 189 students (88.73%) from rural environment in Bihor county compared to 239 students (90.53%) from urban environment and 174 students (88.78%) from rural environment in Hajdú-Bihar county had values within the health zone. In Bihor county, there was a significant difference between the observed and expected frequencies in the case of students from urban and rural areas regarding the distribution of the handgrip test by action zones ($X^2 = 3.70$, $p = 0.05$), while in Hajdú-Bihar there was no significant difference ($X^2 = 0.35$, $p = 0.55$).

Regarding the *standing broad jump test*, in Bihor county there were 201 students (77.01%) from urban environment and 150 students (70.02%) from rural environment with results falling within the health zone, while in Hajdú-Bihar the respective numbers were 190 students (71.97%) from urban environment and 142 students (72.45%) from rural environment. Concerning the classification of the standing broad jump test into action zones, there were no significant differences between the observed and expected frequencies in the case of students from urban and rural environment either in Bihor ($X^2 = 2.73$, $p = 0.09$) or in Hajdú-Bihar county ($X^2 = 0.07$, $p = 0.7887$).

Concerning the *back-saver sit and reach test*, in Bihor county there were 36 students (13.79%) from the urban area and 18 students (8.45%) from the rural area with results falling within the HFZ, while in Hajdú-Bihar county there were 147 students (55.68%) from urban environment and 139 students (70.92%) from rural environment falling in this zone. In Bihor county there was no significant association ($X^2 = 2.67$, $p = 0.10$), while in Hajdú-Bihar county ($X^2 = 11.36$, $p < 0.01$) there was a significant association between the residential environment and the back-saver sit and reach test results.

In Bihor county there were no significant differences between the distribution of the HFZ and the residential environment in the case of BMI ($X^2 = 2.85$, $p = 0.092$), the trunk lift test ($X^2 = 0.0003$, $p = 0.986$), paced push-ups ($X^2 = 0.0006$, $p = 0.98$), standing broad jump ($X^2 = 2.73$, $p = 0.09$) and the back-saver sit and reach test ($X^2 = 2.66$, $p = 0.10$).

In Bihor county there was a significant difference between the distribution of the HFZ and the residential

Table VI

Numerical and percentage distribution of subjects from Bihor county according to action zones depending on their residential environment and test results

Test name	Bihor n = 474								Chi-squared test	P
	Urban n = 261				Rural n = 213					
	HFZ		TIZ		HFZ		TIZ			
	N	%	N	%	N	%	N	%	X^2	
BMI	182	69.73	79	30.27	164	77.00	49	23.00	2.85	0.09
% AT	165	63.22	96	36.78	152	71.36	61	28.64	4.51*	< 0.05
ESR(VO_2max)	174	66.67	87	33.33	164	77.00	49	23.00	5.83*	0.02
PCU (n)	246	94.25	15	5.75	185	86.85	28	13.15	8.70*	< 0.01
TL (cm)	174	66.67	87	33.33	135	63.38	78	36.62	0.0003	0.99
PP (n)	149	57.09	112	42.91	122	57.28	91	42.72	0.0006	0.98
HG (kg)	213	81.61	48	18.39	189	88.73	24	11.27	3.70*	0.05
SBJ (cm)	201	77.01	60	22.99	150	70.42	63	29.58	2.73	0.09
BSSR (cm)	36	13.79	225	86.21	18	8.45	195	91.55	2.67	0.10

*significant difference $p < 0.05$; ** significant difference $p < 0.01$

Table VII

Numerical and percentage distribution of subjects from Hajdú-Bihar county according to action zones depending on their residential environment and test results

Test name	Bihor n = 474								Chi-squared test	P
	Urban n = 261				Rural n = 213					
	HFZ		TIZ		HFZ		TIZ			
	N	%	N	%	N	%	N	%	X^2	
BMI	182	69.73	79	30.27	164	77.00	49	23.00	2.85	0.09
% AT	165	63.22	96	36.78	152	71.36	61	28.64	4.51*	< 0.05
ESR(VO_2max)	174	66.67	87	33.33	164	77.00	49	23.00	5.83*	0.02
PCU (n)	246	94.25	15	5.75	185	86.85	28	13.15	8.70*	< 0.01
TL (cm)	174	66.67	87	33.33	135	63.38	78	36.62	0.0003	0.99
PP (n)	149	57.09	112	42.91	122	57.28	91	42.72	0.0006	0.98
HG (kg)	213	81.61	48	18.39	189	88.73	24	11.27	3.70*	0.05
SBJ (cm)	201	77.01	60	22.99	150	70.42	63	29.58	2.73	0.09
BSSR (cm)	36	13.79	225	86.21	18	8.45	195	91.55	2.67	0.10

* significant difference $p < 0.05$; ** significant difference $p < 0.01$

Key: HFZ = HFZ + the "thin" subzone (only in the case of BMI and %AT); TIZ = TIZ + SIZ (only in the case of BMI, %AT and ESR); ESR = endurance shuttle run; PCU = paced curl-up test; TL = trunk lift; PP = paced push-ups; HG = handgrip test; SBJ = standing broad jump; BSSR = back-saver sit and reach

environment in the case of the percentage of adipose tissue ($X^2 = 4.51$, $p < 0.05$), endurance shuttle run ($X^2 = 5.83$, $p = 0.016$), paced curl-ups ($X^2 = 8.70$, $p = 0.003$) and handgrip ($X^2 = 3.70$, $p = 0.05$).

In Hajdú-Bihar county there was no significant difference between the distribution of the HFZ and the residential environment in the case of BMI ($X^2 = 0.0005$, $p = 0.981$), the percentage of adipose tissue ($X^2 = 1.29$, $p = 0.256$), the endurance shuttle run test ($X^2 = 2.52$, $p = 0.112$), paced push-ups ($X^2 = 0.57$, $p = 0.449$), handgrip ($X^2 = 0.35$, $p = 0.55$), and the standing broad jump ($X^2 = 0.07$, $p = 0.7887$).

In Hajdú-Bihar county there was a significant difference between the distribution of the HFZ and the residential environment in the case of three tests: paced curl-ups ($X^2 = 38.053$, $p< 0.001$), trunk lift ($X^2 = 51.38$, $p < 0.001$) and back-saver sit and reach test ($X^2 = 11.36$, $p < 0.01$).

Discussions

According to the *Alimentación y Valoración del Estado Nutricional en Adolescentes: Food and Assessment of the Nutritional Status of Spanish Adolescents* (AVENA), *European Youth Heart Study* (EYHS) and *Healthy Lifestyle in Europe by Nutrition in Adolescence* (HELENA) studies, health related fitness is a fundamental health factor in childhood and adolescence.

NETFIT has the advantages of using criterion referenced standards which reflect the fitness level necessary to enjoy good health and to avoid the development of certain metabolic diseases. The goal of teachers is to maintain students within the HFZ or to help them get out of TIZ. Parents can be informed about the results obtained by their children and they can contribute to their education and guidance in order to optimize their physical fitness.

The study of De Miguel-Etayo et al. (2014) was one of the first studies in Europe meant to establish the health-related fitness reference standards according to age and gender for children aged between 6-10.9 years.

The results of the study performed by Chillon et al. (2011) show the differences between the components of health-related fitness values among Spanish children from urban environment and rural environment. It was established that students from rural environment had a lower BMI or percentage of adipose tissue, a higher level of aerobic fitness, and higher values of handgrip strength compared to children from urban environment (differences between average values: 1.1 kg, 0.3 kg/m^2 and 4.9 mm, 1.5 ml/kg/min, 0.8 kg). On the other hand, students from rural environment had lower flexibility and a lower number of repetitions in the case of curl-ups (differences between average values = 0.9 cm, 0.9 sec) (n=2569, age 7-16).

In Bihor county the results of the endurance shuttle run test and the handgrip test obtained by girls from urban environment were better by 0.28 ml/kg/min; 1.68 kg less compared to the results of girls from rural environment. Among boys, this difference was 2.63 ml/kg/min; 1.99 kg in favor of those living in rural environment.

In the case of body composition and nutritional status, in Bihor county the difference between students from urban environment and those from rural environment regarding their inclusion in the HFZ was 7.27% (BMI) and 8.14% (AT) in favor of students from rural environment. In Hajdú-Bihar county the difference was 0.42% (BMI) and 4.25% (AT) in favor of students from urban environment.

According to the study performed by Novak et al. (2015), students from urban areas in Croatia showed better speed, flexibility and explosive strength than those living in rural areas (n=9164, age 11-14).

In Bihor county, in the case of three motor tests: endurance shuttle run test (10.33%), handgrip test (7.12%) and paced push-up test (0.19%), the percentage of those from the HFZ was higher for students living in the rural area. In the case of four motor tests: paced curl-ups (7.4%), trunk lift (3.29%), standing broad jump (6.59%) and back-saver sit and reach test (5.34%), the results were in favor of students living in urban areas.

In Hajdú-Bihar county, in the case of four motor tests: endurance shuttle run test (7.32%), trunk lift (33.45%), standing broad jump (0.48%) and back-saver sit and reach test (15.24%), the percentage of those with results within HFZ was higher for students living in rural environment. In the case of three motor tests: paced curl-ups (22.15%), paced push-ups (3.12%) and handgrip test (1.75%), the results were in favor of students from urban environment.

In the seven NETFIT motor tests, the percentage of students with results falling within the HFZ was between 11.39% and 90.93% in Bihor, and between 54.78% and 89.78% in Hajdú-Bihar.

Conclusions

1. In Bihor county there is a significant difference between the results from the HFZ and the residential environment regarding the following components of health-related fitness: body composition ($X^2 = 4.51$, $p < 0.05$), aerobic fitness ($X^2 = 5.83$, $p < 0.05$) and the musculoskeletal fitness component through two tests: the paced curl-up test ($X^2 = 8.70$, $p < 0.01$), and the handgrip test ($X^2 = 3.70$, $p = 0.05$).

