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## EDITORIAL

# Moderate exercise vs. physical exercise addiction Efortul moderat vs. adicția de exercițiile fizice

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The increasing degree of civilization by industrialization, automation, informatization, which leads to a sedentary behavior at the workplace, along with new leisure possibilities and options for the young generation, which are also predominantly sedentary, require finding solutions for the correction of the lifestyle, including physical exercise, which are aimed at fighting increasingly sedentary behavior.

The entire literature relating to physical exercise and health recommends the systematic/regular practice of moderate physical activity, for the promotion of health. The category of moderate exercise includes walking and marching. One-two sessions per week of more intense effort such as jogging or swimming are also recommended. Regarding intensity, moderate physical exercise should be interpreted in the first place as aerobic effort, with heart rate values ranging between 120-180 beats/minute, depending on sex and age. In terms of volume, systematic moderate exercise refers to the duration of physical activity during the course of a day or a week. It is recommended to perform a physical exercise volume of 30-120 minutes per day, and no more than 10 hours of physical exercise per week. The two parameters of physical exercise, volume and intensity, should be limited because of the complications that may occur in the case of overtraining.

The intensity of exercise should not exceed 75-80% of the maximum value; the maximum value of the exercise pulse considered as a reference is 180 beats/minutes for the age of 20 years; thus, in order to attain the objective of maintaining an optimal health status in the elderly, a level of physical exercise raising the pulse to a value accepted by the following formula will be sufficient:

$$0.75 \times (220 - \text{age})$$

e.g.  $0.75 \times (220 - 60 \text{ years}) = 120 \text{ beats/minute}$

The use of physical activity scales and self-evaluation scales for the young and the elderly, correlated with the exploration of physiological parameters, can provide data allowing to control the exercise parameters (Washburn et al., 1999, cited by Bocu, 2007).

Provided the indications for the practice of physical exercise recommended by specialists are respected, taking

into account the principles of intensity and volume, age and sex, its effects on all the systems of the body are exclusively beneficial. The systematic practice of physical activity has multiple advantages, preventing many morbidity and mortality causes: cardiovascular disease, arterial hypertension, diabetes mellitus, osteoporosis, etc. It has also been found that physical exercise can reduce stress, anxiety and depression (Paluska, 2000).

The individual practice of physical exercise, in addition to the practice of curricular physical activities, is frequently a personal decision, unassisted by a specialist; consequently, it is susceptible of not being rigorously monitored, particularly if this occurs in a fitness room, where exercise is practiced without a time limit. Thus, a volume of more than 15 hours of physical activity per week can be very easily reached.

Following the disregard of volume and intensity limits, after a relatively short time period, 5-6 months, an adolescent or young athlete may become addicted to physical exercise. The criteria characterizing body-building and fitness addiction include the following: training more than five times a week over a duration of several hours, training under mild disease or injury conditions, training to the detriment of social and/or family contacts, feeling guilty when missing training for objective reasons (Véléa, 2002; Valleur & Véléa, 2002; Mirescu et al. 2008).

Risks for the health of an individual may occur after a period of excessive physical exercise, during which the brain secretes excess endorphins and serotonin, substances that induce a permanent good mood. When excessive physical training can no longer be performed as a result of objective causes such as an accident or disease, these substances are no longer produced and the general state of the individual is altered, with the possible onset of depression.

In the case of high performance sport, the effort performed should be monitored by complex teams including specialists in various fields (trainers, doctors, psychologists, etc.). In high performance athletes, an impact occurs at the time of sports drop out or activity cessation because of a disease or at the end of sports career.

Since 1976, researchers have drawn attention to positive addictions such as sport, sex, shopping addiction.

This type of addiction was described for the first time in high performance athletes. Excessive physical exercise is a form of addiction. In athletes who practice excessive running, fitness, body-building, i.e. those who are addicted to physical exercise, a behavioral change occurs, in the sense that they consider training to be much more important than friends, family, health or career (Glaser, 1985 cited by Manea et al., 2014).