2. In Hajdú-Bihar county there is a significant difference between the results from the HFZ and the residential environment regarding flexibility ($X^2 = 11.36$, $p < 0.01$) and the musculoskeletal fitness component through two tests: the paced curl-up test ($X^2 = 38.053$, $p < 0.01$) and the trunk lift test ($X^2 = 51.38$, $p < 0.01$).

3. We think that it is necessary to assess the components of health-related fitness in Romania as well, in a way similar to FITNESSGRAM or NETFIT, and also to establish the criterion reference standards and, implicitly, the action zone specific for them. For this purpose we propose for this study to be performed on a sample group representative for Romania.

Conflicts of interests

The authors declare no conflict of interests.

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CASE STUDIES

Rehabilitation treatment of a patient with a hybrid hip endoprosthesis after osteosarcoma of the proximal femur - a case report

Tratamentul de recuperare al unui pacient cu endoproteză hibrid de șold post osteosarcom al femurului proximal - prezentare de caz

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Abstract

Background. Osteosarcoma is the most frequent primary bone tumor found in adolescents, the proximal femur being the fourth most frequent location of osteosarcoma. The rehabilitation of patients with osteosarcoma starts during the preoperative stage with a view to reducing the associated costs and pain, facilitating the early restoration of the function of the affected limb and the increase in the quality of life of these patients. The postoperative rehabilitation program is intense and can last up to one year according to some authors, its main objectives being: amelioration of pain, improvement of the range of motion and muscle tone, treatment of scars, prescription of medical devices, and improvement of the quality of life.

Aim. The aim of this study was to present the case of a 38-year-old patient with a hybrid endoprosthesis of the left coxofemoral joint for an osteosarcoma located in the lesser trochanter of the femur, in order to establish an adequate rehabilitation treatment.

Methods. The patient was diagnosed 16 years before with an osteosarcoma located in the lesser trochanter of the femur, for which he received neoadjuvant chemotherapy and surgical treatment with the resection of the proximal 1/3 of the femur, followed by arthroplasty.

Due to the ascent of the endoprosthesis, about 8 years later, revision surgery with a hybrid total endoprosthesis was performed.

The patient presented to the Clinical Rehabilitation Hospital Cluj-Napoca in March 2017, complaining of muscle weakness and decreased range of motion in the left hip, the tests applied being suggestive in this respect.

Results. The initiation of adequate rehabilitation treatment significantly improved the tested joint angles and muscle forces after two weeks of treatment.

Conclusions. Joint mobility and muscle strength were significantly improved, without reaching normal values.

Key words: osteosarcoma, rehabilitation treatment

Rezumat

Premize. Osteosarcomul reprezintă cea mai frecventă tumoră osoasă primară întâlnită la adolescenţi, femurul proximal fiind cea de-a patra localizare ca frecvență pentru osteosarcom. Recuperarea pacientului cu osteosarcom începe încă din faza preoperatorie în vederea reducerii costurilor şi durerii asociate, facilitând reluarea precoce a funcţiei membrului afectat și creșterea calității vieții acestor pacienți. Programul postoperator de recuperare este intens şi poate dura, după unii autori, până la un an, principalele obiective ale acestuia fiind: ameliorarea durerii, îmbunătăţirea amplitudinii de mişcare, a tonusului muscular, tratamentul cicatricilor, prescrierea dispozitivelor medicale şi îmbunătăţirea calităţii vieţii.

Obiectiv. Obiectivul acestui studiu este de a aduce în atenție cazul unui pacient în vârstă de 38 de ani cu o endoproteză hibrid la nivelul articulației coxo-femurale stângi pentru un osteosarcom localizat la nivelul trohanterului mic al femurului, în vederea stabilirii unui tratament adecvat de recuperare.

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Metode. Pacientul a fost diagnosticat în urmă cu 16 ani cu osteosarcom localizat la nivelul trohanterului mic al femurului, pentru care a urmat chimioterapie neo-adjuvantă și tratament chirurgical cu rezecția 1/3 proximale a femurului, urmată de artroplastie.

Datorită ascensionării endoprotezei, are loc după aproximativ 8 ani o intervenție chirurgicală de revizie, cu o endoproteză totală hibrid.

Pacientul se prezintă la Spitalul Clinic de Recuperare Cluj-Napoca în martie 2017, acuzând scăderea forţei musculare și amplitudinii de mișcare a șoldului stâng, testele aplicate fiind sugestive în acest sens.

Rezultate. Instituirea unui tratament adecvat de recuperare a îmbunătățit semnificativ unghiurile articulare și forțele musculare testate, după aproximativ două săptămâni de tratament.

Concluzii. Mobilitatea articulară și forța musculară au fost ameliorate semnificativ, fără a atinge valorile normale.

Cuvinte cheie: osteosarcom, tratament de recuperare.

Introduction

Osteosarcoma (OS) is the most frequent primary bone tumor found in adolescents (Campanacci, 2013). With an annual incidence of 3.1 cases per 1 million population in USA, OS accounts for less than 1% of newly diagnosed cases in adults and 3-5% of these in children (Damron et al., 2012). A greater predominance is seen in the male sex, with the highest incidence between the age of 10 and 14 years (Dos Santos & Swerdlow, 1993). In 75% of cases, OS is located in the long bone metaphyses of the limbs (Miller, 1981). Currently, patients diagnosed with OS benefit from surgical treatment and postoperative neoadjuvant and adjuvant chemotherapy (Ferrari & Serra, 2015).

Many uncontrolled studies have demonstrated that an adjuvant and neoadjuvant chemotherapy program significantly improved the prognosis of patients with non-metastatic OS, increasing the survival rate from 60% to 70%, concomitantly with an increase in the rate of limb salvage surgery from 80% to 90% (Mittermayer et al., 2001). The combination of methotrexate, adriamycin and cisplatin has become the gold standard in North America and Europe. Some centers add ifosfamide, but recent randomized clinical studies have not evidenced an increased rate of survival (Ferrari et al., 2012).

Before starting chemotherapy, OS should be subjected to biopsy for the identification of the histological type and grade. Percutaneous biopsy techniques for the diagnosis of bone and soft tissue lesions have been used since the late 1970s. Even if percutaneous biopsy is more specific for the obtaining of tissue in order to establish histological diagnosis, surgical biopsies are more frequent, being performed en bloc to reduce the risk of local recurrence (Ayala et al., 1989).

The proximal femur is the fourth most frequent location of osteosarcoma. Most of the tumors located at this level can be approached by surgery, because femoral vessels, the crural and sciatic nerves are rarely involved (Ecurad et al., 2013).

For a long time, amputation was considered to be necessary for local tumor control, but this has changed over the past two decades due to progress made in oncology, imaging, as well as to reconstruction techniques, which have made limb salvage surgery more feasible (Li et al., 2016). Currently, 85% of all OS cases can be resected and reconstructed, with the preservation of the affected limb and its function (Marulanda et al., 2008). Many studies show a 67-90% survival rate of patients with endoprostheses after osteosarcoma at 5 years from surgery (Grimer et al., 2016). Current limb salvage techniques include reconstruction using a bone graft (Enneking & Mindell, 1991), an endoprosthesis (Cheng & Gebhardt, 1991) or a hybrid prosthesis (Eckardt et al., 1991).

A frequent complication of hip endoprostheses is dislocation, with a rate varying from 1.7% to 20%. This is due to extensive resection of soft tissues around the joint and capsule (Gosheger et al., 2006).

Osteosarcoma located in the proximal femur requires resection and reconstruction of the hip joint and proximal femur. The use of both megaprostheses and alloprosthetic composites has favorable results (Zehr et al, 1996). Sometimes, for certain reconstructions, a bone graft in conjunction with an endoprosthesis is used. An adequate graft is selected and implanted to replace the resected bone segment. The articular surfaces of the graft are excised and replaced using conventional total arthroplasty techniques. The bone graft is a source for tendon insertions, while the prosthesis ensures a reliable and stable joint and a support for the bone graft. A graft-prosthesis construction has a lower fracture rate and is not susceptible to osteoarthritis (Muscolo et al., 2006).

The rehabilitation of patients with OS starts during the preoperative stage in order to reduce the associated costs and pain, facilitating the early restoration of the function of the affected limb and the increase in the quality of life of these patients (Karasek et al., 1992).

The postoperative rehabilitation program is intense and can last up to one year, according to some authors (Fulton, 1994). Its main objectives are: amelioration of pain, improvement of the range of motion and muscle tone, treatment of scars, prescription of medical devices if necessary, and not least, improvement of the quality of life by minimizing the limitations in activities of daily living caused by the disease and associated treatments (Lambert & Sugarbabker, 1992).

The principles of the rehabilitation program are:

1. During the first 6-8 weeks, the patient should avoid adduction, flexion more than 90° and internal rotation of the hip.
2. The limb has a tendency to external rotation because the external adductors and rotators are attached in a shorter position during surgery, which is why the limb must be maintained in a neutral position with a splint.
3. Exercises for the improvement of the range of motion of the hip and knee joints.
4. Maintenance of muscle tone: progressive, within the

limit of tolerance during the first 4-6 weeks, consisting of isotonic contractions. After the early postoperative period, both open and closed kinetic chain exercises are indicated.

5. Ambulation: the patient will use a walker or crutches for 6-12 weeks, then a cane (Lewis, 1992).

Hypothesis

We present the case of a 38-year-old male patient with total hip endoprosthesis after resection of an osteosarcoma located in the left proximal femur as a model for postoperative management of rehabilitation treatment.

Material and method

The study was carried out according to current deontological laws, with the approval of the Ethics Committee of the "Iuliu Haţieganu" University of Medicine and Pharmacy, after the patient gave his written informed consent.