Scientists do not deny the benefits of sport, as long as exercise does not become a purpose in itself, but they draw attention to the practice of physical exercise in an obsessive way, in order to reduce body weight or increase muscle mass.

When practiced with moderation, physical exercise has unquestionable beneficial effects on health, and people should be encouraged to remain physically active.

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## EDITORIAL

# Efortul moderat vs. adicția de exercițiile fizice Moderate exercise vs. physical exercises addiction

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Creșterea continuă a gradului de civilizație prin industrializare, automatizare, informatizare, care conduce către un comportament sedentar la locul de muncă, apoi noile preocupări și posibilități de petrecere a timpului liber ale tinerei generații, care sunt tot preponderent sedentare, impun găsirea unor soluții de corectare a stilului de viață care să includă și exerciții fizice, menite să contracareze sedentarismul în creștere.

Întreaga literatură aferentă domeniilor activități fizice-sănătate recomandă practicarea sistematică/regulată a efortului fizic moderat, în vederea promovării sănătății. În categoria efortului moderat intră plimbările și plimbările în ritm alert (gen marș). Sunt recomandate și 1-2 reprize pe săptămână de efort mai intens, ca de exemplu cele din categoria jogging-ului sau înotului. În privința intensității, efortul fizic moderat trebuie interpretat în primul rând ca efort aerob, cu limitele frecvenței cardiace între 120-180 bătăi/minut, în funcție de gen și vârstă. În privința volumului, efortul moderat practicat sistematic se referă la durata activității fizice pe întinderea unei zile sau a unei săptămâni. Se recomandă efectuarea unui volum cuprins între 30-120 minute pe zi, nu mai mult de 10 ore de exerciții fizice pe săptămână. Se observă că acești doi parametri ai efortului fizic, volumul și intensitatea, se cer a fi limitați dacă se are în vedere complicațiile care pot surveni în cazul unor exagerări în practicarea exercițiilor fizice.

Intensitatea efortului depus nu trebuie să depășească 75-80% din valoarea maximă; valoarea maximă a pulsului de efort care este luată ca reper este cea de 180 bătăi/minut pentru vârsta de 20 ani; astfel, pentru atingerea obiectivului de menținere a stării optime de sănătate la vârstnici, va fi suficient un efort care să ridice pulsul la un nivel acceptat de formula:

$$0,75 \times (220 - \text{vârsta})$$

ex.  $0,75 \times (220 - 60 \text{ ani}) = 120 \text{ bătăi/minut}$

Utilizarea unor scale de activitate fizică și de autoevaluare a activității fizice pentru tineri și vârstnici, corelate cu explorarea unor parametri fiziologici, poate oferi date care să țină sub control parametrii efortului (Washburn ș.c., 1999, citat de Bocu, 2007).

În condițiile respectării indicațiilor de practicare a activităților fizice, având în vedere principiile de intensitate

și volum, vârstă și gen, recomandate de specialiști, efectele acestora asupra tuturor sistemelor organismului sunt exclusiv benefice. Practicarea sistematică a exercițiului fizic are multiple avantaje, prevenind multe cauze de morbiditate și mortalitate: bolile cardiovasculare, hipertensiunea arterială, diabetul zaharat, osteoporoza și altele. De asemenea, s-a constatat că exercițiile fizice sunt mijloace de reducere a stresului, anxietății și depresiei (Paluska, 2000).

De multe ori, practicarea individuală a exercițiilor fizice, suplimentare celor practicate în cadrul curriculumului școlar, este o decizie personală, neasistată de un specialist, ca urmare riscă să nu fie monitorizată riguros, mai ales dacă aceasta se petrece într-o sală de fitness, unde practicarea exercițiilor este fără limită de timp. Se poate ajunge astfel ușor la un volum de peste 15 ore de activități fizice pe săptămână.

Practicate fără respectarea limitelor de volum și intensitate, după o perioadă relativ scurtă, de 5-6 luni, un adolescent sau un tânăr poate deveni dependent de exercițiile fizice. Dintre criteriile prin care se caracterizează dependența de body-building și fitness, pot fi enumerate următoarele: practicarea antrenamentelor de mai mult de cinci ori pe săptămână, acestea întinzându-se pe o durată de minim câteva ore, continuarea activității în condiții de boală ușoară sau accidentare, răcirea contactelor sociale și/sau familiale în favoarea antrenamentelor, apariția sentimentelor de vinovăție la ratarea unor antrenamente, din motive obiective (Vélée, 2002; Valleur & Vélée, 2002; Mirescu et al. 2008).

Riscurile pentru sănătatea individului pot apare după o perioadă de practicare a exercițiilor fizice în exces, perioadă în care creierul secretă în exces endorfine și serotonină, substanțe care au ca efect o stare permanentă de bună dispoziție. În momentul în care posibilitatea de efectuare în exces a exercițiilor fizice este întreruptă ca urmare a unor cauze obiective, cum ar fi un accident sau o boală, substanțele respective nu se mai produc, iar starea generală a individului se alterează, cu posibilitatea de instalare a depresiei.

În cazul practicării sportului de performanță, efortul prestat trebuie supravegheat de către echipe complexe, formate din specialiști din mai multe domenii (antrenori, medici, psihologi etc). La sportivii de performanță, un impact se produce în momentul abandonului sportiv sau al opririi din activitate, datorită unor boli sau în momentul

ieșirii din sistem la încheierea carierei sportive.

Încă din anul 1976, unii cercetători atrag atenția asupra adicțiilor cu valență pozitivă precum (sportul, sexul, shoppingul). Acest gen de adicție a fost descris pentru prima dată la atleții de înaltă performanță. Practicarea în exces a exercițiilor fizice este o formă de adicție. La cei care practică în exces alergarea, fitnessul, body-buildingul, adică la cei cu adicție de exercițiile fizice, s-a observat și o schimbare de comportament, în sensul că aceștia consideră antrenamentele mult mai importante decât prietenii, familia, sănătatea și cariera (Glaser, 1985 citat de Manea et al., 2014).

Oamenii de știință nu neagă beneficiile sportului, atât timp cât exercițiile nu devin un scop în sine, dar atrag atenția asupra practicării acestora într-un mod obsesiv, cu scopul reducerii greutății corporale, sau creșterea masei musculare.

Practicate cu moderație, efectele sanogenetice ale exercițiilor fizice asupra stării de sănătate nu sunt puse sub semnul întrebării, iar oamenii trebuie încurajați să rămână fizic activi.

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**ORIGINAL STUDIES**  
**ARTICOLE ORIGINALE**

**Correlation of periprosthetic bone mineral density  
and skeletal bone mineral density values  
in patients with total hip arthroplasty**  
**Corelația valorilor densității mineral osoase periprotetice  
cu densitatea mineral osoasă a întregului schelet  
la pacienții cu artroplastie totală coxofemurală**

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**Abstract**

*Background.* The presence of periprosthetic osteoporosis influences the postoperative evolution of hip replacement patients, delays the functional rehabilitation process and considerably decreases the quality of life of these patients.

*Aims.* The aim of the study is to demonstrate the role of periprosthetic bone mineral density (BMD) and to correlate its values with skeletal (BMD) values.

*Methods.* The study was carried out at the Clinical Rehabilitation Hospital Cluj-Napoca in the period June-December 2009, on 58 patients aged between 30-83 years with uni- and bilateral cemented and uncemented total hip endoprostheses. For the determination of the bone mineral density, the dual X-ray absorptiometry (DXA) method was used, with the software for orthopedic prostheses available.

*Results.* Statistical data analysis demonstrated a direct correlation between periprosthetic (BMD) and skeletal bone mineral density values, without 100% overlapping, which requires the presence of reference values for periprosthetic areas.