Research protocol

a) Period and place of the study

In March 2017 the pacient presented to Clinical Rehabilitatiom Hospital Cluj-Napoca for the rehabilitation of muscle weakness and decreased range of motion in the left hip.

b) Subject

We present the case of a 38-year-old male patient who attended the our hospital for the rehabilitation treatment.

The current disease started insidiously in April 2001 with mixed pain in the left coxofemoral joint (CF), irradiating to the inguinal area, increased by effort, refractory to ordinary analgesics.

In November 2001, the patient observed an aggravation of symptoms, with a progressive limitation of hip joint mobility, for which reason he presented to the service of Orthopedics of the Cluj County Emergency Hospital in Cluj-Napoca. A pelvic X-ray for CF was performed and a tumor mass was described in the left lesser trochanter. Subsequently, bone scintigraphy was indicated, which described a single area with increased pathological uptake in the left lesser trochanter. Following the investigations performed (X-ray and bone scintigraphy), surgical biopsy under spinal anesthesia was decided, with en bloc resection of the tumor for histopathological examination.

Anatomo-pathological examination described a malignant tumor process, in which the proliferated cells (osteoblastic in nature, presenting atypias) directly produced bone spicules, among which many vessels of various calibers, as well as osteoplasts and fibroblasts were present, an appearance suggestive of telangiectatic osteosarcoma.

Given the established diagnosis, the patient presented to the "Ion Chiricuţă" Oncology Institute Cluj-Napoca, where neoadjuvant chemotherapy was initiated according to the protocol of the Rizzoli Institute: high dose methotrexate with folic acid protection - week 0, 4, doxorubicin + cisplatin - week 1, ifosfamide + cisplatin - week 5, 8.

In February 2002, the patient was scheduled at the Clinic of Orthopedics Timişoara, where he underwent resection of the proximal 1/3 of the left femur and total joint arthroplasty with bipolar Kent prosthesis (Fig. 1).

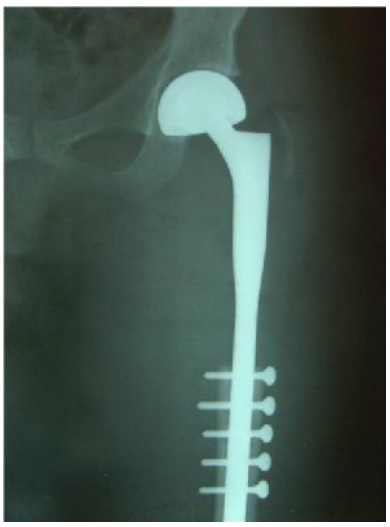
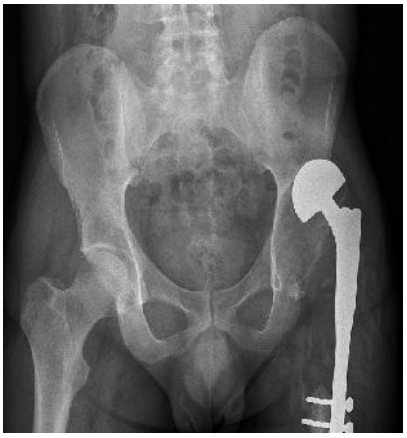
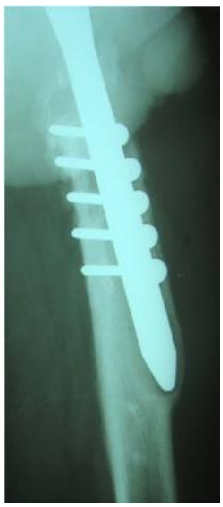


Fig. 1 – X-ray of the left hip (AP), February 2002. Bipolar Kent endoprosthesis

Postoperatively, the patient received adjuvant chemotherapy, 6 cycles, with complete remission.

In March 2010, the patient presented to the service of Orthopedics Cluj-Napoca for pain and functional impotence of the left lower limb. Radiographic and scintigraphic examination supported the ascent of the prosthesis, without other images suggesting a primary bone tumor (Fig. 2a, 2b).





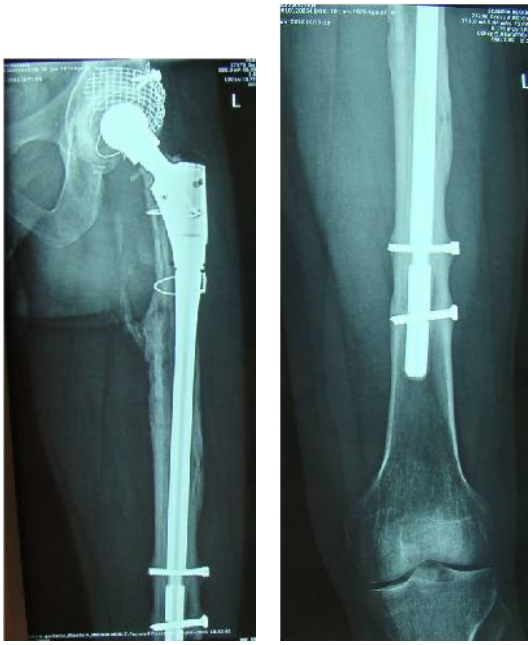
2a **2b**

Fig. 2a – Pelvic X-ray for CF (AP), March 2010
Fig. 2b – X-ray of the left distal femur (AP), March 2010

Surgery was recommended, which was performed in May 2010 at the Elias Emergency University Hospital Bucharest. Revision surgery was carried out with reverse hybrid total hip arthroplasty, with a modular femoral component and augmentation of the cotyle with external bone graft and mesh, augmentation of the femur with massive bone graft fixed by cerclage (Fig. 3a, 3b).

In March 2017, on general and local objective examination, the following were found: BMI=22.5, good general state, L-S spine: mild dextroconvex scoliosis, effaced lordosis, left CF: postoperative scar in the proximal

1/3 of the left hip, left thigh circumference at 10 cm from the patella = 40 cm, at 20 cm from the patella = 49 cm, right thigh circumference at 10 cm from the patella = 42 cm, at 20 cm from the patella = 52 cm (Table I), the difference in length between the lower limbs was about 1 cm, measured from the umbilicus to the internal malleolus (92 cm the left lower limb, 93 cm the right lower limb).



3a **3b**

Fig. 3a – X-ray of the left hip (AP), May 2010
Fig. 3b – X-ray of the left distal femur (AP), May 2010

Table I
Thigh circumference of the lower limbs

Length	Left thigh circumference	Right thigh circumference
At 10 cm from the patella	40 cm	42 cm
At 20 cm from the patella	49 cm	52 cm

c) Tests applied

Hip joint and muscle assessment at the time of presentation in our clinic were evaluated using goniometry which showed a limitation of active mobility in the left hip.

Considering these aspects, the patient was proposed and underwent a complex and individualized rehabilitation treatment; its objectives were the improvement of muscle strength and range of motion, the correction of walking, and the increase in the quality of life.

The patient received kinesiotherapy complemented by hydrokinesiotherapy, toning massage of the lower limb, occupational therapy, for two weeks, with a favorable evolution of the tested joint angles and muscle forces.

The kinesiotherapy program included exercises for the increase in the range of motion of the hip joint, endurance exercises, muscle stretching exercises for the gluteal and quadriceps muscles, closed kinetic chain exercises for stabilization and coordination, recovery of standing and walking with progressive loading. A kinesiotherapy session lasted for 30 minutes, and was performed twice a day.

Hydrokinesiotherapy brought the benefits of mobilization in water (30 minutes daily), while massage, in addition to its local and general effects, improved the patient's psychological state. Occupational therapy was mainly aimed to recover walking, being performed daily for 30 minutes.

The patient continued the kinesiotherapy program at home, daily, being followed up every 3 months.

Results

Initial evaluation of the left hip revealed: flexion 110^o, abduction 25^o, internal rotation 20^o, external rotation 30^o. The passive range of motion was 5-10^o greater, without reaching normal values for the coxofemoral joint.

Testing of the iliopsoas, as the main thigh flexor muscle in the pelvis, evidenced a 4 out of 5 strength, testing of the middle gluteal muscle showed a 3 out of 5 strength, and the pelvitrochanteric muscles (as external rotators) and the internal rotators of the hip also had a reduced strength, with values of 4 out of 5 strength degrees.

After three months from the initial evaluation active flexion of the hip was 120^o, abduction 30^o, internal rotation 30^o, external rotation 35^o.

Also improve muscle strength, testing of the middle gluteal muscle became 4 of 5 strength, other muscle groups reached the addition of 4 addition of 5 strength degrees.

So we can say after 3 months of intens rehabilitation the patient was able to stand and walk without using assistive walking divaces, to maintain balance, there were observed an improvement of muscle strength and range of motion and also an improvement in the quality of life**.**

Discussions

The rehabilitation of patients with OS depends on its anatomical location and the type of surgery, either limb salvage with reconstruction or amputation (Lane et al., 2001).

Reconstructions with allografts remain fragile for a long time period. In addition, because of surgery and chemotherapy, these patients are at risk for complications such as: decrease in the range of motion, reduction of muscle strength, poor motor control, difference in the length of the limbs, pain, complications that may affect the activities of daily living as well as quality of life (Yadav, 2007).

Studies have demonstrated that adherence to a strict, well documented program in accordance with the anatomical location of OS can significantly improve the functional status of these patients (Shehadeh et al., 2013).

Regarding the use of electrotherapy for the purpose of analgesia or neuromuscular stimulation in these patients, there is no consensus as to its usefulness, the type of electric current or the timing of this therapy.

The particularity of the case resides in the anatomical location of the tumor in the lesser trochanter of the femur, which makes it more difficult to approach and requires complex and laborious surgery, which caused the ascent of the first endoprosthesis, with the subsequent reconstruction of the acetabulum and proximal femur.

Conclusions

1. The rehabilitation program should be adapted to the location of the osteosarcoma and the type of surgery, and should be continued until the therapeutic objectives are reached.

2. Successful limb salvage and reconstruction surgery requires an intense and complex rehabilitation program.

3. The impact of physiotherapy is predicated on an ability to preserve those structures necessay for function, to match patient expectations with oncologically appropriete treatment and to designe a rehabilitation programe that can be followed in the long term to sustain function.

Conflicts of interests

There are no conflicts of interest.

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REVIEWS

Physical exercise and arterial stiffness in elderly

Efortul fizic şi rigiditatea arterială la vârstnici

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Abstract
Increased arterial stiffness is an important feature of vascular aging. Pathogenic mechanisms of arterial stiffness are complex and incompletely elucidated. Very many clinical and experimental data support the involvement of oxidative stress, systemic inflammation and neuro-hormonal mechanisms in arterial wall alteration. Structural modifications which accompany arterial stiffness involve both cellular and extracellular matrix of the vascular wall, including fragmentation of elastin fibers with increase in collagen, irreversible cross-linking between matrix fibers through advanced glycation end-products, vascular fibrosis and calcification. It has been shown that aerobic exercise may be involved in molecular and cellular mechanisms of arterial stiffness, inducing a favorable effect on the arterial wall elasticity. Regular aerobic exercise is currently considered an essential component of non-pharmacological treatment of arterial stiffness.
Key words: arterial stiffness, physical exercise, elderly people

Rezumat
Creşterea rigidităţii arteriale este o modificare caracteristică a vaselor, asociată procesului de îmbătrânire. Mecanismele patogenetice implicate în apariţia rigidităţii arteriale sunt complexe şi incomplet elucidate. Foarte multe date clinice şi experimentale susţin implicarea stresului oxidativ, a inflamaţiei sistemice şi a mecanismelor neuro-hormonale în alterarea peretelui vascular. Modificările structurale care însoţesc rigiditatea arterială interesează atât celulele cât şi matricea extracelulară a peretelui vascular, ducând la fragmentarea fibrelor de elastină, creşterea colagenului, formarea punţilor ireversibile între fibrele matriceale, prin compuşii finali de glicozilare avansată, fibrozarea şi calcifierea vasculară. S-a constatat că efortul fizic aerob poate interfera cu mecanismele moleculare şi celulare care induc rigiditatea arterială, cu consecinţe favorabile asupra elasticităţii peretelui arterial. Exerciţiul fizic aerob consecvent este considerat, în prezent, un component esenţial al tratamentului non-farmacologic al rigidităţii arteriale.
Cuvinte cheie: rigiditatea arterială, efortul fizic, vârstnici

Introduction

Cardiovascular diseases remain the main cause of morbidity and mortality in modern society, in both industrialized and developing countries. Aging is a major risk factor for cardiovascular diseases, including hypertension, stroke and heart failure (Najjar et al., 2005; Zieman et al., 2005; Lakatta & Levy, 2003; Lakatta, 1993; Cavalcante et al., 2011).

Aging leads to a multitude of morphological changes in the vasculature. These include dilatation of the central aorta and increase of arterial wall thickness, even in the absence of atherosclerotic disease. Degenerative changes in the wall of large arteries, such as rupture of elastic fibers, impairment of extracellular matrix components, accumulation of collagen fibers, necrosis of vascular smooth muscle cells (VSMCs), inflammation and calcification of the vascular wall, may induce arterial stiffness (Dao et al., 2005; Doyon et al., 2013), increasing the risk of cardiovascular events, dementia and death (Zieman et al., 2005).

Vascular aging is closely associated with vascular stiffness (Steppan et al., 2014; Vaitkevicius et al., 2002). Aorta stiffening with aging is accelerated by arterial hypertension (Cavalcante et al., 2011).

Habitual aerobic exercise is the first-line therapeutic strategy for reducing the risk of cardiovascular diseases

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with aging (Blair et al., 1989). Physical activity is associated with 35% reduction in cardiovascular diseases and 33% reduction in all-cause mortality (Nocon et al., 2008). This favorable effect of exercise on cardiovascular modifications with age may be partly due to reduction in large arterial stiffness.

Causes of arterial stiffness

Besides advanced age and hypertension, the increase in arterial stiffness has been associated with several physiological states such as low birth weight, menstrual status, menopause, sedentary life or high salt intake. Some known cardiovascular risk factors, including smoking, obesity, impaired glucose tolerance, type 1 and 2 diabetes mellitus, metabolic syndrome, hypercholesterolemia and chronic kidney disease may also induce arterial stiffness. Chronic inflammatory diseases such as rheumatoid arthritis, systemic lupus erythematosus, and other pathological states including hyperhomocysteinemia and osteoporosis have also been associated with an increased risk of arterial stiffening (reviewed in Laurent et al., 2006).

Arterial stiffness in the elderly

Aging, according to the "theory of free radicals" formulated by Harman (1956), is the consequence of subcellular lesions caused by the progressive increase of reactive oxygen species (ROS), leading to oxidative damage of nucleic acids (DNA as the major substrate), lipid and protein oxidation. This process is accompanied by a decrease in antioxidant defense mechanisms and by a pro-oxidative action of environmental factors (Tache, 2001).

Changes in mechanical and elastic properties of the arterial wall, occurring as a consequence of age and disease, may be induced by oxidative stress, which may cause, directly or indirectly, a reduction in arterial elasticity and increased arterial stiffness (Uddin et al., 2003; Patel et al., 2011).

All layers of the vascular wall have enzyme systems that produce ROS. The most important vascular structures and mechanisms involved in oxidative stress augmentation with age are: NAD(P)H oxidase stimulation, responsible for ROS increase with age, the decrease in mitochondrial antioxidant superoxide dismutase activity, increase in xanthine oxidase production of superoxide ($\cdot O^{-}$) and reduction in endothelial NO synthase activity, which decreases NO bioavailability (Schulz et al., 2004; Cao et al., 2015; Gomez et al., 2015). VSMCs are hypersensitive to oxidative damage (Zhang et al., 2015). Proliferation of VSMCs, mediated by OS, contributes to plaque formation and progression of atherosclerosis (Ma et al., 2016). In an experimental model inducing OS in the arterial wall, the authors reported earlier apoptosis of smooth muscle fibers. Suppression of OS reduced the number of apoptotic cells and also, intima-media thickness (Gomez et al., 2015).

Stiffness in the elderly is more pronounced at the level of elastic arteries, the involvement of distal muscular arteries being less important (McEniery et al., 2008).

The main wall structures participating in vascular function are media and intima layers. The media of large arteries consists of VSMCs, elastic and collagen fibers, all included in an extracellular matrix, which contains glycoproteins and proteoglycans (Diez, 2007; Fleenor & Berrones, 2015). Arterial wall modifications associated with aging are complex and consist of:

- Wall alterations with increased intima-media thickness, increased collagen deposition and reduced elastin fibers, accumulation of advanced glycation end-products, with collagen cross-linking, and calcium deposits at the level of the media layer and also, increased fibrosis of adventitia (Fleenor & Berrones, 2015).
- Cellular modifications in VSMCs, endothelial cells, inflammatory cells and also, interactions between cells and the extracellular matrix.

Physiologically, VSMCs play an essential role in the mediation of vascular tone and synthesize the extracellular matrix (Lacolley et al., 2012). During the aging process, VSMCs may undergo important changes of the actin cytoskeleton, which may alter arterial wall elasticity (Sehgelet al., 2015; Fleenor & Berrones, 2015).

Endothelial cells form the internal layer of vessels, which is exposed to mechanical forces and humoral stimuli, performing an important function in arterial physiology. The endothelium has a determinant role in the regulation of vascular tone, leukocyte adhesion and VSMC proliferation. Endothelial cells synthesize various mediators:

- Vasodilator substances, such as nitric oxide (NO), prostacyclin I_2 (PGI_2), endothelial derived hyperpolarizing factor (EDHF)
- Vasoconstrictor substances such as endothelin-1 (ET-1), thromboxane A2 and angiotensin II (Ang II) (Sprague & Khalil, 2009)
- ROS, such as superoxide anion (O_2^{-}) and hydrogen peroxide (H_2O_2) (Schulz et al., 2004).

Arteries have important functions that contribute to hemodynamic homeostasis, such as:

- Elasticity, the property of the large central arteries, which dampens the rise in systolic pressure, transforming pulsatile flow, produced by each cardiac beat, into a continuous flow.
- Contractility, the property of the small vessels to modify their diameter, due to the contraction of smooth muscle fibers, caused by the influence of neural and humoral factors. It modulates peripheral vascular tone.
- Distensibility or extensibility, the property of large arteries to distend in response to blood volume or pressure variations.
- Secretory function, which can be induced by various stimuli and results in the release of: interleukins (IL-1, IL-6, IL-8, IL-11), γ-interferon (IFN-γ), granulocyte colony stimulating factor (GM-CSF), monocyte chemoattractant proteins (MCPS), basic fibroblast growth factor (bFGF), vascular endothelial growth factor (VEGF), macrophage migration inhibitory factors (MMIFs) type 1α and 1β, platelet-derived growth factor (PDGF), regulated on activation, normal T cell expressed and secreted (RANTES) (Sprague & Khalil, 2009), metalloproteinases, particularly MMP-2 and MMP-9 (Arun, 2016) and also, ROS (Schulz et al., 2004).