*Conclusions.* Although it follows the tendency of skeletal (BMD), periprosthetic bone mineral density requires T scores specific for the periprosthetic Gruen zones.

**Key words:** bone mineral density, periprosthetic osteoporosis, hip endoprosthesis.

**Rezumat**

*Premize.* Prezența osteoporozei periprotetice influențează evoluția postoperatorie a pacienților endoprotezați, întârzie procesul de recuperare funcțională și scade considerabil calitatea vieții acestor pacienți.

*Obiective.* Obiectivul studiului este de a demonstra rolul densității mineral osoase (DMO) periprotetice și de a corela valorile acesteia cu valorile DMO ale întregului schelet.

*Metode.* Studiul s-a desfășurat în cadrul Spitalului Clinic de Recuperare Cluj-Napoca, în perioada iunie-decembrie 2009, fiind incluși un număr de 58 de pacienți, cu vârsta cuprinsă între 30-83 ani, cu endoproteze totale de șold cimentate și necimentate, uni- și bilaterale. Pentru determinarea densității mineral osoase s-a folosit metoda absorptiometriei bifotonice cu raze X (DXA), având la dispoziție software-ul pentru proteze ortopedice.

*Rezultate.* Analiza statistică a datelor a demonstrat o corelație directă între valorile DMO periprotetice și cele ale întregului schelet, fără a exista o suprapunere de 100%, ceea ce face necesară existența unor valori de referință pentru zonele periprotetice.

*Concluzii.* Densitatea mineral osoasă periprotetică, deși urmează tendința DMO a întregului schelet, impune existența unor scoruri T specifice zonelor periprotetice Gruen.

**Cuvinte cheie:** densitate mineral osoasă, osteoporoza periprotetică, endoproteze de șold.

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## Introduction

The World Health Organization considers osteoporosis as one of the major diseases of the modern period, the consequence of a certain lifestyle (diet, physical exercise), which places an important burden on the community and is continuously increasing with the increase of the proportion of the elderly in the population. Data provided by WHO show that if in 1960 the number of people aged over 60 years was 250 million, by 2020 it will reach about 1 billion (Glowacki et al., 2003).

This general population aging tendency has occurred on the background of an increase of life expectancy in developed countries, which is 80 years for women. Since the menopause onset age remains the same (around 50 years), more than 30% of a woman's life is postmenopausal (Jones et al., 2005).

Osteoporosis is a systemic disease characterized by low bone mass and the alteration of bone microarchitecture, resulting in increased bone fragility and fractures.

The diagnostic threshold of -2.5 SD identifies osteoporosis in 15-30% of postmenopausal women (Harty et al., 2005). Studies have demonstrated that osteoporosis is an underdiagnosed and undertreated disease: it is estimated that there are currently more than 150 million people worldwide who suffer from osteoporosis, and after the age of 50 years, 40% of women and 13% of men develop at least one osteoporotic fracture (Delisa, 2005; Mihailov & Cevei, 2006; Feldstein et al., 2003). The literature emphasizes that the risk of a hip fracture during a woman's life is higher than the risk of breast, endometrial and ovarian cancer together (Harvey et al., 2010).

Patients who had a previous vertebral fracture have a 4 times higher risk to develop another vertebral fracture compared to the general population. The most common location of vertebral fractures is at the thoracolumbar junction and in the middle thoracic area (Vissers et al., 2011). Patients with prevalent vertebral fractures also have a two times higher risk of hip fractures compared to the general population (Harvey et al., 2010; Boonen & Singer, 2008). The number of hip fractures worldwide is estimated to increase from 1.66 million in 1990 to 6.26 million in 2050. Over the next 50 years, the number of osteoporotic fractures will double (Rodaro et al., 2004).

In the United States of America, about 13.8 billion dollars are spent every year for the treatment of osteoporotic fractures and the costs continue to increase. Therefore, the efforts made in order to develop a coherent and sustained strategy for the prevention, early detection and treatment of osteoporosis are easy to understand (Harvey et al., 2010).