Aging of the arteries, characterized by increased arterial stiffness, is accompanied by some important processes, including:

a) The transformation of the VSMC, which has a key role in buffering pressure pulsatility, in central arteries, from a contractile to a secretory cell, producing matrix metalloproteinases with proinflammatory and procalcifying actions (Burton et al., 2008; Lacolley et al., 2012). VSMCs may also dedifferentiate to a more osteogenic phenotype and induce vascular calcification (Pikilidou et al., 2015). Increased stiffness and adhesiveness of VSMCs have also been reported and, recently, the concept of "smooth muscle cell stiffness syndrome" in the pathogenesis of arterial stiffness has been proposed (Sehgel et al., 2015).

b) Increase in extracellular matrix stiffness, due to an increase in collagen and a decrease in elastin and to irreversible cross-links between matrix fibers, produced by advanced glycation end-products (AGEs) (Bailey et al., 2001, Konova et al., 2004).

c) Activation of the renin-angiotensin-aldosterone system with the involvement of angiotensin II and aldosterone in:

- Stimulation of proinflammatory cytokines, (TNF-α, IL-6) (Belmin et al., 1995), and C-reactive protein (Pasceri et al., 2000).
- Activation of matrix metalloproteinases, particularly MMP-2, which stimulates TGF-1β, a profibrotic molecule, and also, the expression of adhesion molecules (Wang et al., 2006; Sehgel et al., 2015).
- Increase of ROS production and OS, which determines the reduction of NO bioavailability and endothelial dysfunction (Csiszar et al., 2002; Cockroft et al., 2007).
- Hyperproduction of fibronectin, VSMC hypertrophy and vascular fibrosis, due to increased aldosterone levels (Lacolley et al., 2012).
- Stimulation of medial calcification (London, 2013).

d) Reduction of mitochondrial antioxidant superoxide dismutase with age, which may be involved in vascular alterations (Li et al., 2006).

e) Endothelial dysfunction, which has been reported in the elderly, even in the absence of cardiovascular diseases (Cockroft et al., 2007).

Treatment of arterial stiffness

The main therapeutic interventions in arterial stiffness include:

- Antihypertensive medication, which indirectly decreases arterial stiffness by lowering the distending pressure.
- Therapy aimed at ameliorating arterial elasticity, by vascular remodeling and direct action on the arterial wall.

Methods of treatment

1. Non-pharmacological methods, including reduction in body weight, restriction in salt intake, moderate alcohol consumption, nutritional and non-nutritional supplements with antioxidant effects.

2. Pharmacological interventions, based mainly on antihypertensive medications, such as angiotensin converting enzyme inhibitors, angiotensin-2 receptor blockers, calcium-channel blockers and diuretics. Other medications including statins, aldosterone receptor antagonists, nitrates, phosphodiesterase 5 inhibitors, thiazolidinediones, LCZ696 - an angiotensin receptor neprilysine inhibitor (Williams et al., 2014), and advanced glycation end-product cross-link breakers have also been used, with some promising results (Zieman et al., 2005; Cavalcante et al., 2011).

Effects of physical exercise on arterial stiffness in the elderly

Numerous studies have shown the favorable effects of aerobic endurance exercise in reducing arterial stiffness in both elderly animals (Hanna et al., 2014; Gu et al., 2014; Roque et al., 2013; Steppan et al., 2014; Nosaka et al., 2003; Vaitkevicius et al., 1993; Tanaka et al., 2000) and elderly patients (Kingwell 2002; Ashor et al., 2014; Vaitkevicius et al., 2002).

The mechanisms underlying the effects of physical exercise on arterial stiffness are not completely elucidated, but the decrease in oxidative stress and systemic inflammation seems to play an important role.

A great number of experimental and clinical studies have investigated the effects of physical exercise in the treatment of diseases associated with the aging process (Tache, 2001). Exercise-induced antioxidant defense, with reduction of OS, has been associated with different types of activities, such as moderate repetitive aerobic exercise, prolonged low-intensity training and also, detraining, being correlated with the hyperregulation of antioxidant defense mechanisms (Tache & Staicu, 2010).

The decrease in OS could have favorable effects on the vascular wall, inducing a decrease in arterial stiffness in elderly people (Roque et al., 2013; Vaikevicius et al., 2002; Fleenor et al., 2010; Steppan et al., 2014). At a molecular and cellular level, exercise stimulates NO endothelial synthesis (Green et al., 2005) and the activity of antioxidant enzymes (Sharifi et al., 2014).

The anti-inflammatory effect of regular exercise has also been documented in clinical studies. Exercise may increase interleukins 4 and 10, which have anti-inflammatory effects, and decrease IL- 6 and TNF-α, two pro-inflammatory cytokines (Teixeira-Lemos et al., 2011; Ashor et al., 2014).

Physical exercise may decrease vasoconstrictor mediators (angiotensin II, endothelin-1) (Zieman et al., 2005) and sympathetic nervous tone (Mavritzakis, 2014), and reduce TGF-β1, involved in adventitial remodeling and fibrosis (Fleenor et al., 2010).

Histological research in animals has shown that elastin content is not influenced by exercise (Fleenor et al., 2010; Nosaka et al., 2003). The favorable effect of aerobic exercise seems to be mainly induced by a decrease in collagen fibers (collagen subtypes I and III) in both adventitia and media layers (Fleenor et al., 2010). However, in sedentary spontaneously hypertensive rats, a decrease in the elastic component has been found compared to spontaneously hypertensive rats subjected to physical training (Andrade et al., 2013).

Aerobic exercise may reverse arterial wall calcification (Fleenor et al., 2010).

A recent meta-analysis of studies investigating the effects of exercise on arterial stiffness confirms the clear

beneficial role of aerobic exercise on arterial stiffness. These favorable effects were more pronounced after higher intensity exercise, in subjects with more severe baseline arterial stiffness and with longer physical training programs (Ashor et al., 2014).

The favorable influence of aerobic exercise on arterial stiffness may persist over time in aging athletes. Masters endurance athletes may have more elastic arteries, preserved endothelial function and reduced arterial wall thickness when compared to untrained subjects, illustrating a model of "exceptional vascular aging" (DeVan & Seals, 2012).

Conclusions

Arterial stiffness in elderly patients requires an active therapeutic attitude. Besides the administration of antihypertensive therapy, aerobic exercise represents an important means to reduce arterial stiffness and cardiovascular risk.

Conflicts of interests

Nothing to declare.

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New and old theories in hip biomechanics

Teorii noi şi vechi în biomecanica şoldului

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Abstract
Knowledge of kinematics, the physiological load bearing during statics and dynamics, and all forces that act on the hip joint have been and still are a major challenge even today, and this subject was also the purpose of the authors' study. The authors suggest that through this work the qualitative analysis of the movement, patterns and motion geometry, forces and anatomy of the movement should be encouraged. The aim of this paper was to draw an up-to-date picture of the normal anatomical and biomechanical knowledge of the hip. Only by observing the anatomical elements of the hip can the architecture and stability of the hip be understood. By corroborating the anamnesis and physical examination data the source of the pathology can be identified and evaluated. This paper should serve as a foundation for understanding, evaluating and treating the musculoskeletal deficiencies that concern not only the hip, but also the knee and the pelvic ring.
Key words: hip, anatomy, biomechanics.

Rezumat
Cunoaşterea cinematicii, a încărcăturii fiziologice din timpul static şi dinamic şi a forţelor mecanice ce acţionează asupra articulaţiei şoldului au fost şi au rămas o provocare, fiind şi subiectul lucrării propuse de autori. Această prezentare serveşte drept fundament în analiza calitativă a patternului şi geometriei mişcării, prezentarea forţelor şi complexului anatomic ce conduc la realizarea mişcării. Lucrarea de faţă işi propune să ofere o imagine de ansamblu, actualizată, a cunoştintelor anatomice şi biomecanice la şoldul normal. Observarea componentelor anatomice ale şoldului, înţelegerea arhitecturii şi stabilităţii lui, în combinaţie cu anamneza şi examinarea fizică, constituie un element important pentru a identifica şi evalua sursa durerilor. Cu acest referat ne-am propus o înţelegere completă a forţelor ce traversează articulaţia şoldului şi detaliile anatomiei acesteia, creând şi dezvoltând astfel soluţii în recuperarea patologiilor aferente acestei articulaţii.
Cuvinte cheie: şold, anatomie, biomecanică.

Introduction

We have envisioned a wide comprehension of the forces that act on the hip joint and the anatomical details of the latter, creating and developing solutions for the rehabilitation process in the diverse pathology of this joint.

Biomechanics is essential for understanding the mechanisms of the pathological process, also bringing a valuable perspective on the diagnosis and treatment of the disease. The domains that reap the fruits of this science are both surgical (with the development of reconstructive surgery and hip arthroplasty) and medical, such as rehabilitation medicine with the implementation of new adapted and complex therapeutic programs (Jumaa et al., 2014).

The coxofemoral joint or the hip joint is one of the most robust joints of the human body, combining stability and mobility due to the combination of a highly resistant joint capsule and 3 thick ligaments. By making a short description, we can say that this is the most important joint in the human body, sensitive to load bearing, especially if there are any axial anomalies. We can separate the hip into the hip bone, hip ligament and hip muscle.

Anatomy

The coxofemoral joint is a synovial, typical spheroidal joint (enarthrosis) with 3 degrees of freedom, in which the following movements can be produced: flexion-extension, abduction-adduction, internal rotation-external rotation

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and circumduction; so it can be said that the hip allows movement in all directions.

In order to understand the pathology of the hip joint, an accurate knowledge of its internal structure and anatomy as well as biomechanics is required; therefore the authors have decided to study the hip joint in the following order:

1. The hip bone

The acetabulum: a round cavity formed by 3 bones: ilium (roughly 40% of the acetabulum), ischium (40%) and pubis (20%). The immature skeleton has these 3 bones separated by the ypsiloformis cartilage - the fusion of these bones starts around the age of 14-16 years and is final at about 23 years of age (Moore et al., 2014).