Prevention in osteoporosis remains extremely important, as long as there is practically no method for restoring the quality of bone affected by osteoporosis (Watts et al., 2011).

Osteoporosis is a classical example of disease that is easier to prevent than to treat, because the results of treatment are various and unpredictable. The most promising prophylactic tendencies are represented by the attempts to reach maximal skeletal bone mass (Sánchez-Riera et al., 2010; Cooper et al., 2011).

## Hypothesis

The aim of the study is to correlate periprosthetic bone mineral density and skeletal bone mineral density values and to obtain cut-off values for the seven Gruen zones, for which there is currently no T score.

## Materials and Methods

We mention that according to the Helsinki Declaration, Amsterdam Protocol and the Directive 86/609/EEC, there is the approval of Ethical Commission from the University of Medicine and Pharmacy „Iuliu Hațieganu” Cluj-Napoca.

### Research protocol

#### Period and place of the research

The study was carried out in the medical rehabilitation service of the Clinical Rehabilitation Hospital Cluj-Napoca, in the period June-December 2009.

#### Subjects and groups

Was included 58 patients, 22 males and 36 females, aged between 30-83 years with uni- and bilateral cemented and uncemented total hip endoprostheses.

#### Tests applied

Bone mineral density was determined by the dual X-ray absorptiometry (DXA) method, with the Lunar Prodigy Advance osteodensitometer, using the en. Core 11.x software and computers with the Windows XP Professional operating system.

Bone mineral density was measured at vertebral and bilateral femoral level, with the software for orthopedic prostheses available. Using this software, the osteodensitometer recognizes the existing prosthesis, differentiating bone tissue from the prosthetic material; thus, the bone density level is the real one.

The device allows to measure the bone mineral content BMC (grams) and bone mineral density BMD (grams/cm<sup>2</sup>), in seven different periprosthetic areas known as the Gruen zones.

Inside the seven Gruen zones (RM), seven small periprosthetic areas (rm) of 0.5/1 cm were selected (each RM zone having a corresponding small rm zone), in order to evidence periprosthetic bone loss.

The 7 periprosthetic Gruen zones (RM) and the small areas corresponding to the Gruen zones (rm) in the replaced hip are represented in Figures 1 and 2.

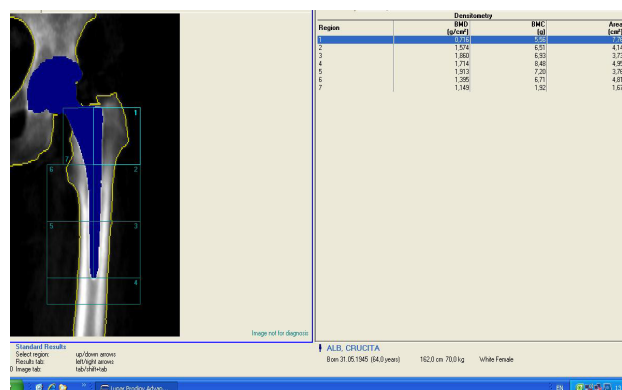


Fig. 1 – Gruen zones in the replaced hip

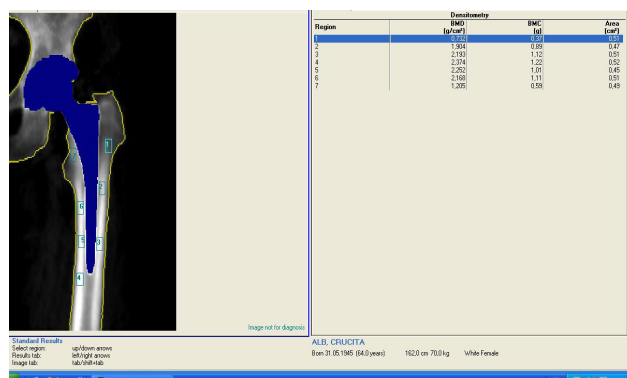


Fig. 2 – Small areas corresponding to the Gruen zones in the replaced hip

According to WHO criteria, osteoporosis is defined as a T score lower than or equal to -2.5 SD; in the case of osteopenia, T score values range between -1.5 and -2.5 SD; T score is the standard for the interpretation of results.