Attached to the acetabulum is the acetabular labrum, with a role in holding the femoral head in the reception cavity. This is a fibrocartilage in the shape of a ring that is composed of collagen fibers with a circumferential arrangement, and covers almost the entire acetabulum, continuing with the transverse ligament (Byrne et al., 2010).

The physiological functions of the labrum are not yet fully known, but this seems to have multiple purposes, including the limitation of external mobility and joint stability through deepening of the acetabular dome. It also has the role of ensuring a high hydrostatic pressure of the intra-articular fluid, thus contributing to the proper lubrication of the synovium and giving resistance to forced traction movements (Crawford et al., 2007). Modern surgical techniques focus on maintaining and repairing the acetabular frame in order to keep the intra-articular environment and, also, to minimize the degenerative potential (Bowman et al., 2010).

The femoral head is a round articular surface which represents 2/3 of a sphere.

2. The hip ligament - joining methods/intra-articular components

The joint capsule is very strong, with a wide insertion surface on the coxal bone (the acetabular upper edge and the external face of the labrum) and a small area on the femur (the anatomical neck) (Kishner et al., 2015).

Pericapsular joint ligaments are soft tissues that have the role of connecting the bone surfaces. The iliofemoral ligament can be observed anteriorly in the shape of an inverted "Y". It has the property of being the strongest ligament of the body, supporting a load of 350-500 kg, helping maintain the bipedal position with minimal help from the muscles (Martin et al., 2008). It also limits the extension, internal rotation and abduction of the hip. Inferior and posterior of the iliofemoral ligament and mixing with this on the medial side is the pubofemoral ligament, which only has a small role in reinforcing the anterior-inferior side of the joint capsule and limits the external rotation and abduction of the hip (Fig. 1).

The femoral head is covered by articular cartilage in a proportion of 60-70% of a sphere, where the central part, which is uncovered, forms the fovea capitis, the femoral insertion of the round ligament of the femoral head. It contains blood vessels but it has little contribution to the joint stability. The cartilage is composed of collagen type II fibers rich in glycosaminoglycan, which are hydrophilic and have the role of retaining water inside the cartilage, thereby protecting the joint surface from inherent stress, absorbing shocks, and disseminate the forces that are generated around the joint. These three ligaments are the main stability force of the hip (Popescu et al., 2007). Posteriorly, the ischiofemoral ligament completes the ligament anatomy. It connects the ischiatic acetabular wall with the femoral neck, thus limiting the internal rotation and adduction of the hip.

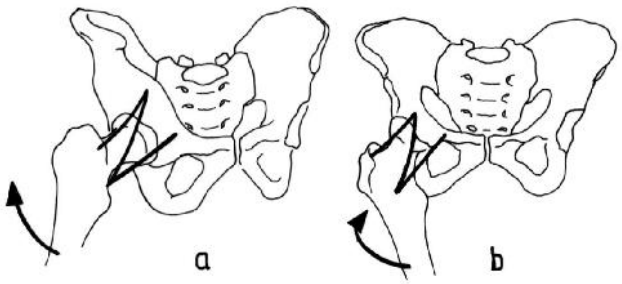

Fig. 1 – The concomitant tensioning of the three ligaments, which form the letter N shape, from an anterior view: a) in extension, b) in external rotation.

3. The hip muscle – extra-articular structures, motion

The 21 muscles that traverse the hip joint provide a wide range of motion as well as stability between the hip bone and the femur. Muscle analysis should consider spatial distribution in respect to the rotation axis of the hip, as well as the co-activating muscles of the trunk (Neumann, 2010).

The strongest flexor of the hip is the iliopsoas muscle (psoas major, minor and iliacus muscles), helped by the sartorius, rectus femoris and tensor fasciae latae muscle. The strongest extensor of the hip is the gluteus maximus muscle with an important role in anteroposterior stability. The main abductors are gluteus medius and gluteus minimus muscles. Adduction is done by the adductor muscles (long, short and magnus), gracilis, external obturator and pectineus muscles.

In normal kinematics, the flexion-extension motion, as well as abduction-adduction is associated with rotation movements due to the length of the femoral neck and the inclination angle. The small muscles (piriform, external and internal obturator, quadratus femoris muscles), with the insertion around the greater trochanter, help augment the rotations. Besides ensuring movement and stability of the hip joint, the muscle bed prevents peaking tensions on the femur and potential harming by moving the weight center (Byrne et al., 2010).

Biomechanics

The coxofemoral joint is a grade 1 lever with unequal arms. The support point is the femoral head, the force is represented by abductor muscles, and resistance is the weight of the body (Erceg, 2009).

Regardless of unipodal or bipodal support, the force that acts on the hip joint is conditioned by:

- the area and the integrity of the articular surface;
- the cartilaginous surface integrity.

When one of the parameters in modified, the balance is disturbed and biomechanical overloads of the joint segments occur with clinical-functional echoes.

The factors that can influence the magnitude and direction of action for the compression force on the femoral head are:

- the position of the body's weight center;
- the length of the lever arm;
- the value of resistance.

Thereby, if the weight center overlaps the centers of the femoral heads, minimal muscular forces will be required to maintain equilibrium. If the trunk is slightly bent posteriorly, the weight center is in the posterior area of the femoral heads, and the anterior capsule of the hip will become tense and the Y-shaped ligament of Bigelow will ensure stability. Thus, with unipodal support, the weight center will move distally and away, the lifted member being considered as body weight that acts on the bearing hip. Because the bearing pillar is outside the action of the weight center, this will have to be compensated through the abductor forces of the muscles with insertion on the lateral femur (upper fibers of gluteus maximus, gluteus minimus and medius, tensor fasciae latae, piriform, internal obturator muscles). The shortening of the lever arm through coxa valga or excessive femoral anteversion will result in increased action of abductor muscles and, hereby, an increase in the load of the joint. If the shortening of the lever arm is increased, the muscles become overloaded and there is a lateral shift of the weight center, over the bearing hip, or an inclination of the pelvis which leads to the Trendelenburg sign (1).

The hip bears the whole weight of the body that it transmits to the ground. During walking or standing, the human bipedal posture is a vertical balance in respect to the gravitational force. In certain conditions, the mobility of the hip can be sacrificed, but not its stability. The concept of hip instability and capsular laxity has recently emerged, as an identifiable and potentially correctable cause of hip pain and disability (Tibor & Sekiya, 2008). The origin of instability can be split between traumatic and atraumatic causes; the hypothesis of atraumatic instability may be the result of injury to the ligament capsule during activities that force and tend to overload the hip, a main cause for coxa saltans (Bowman et al., 2010).

Hip biomechanics has attracted a lot of attention from researchers and clinicians. Julius Wolff became interested in the relationship between bone architecture and the functional load bearing as early as the 19th century (Morlok et al., 2011), when he tried to understand the joint load trough a mechanical approach (Erceg, 2009). He tried to understand the pathological influence of the anatomical valgus and varus positions of the femoral neck, proving that, for a joint, the valgus position suggests a smaller lever and abductor muscles have to develop a greater force. This increases the role of the resultant force in the hip joint and changes the action point on the pelvis into a more lateral position. His discoveries have influenced the treatment of femoral neck fractures and femoral osteotomies in a decisive way.

From all animal species, only humans and birds use bipedal walking and standing in a regular way. Even big primates use quadrupedal walking. When the body weight is supported on both feet, the weight center is centered between the two hips and weight is equally distributed to both joints. This is around 2/3 of the total body weight, which means 1/3 of the body mass distributed per hip in a vertical manner (Fig. 2).

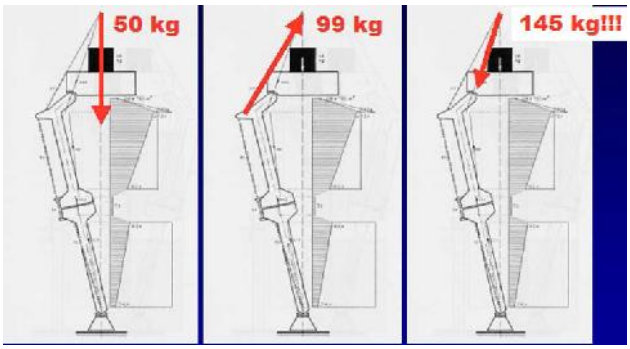

Fig. 2 – Pressure zones imposed by the body weight on the hip

This changes when the force is concentrated on a single hip, for example in the stance phase of gait. The pelvis tends to fall on the unloaded side, the abductor muscles opposing this motion and, also, having a role in maintaining the pelvis in a horizontal position. Pauwels compared this with a horizontal lever in equilibrium K1 and K2, whose position is influenced by body mass G and muscle force F (Pauwels et al., 1935).

In present days, Pauwels' theory has been recently criticized by some authors. The fundamental elements of the classical approach have been revised, analyzed and completed, through some modern solutions. Kummer did not contradict Pauwels, he just added 2 conditions:

- The weight bearing limb should be positioned on the line of action of the gravitational force;
- The abductor forces of the hip are composed of gluteus medius and minimus muscles (70%) and the muscles that control the iliotibial tract (30%) (Kummer, 1993).

During posterolateral hip dislocation, the femoral head moves proximally and laterally. The Pauwels method explains the effects of lateral motion, without considering or mentioning cranial movement. This approach was debated by Erceg et al. (2014), and it could be useful in understanding the influence of cranializing the hip during hip arthroplasty when the acetabulum is implanted more to the side or cranial than its natural position.

In conclusion, numerous researchers support Pauwels' theory, but they believe that in addition to the gluteus medius and minimus muscles which counterbalance the forces that act on the hip and the iliotibial tract, the gluteus medius-vastus lateralis complex also plays a role (Martin et al., 2015).

Biomechanics becomes even more complicated in hip arthroplasty, because all articular parameters are influenced by the surgical procedures: the articular center, the neck angle, levers, muscles, the range of motion (ROM), until articular impingement. ROM and joint stability become decisive in younger patients, with great quality of life expectations after hip arthroplasty. The valgus or varus position and the articular center are determined by the implant positioning in the pelvis and femur, influencing the local load bearing situation on the components. For

example, a slightly cranial, posterior or medial articular center after the implant is associated with a greater articular force (Erceg et al., 2014).

In vivo studies have shown that patients performing daily activities with relative joint load during the immediate postoperative period may generate forces up to 8 times the weight of the whole body on the prosthetic hip during unexpected events or instability periods during unipodal load bearing (Mirza et al., 2010). The most physiological position of the adult hip in which intra-articular pressure is the lowest is in slight extension, abduction and internal rotation, a position in which the jointing of articular surfaces is the best and the pressure is the lowest (Erceg, 2009). This physiological position becomes opposite to the antalgic position, the most common vicious position of the hip joint: flexion, adduction, external rotation.

Knowing the degree of motion of a joint or the value of the contraction force necessary for a muscle to perform a certain movement is absolutely necessary in establishing a functional diagnosis, as well as in evaluating the efficiency of treatment. Hip movements performed with a flexed knee are 20-30 degrees wider than with the knee extended. Also, the difference between active and passive motion is greater in the hip than in any other joint of the body. Due to this reason, the values recorded by hip joint testing will be accompanied by these specifications. For a functional hip we have to start from the exact knowledge of movement physiology. The range of motion (ROM) during regular activities is considerable: flexion/extension up to 124^0, abduction/adduction up to 28^0 and internal/external rotation up to 33^0 (Charbonnier et al., 2015).

Lower back, hip, knee and ankle problems can be affected by inefficient pelvic and/or hip stabilization, because the muscles are weak or tight. The most followed principles in the rehabilitation program are to focus on centring or maintaining the body in a neutral position. In all types of exercises that are used to restore mobility, increase muscle strength, obtain stability, it is important to apply the entering concept when performing and keeping the movement in controlled, small ranges (2).

Kinetic program

We present a series of exercises as examples to follow in global rehabilitation of the hip that we use in our department. This program starts with analytical elements and ends with global exercises.

Hip extensor stabilizing exercises:

- prone position, hip extension;
- supine position, hip extension, starting from flexed knee position, load bearing using pulleys;

Anterior hip stabilization exercises:

- quadricipital isometry, maintain knee extension for 5 minutes. It can use: towel, ball, pillow, sand sacks;
- knee extension from sitting position;
- hip flexion using elastic bands;
- triple flexion of the lower limb from standing position, maintained for 3 seconds, without exceeding the hip protection limit;

Hip stabilization exercises that tonify the real hip stabilizer, the gluteus medius, coupled with tensor fasciae latae exercises:

- hip abduction, from heterolateral position, with a pillow or rug between the knees for hip stabilization;
- from supine position, hip abduction with load bearing using pulleys;
- using elastic bands, starting from standing position, lower limb abduction;
- hip abduction, from standing position keeping the alignment of the hip, knee and ankle, followed by a slow return and hip extension which is maintained for 3 seconds, all while maintaining a straight position of the trunk.

Conclusions

1. Human bone structures are sufficiently light to allow movements with reduced energy consumption, rigid enough to build strong levers for the muscles and strong enough to withstand usual load bearing without breaking.

2. A thorough clinical-functional evaluation of the hip joint and muscle biomechanics is required when establishing the patient's functional state and for selecting the most efficient techniques and methods to re-educate the patient. Strict individualization of kinetic treatment in accordance with the functional deficit leads to shortening of the recovery time.

3. During this study, we reviewed a series of basics of hip anatomy and biomechanics, important for patients as well as for medics and therapists. Once the forces that affect the hip and its anatomy are understood, we can learn from past mistakes and focus on current and future solutions.

4. Rehabilitating the hip, as well as inguinal lesions represents a clinical challenge. While the mass of clinical knowledge is growing, there are still missing pieces in the diagnosis and treatment of these lesions. Differential diagnosis is complex and many entities may co-exist. During our continuous exploration of hip and inguinal disorders, physiotherapists analyze and identify corresponding group and individual rehabilitation strategies.

Conflicts of interest

There are no conflicts of interest.

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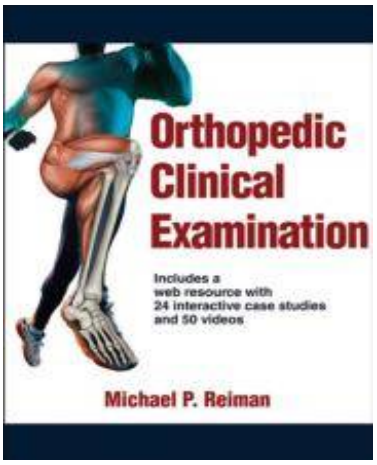

As almost every day somewhere in the world a new interesting and useful book is released, deciding on the one to be presented to our readers becomes a very long and difficult process. Under these circumstances, it may happen that a really worthy book is ignored at the time of its publication, an injustice that should be repaired later. This is why even if the book we will speak about was launched in 2016, considering all its merits - which led Prof. Karim Khan (Editor-in-chief, British Journal of Sports Medicine) to write that "if I see out three or four more decades on earth, *Orthopedic Clinical Examination* will still illuminate the otherwise hidden hazards confronting patients and their clinicians" -, there is every reason to present it now, in the middle of 2017.

Having 29 chapters and more than 1100 pages, the book edited by Dr. Michael Reiman and authored by him together with 18 collaborators is much more than a comprehensive product about examination; it is a new keystone not only for orthopedics, but also for physiotherapy and sports medicine. And as clinical orthopedic examination is a skill that requires knowledge and practice, the book provides readers with both the necessary knowledge and skills for approaching the examination process.

Many chapters are dedicated to the different parts of the human body, but each of them is organized and presented in the same manner; the so-called funnel approach, which means from a broad to a focused approach. Being intended for physical therapy, athletic training and medical students as well as clinicians, the book provides all of them with the necessary knowledge for performing a correct and efficient evaluation of orthopedic patients, i.e. a systematic evaluation without any pain. Special attention is given to musculoskeletal tests that are clinically relevant, so that the authors provide students and clinicians with the most recommended testing options, instead of simply listing all the known tests. However, apart from musculoskeletal testing, the book contains extensive reliable information on how to include and benefit from data provided by history, observation, diagnostic imaging, neurological screening and performance measures in the examination of each patient. Moreover, taking into consideration the importance for the student and practicing clinician to have differential diagnostic skills, the book contains both a dedicated chapter (Chapter 6) and emphasis in each chapter of Parts III and IV on triage and differential diagnosis.

The text of the book is structured into five parts, the first two of which present the requisite knowledge, i.e. information about the musculoskeletal and nervous systems and tissue healing (Part I; 3 chapters - 48 pages), and the principles of the examination sequence (Part II; 11 chapters - 178 pages). Part III (6 chapters - 263 pages) presents the examination sequence for evaluating the face and head and the temporomandibular joint, the cervical, thoracic and lumbar spine, and the sacroiliac joint and pelvic girdle, while Part IV (6 chapters - 453 pages) is dedicated to the examination of the extremities: shoulder, elbow and forearm, wrist and hand, hip, knee, lower leg, ankle and foot. The final Part (3 chapters - 55 pages) starts with the chapter entitled "Emergency sport examination", and ends with considerations that should be kept in mind when examining special populations, such as geriatric and pediatric patients.

In addition to the briefly presented text, the book offers the readers other learning tools, specially designed to enhance comprehension and engagement: full-color photographs, a library of 50 videos, graphics, case studies and links to additional clinical learning scenarios. A special gift for those involved in teaching activities consists of the image bank, the test package and instructor guide, all of them very useful and efficient in teaching and testing the students.

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Palestrica of the third millennium – Civilization and Sport
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EVENTS

MINISTRY OF NATIONAL EDUCATION

CLUJ COUNTY SCHOOL INSPECTORATE

The educational health prevention project *Sport – an alternative for a healthy life,* the 2016-2017 spring stage

Proiectul educaţional şi de prevenţie în sănătate *Sportul – alternativa pentru o viaţă sănătoasă,* etapa de primăvară 2016-2017

As shown in previous issues of the journal, the Cluj County School Inspectorate in collaboration with the Romanian Medical Society of Physical Education and Sport carries out a long-term educational health prevention project, targeting rural middle school students. The aim is the organization of sports events in strategic localities, in order to attract each year more and more students to spring sports activities. These complement autumn and winter sports events, described in previous issues of the journal.

The Annual County School Cup in Athletics (4)
Cupa anuală a Inspectoratului Şcolar Judeţean la atletism (4)

The annual competition entitled the Annual County School Cup in Athletics, which this year took place on 12 May 2017, gathered more than 400 participants from rural and urban areas, a higher number than last year. The competition was hosted, like a year ago, by the Cluj Arena Stadium and included 200-600 m endurance running races for middle school students. We mention that the events had two stages, the second one taking place at the Cluj Arena Stadium, with accumulation of points, and the endurance races were decisive.

For the first time, this year's event started with an athletic competition for disabled students. The competition "*Together toward success*" is a sports competition intended for students with special needs (*hearing sensory impairment and mental deficiencies*) from special schools and voluntary students from regular schools. The aim of this competition is to promote dialogue and communication between students from different schools and environments, to develop cooperation and collaboration between teachers from different schools, to develop a positive attitude of students towards *education – school – life*, for the *social inclusion of students with special needs*. All participants were awarded prizes.

The general rankings are presented in the following tables:

Rural grades III-IV

Place	School	Points stage I	Endurance stage II	Total points
1	Frata Middle School	870	141	1011
2	Rachitele Middle School	740	207	947
3	Luna Middle School	750	133	883

Rural grades V-VI

Place	School	Points stage I	Endurance stage II	Total points
1	Frata Middle School	840	309	1149
2	Rachitele Middle School	710	230	940
3	Luncani Middle School	630	261	891

Rural grades VII-VIII

Place	School	Points stage I	Endurance stage II	Total points
1	Frata Middle School	940	203	1143
2	"A. Iancu" Middle School Belis	870	142	1012
3	Rachitele Middle School	840	103	943

Urban grades III-IV

Place	School	Points stage I	Endurance stage II	Total points
1	"J. Zsigmond" Unitarian High School Cluj-Napoca	940	270	1210
2	"I. Bob" Middle School Cluj-Napoca	850	164	1014
3	"G. Cosbuc" National College Cluj-Napoca	760	247	1007

Urban grades V-VI

Place	School	Points stage I	Endurance stage II	Total points
1	"I. Bob" Middle School Cluj-Napoca	870	294	1164
2	"A Iancu" Middle School Dej	890	252	1142
3	"Pavel Dan" Theoretical High School Campia Turzii	880	227	1107

Urban grades VII-VIII

Place	School	Points stage I	Endurance stage II	Total points
1	"N. Titulescu" Middle School Cluj-Napoca	970	208	1178
2	"G. Cosbuc" National College Cluj-Napoca	940	204	1144
3	" I. Hatieganu" Middle School Cluj-Napoca	940	166	1106

The Annual County School Cup in Athletics (4)

Joy of the winners

Alongside participating students, the teachers: Claudiu Roşu - Răchiţele, Sebastian Popa - Frata, Anghel Todea – Beliş, and School Inspector Cristian Potoră

Prize giving ceremony at the competition "*Together toward success*"

Sports competitions in Cămăraşu (6)
Întrecerile sportive de la Cămăraşu (6)

The 6th edition took place this year, on 20 May 2017, according to the calendar of educational and sports activities in Cluj county, under the name "Sports competitions in Cămăraşu". Like in the previous edition, the program of the competition included 4 athletic events: 40 m, 50 m and 60 m *sprint* by age categories; *long jump*, *rounders ball throw*, 100 m, 150 m and 200 m *mixed relay*, and *tug of war* - teams.

The event was attended by 14 schools from 14 localities of Cluj county, and by the high school in Sărmaşu, Mureş county, in total 15 schools involving 170 students. 53 teachers from the Cămăraşu Middle School and guests, as well as 35 voluntary students and graduates of the school took part in the event. The participating localities were as follows: Frata, Cornești, Mociu, Apahida, Cătina, Geaca, Căianu, Borşa, Sărmaşu (Mureş county), Căşeiu, Poieni, Palatca, Cămăraşu, Sic, Cojocna-Cara.

Place	Tug of war	General ranking
1	Frata Middle School	Cămăraşu Middle School
2	Cătina Middle School	Frata Middle School
3	Borşa Middle School	"Samuil Micu" Middle School Sărmaşu

Physical education teacher: Sorina Lăpuşte
Director: Prof. Felician Ştefan Prunean-Bagoşi
Mayor: Marcel Iancu Mocean

Results

(40 m, 50 m, 60 m sprint, running long jump, rounders ball throw, tug of war - teams)

Place	Girls 9-10 years	Boys 9-10 years	Girls 11-12 years	Boys 11-12 years	Girls 13-14 years	Boys 13-14 years
	40 m sprint		*50 m sprint*		*60 m sprint*	
1	Gaşpar Raluca-Cămăraşu	Mazur Bănel Nicoliţă-Sărmaşu	Bădulă Adela-Sărmaşu	Cherteş Felician-Apahida	Moldovan Didica-Frata	Morariu Simion-Cămăraşu
2	Chiş Denisa-Frata	Bujor Eugen-Cămăraşu	Kutos Krisztina-Borşa	Trifu Daniel-Frata	Cătălişan Daniela-Cornești	Baciu Andrei-Sărmaşu
3	Szekely Diana-Mociu	Gaşpar Nicolae Guţă-Sărmaşu	Todea Oana-Frata	Deac Darius-Cătina	Turău Raluca-Poieni	Căuce an Laurenţiu-Frata
Long jump						
1	Szekely Diana-Mociu	David Paul-Borşa	Bădulă Adela-Sărmaşu	Deac Darius-Cătina	Buchei Denisa-Căşeiu	Morariu Simion-Cămăraşu
2	Szekely Diana-Mociu	Mazur Bănel Nicoliţă-Sărmaşu	Todea Oana-Frata	Pop Damian-Frata	Fişer Roxana-Cătina	Baciu Andrei-Sărmaşu
3	Michi Ionela-Cămăraşu	Bujor Eugen-Cămăraşu	Chendereşi Denisa-Frata	Cherteş Felician-Apahida	Turău Raluca-Poieni	Nagy Sebastian-Cătina
Rounders ball throw						
1	Gaşpar Raluca-Cămăraşu	Gaşpar Nicolae Guţă-Sărmaşu	Chiorean Andreia-Cămăraşu	Tocoş Andrei-Apahida	Moldovan Didica-Frata	Gaşpar Cristian-Sărmaşu
2	Crişan Alicia-Poieni	David Paul-Borşa	Doboş Paula-Cămăraşu	Pop Damian-Frata	Turău Raluca-Poieni	Morariu Simion-Cămăraşu
3	Szekely Diana-Mociu	Mazur Bănel Nicoliţă-Sărmaşu	Moldovan Cristina-Frata	Săpşăcan Alin-Căşeiu	Buchei Denisa-Căşeiu	Baciu Andrei-Sărmaşu
4x100 mixed relay			*4x150 mixed relay*		*4x200 mixed relay*	
1	Cămăraşu Middle School		Frata Middle School		Frata Middle School	
2	"Samuil Micu" Theoretical High School Sărmaşu		"Ştefan Pascu" Technological High School Apahida		Cămăraşu Middle School	
3	Frata Middle School		Căianu Middle School		Cătina Middle School	

Sports competitions in Cămăraşu (6)

On the winners' podium, the 13-14 years category, girls

The Frata team, winner in the tug of war event, encouraged by Prof. Sebastian Popa

The team of referees in Cluj

The *Sports Spring Cup* athletic competition for middle schools in Borşa (2)

Concursul de atletism pentru Gimnaziu *Cupa primăverii sportive* la Borşa (2)

The novelties of the second edition of the Spring Cup, held on 27 May 2017, were the attendance of an increasing number of students, boys and girls of two age categories, 11-12 and 13-14 years, and the participation of two new communes. The athletic events included in the competition program were: 50 m sprint, running long jump, rounders ball throw, and tug of war - teams. The participating localities were the following: Aghireş-Fabrici, Apahida, Aşchileul Mare, Borşa (organizing locality), Bonţida, Cămăraşu, Mociu, Panticeu, Răscruci and Vultureni. Like last year, the competition was hosted by the wonderful stadium of the commune, equipped with a nocturnal lighting system, The Cluj County School Inspectorate, represented by inspectors Cristian Potoră and Laura Ionescu, in collaboration with the Mayor's Office of the Borşa commune through Mayor Maria Secară and the middle school director Paul Ciprian Varga, contributed to the success of the competition.

Place	Tug of war	General ranking
1	Borşa	Bonţida General School
2	Bonţida	Cămăraşu General School
3	Aşchileu	Răscruci General School

Physical education teacher: Prof. Nicolae Pop
Director: Prof. Paul Ciprian Varga
Mayor: Maria Secară

Results

Borşa - *Sports Spring Cup* 2nd edition - 27 May 2017 (50 m sprint, running long jump, rounders ball throw, tug of war - teams)

Place	Girls 11-12 years	Boys 11-12 years	Girls 13-14 years	Boys 13-14 years
	50 m sprint			
1	Kutaş Krisztina-Borşa	Kallo Andrei-Bonţida	Ghiran Alexia-Aghireşu F.	Morariu Simion-Cămăraşu
2	Balas Andrada-Răscruci	Mireştean Flavius-Bonţida	Iaroi Antonela-Mociu	Berci Marian-Bonţida
3	Doboş Paula-Cămăraşu	Giurco Eduard-Aghireşu F Macarie Alehandro-Cămăraşu	Mândruşcă Amanda-Cămăraşu	Varga Daniel-Bonţida
	Long jump			
1	Doboş Paula-Cămăraşu	Mireştean Flavius-Bonţida	Corîci Ana-Apahida	Morariu Simion-Cămăraşu
2	Balaş Andrada-Răscruci	Giurco Eduard-Aghireşu F	Mureşan Antonia-Cămăraşu	Berci Marian-Bonţida
3	Chiorean Andreia-Cămăraşu	Kallo Andrei-Bonţida	Kallo Maria	Maghiar Rareş-Apahida Ciurar Dan-Aşchileu
	Rounders ball throw			
1	Felecan Andreea-Aşchileu	Ticos Andrei-Apahida	Mureşan Antonia-Cămăraşu	Berci Marian-Bonţida
2	Chiorean Andreia-Cămăraşu	Mireştean Flavius-Bonţida	Kolbas Casiana-Bonţida	Brancea Denis-Panticeu
3	Pop Adina-Vultureni	Kovacs Darius-Borşa	Pop Denisa-Vultureni	Morariu Simion-Cămăraşu

The *Sports Spring Cup* athletic competition for middle schools in Borşa (2)

Opening ceremony

Prize giving by the Mayor of the Borşa commune, Maria Secară

Start of the prize giving ceremony, conducted by School Inspector Cristian Potoră and Mayor Maria Secară

Cristian Potora, Laura Ionescu
cristipotora@gmail.com
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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.

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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).

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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

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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

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