For diagnosis, T scores at vertebral level and at the level of the hip contralateral to the replaced hip were used in the case of unilateral arthroplasty, and only at vertebral level in the case of bilateral endoprostheses, as there were no reference values for the replaced hip.

T score values along the vertical axis to the right indicate the standard derivations of the BMD of a patient compared to the bone mineral density of a young adult (Fig. 3).

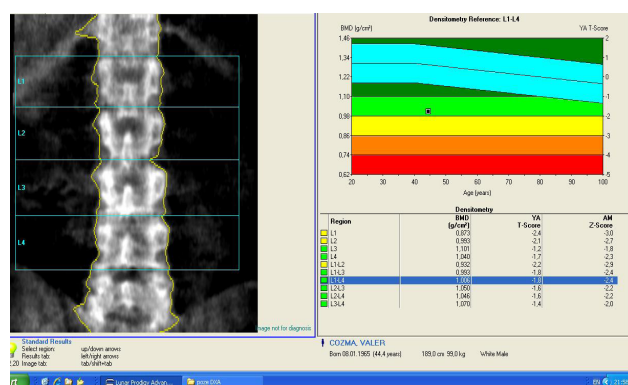


Fig. 3 – Reference diagram

### Statistical processing

In order to determine the cut-off value, in the case of a quantitative variable in a significant relationship with a qualitative variable, the method of the ROC (Receiver operating characteristic) curves was used. The cut-off value found was verified by testing the relationship with the qualitative variable.

Statistical calculations were performed using the SPSS 13.0 and Microsoft EXCEL applications.

### Results

The mean bone mineral density values were statistically significantly lower in the case of the replaced hip both for the Gruen zones ( $p=0.02$ ) and the small areas corresponding to the seven Gruen zones ( $p=0.01$ ) (Figures 4, 5).

The mean BMD values of the seven periprosthetic

zones were statistically significantly lower ( $p<0.05$ ) in the case of the diagnosis of osteoporosis compared to osteopenia, and lower in the case of osteopenia compared to normal BMD, both for the Gruen zones and for the small areas corresponding to the Gruen zones (Figures 4, 5).

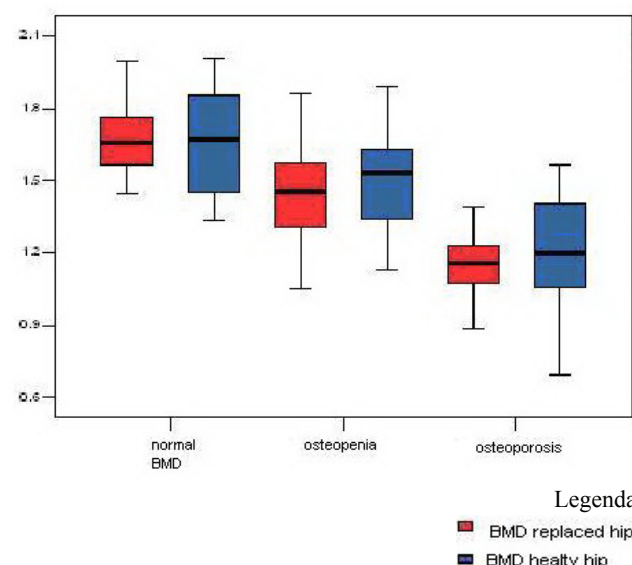


Fig. 4 – Comparison between the mean BMD of the 7 Gruen zones (RM) depending on the diagnosis made by DXA, in the two hips

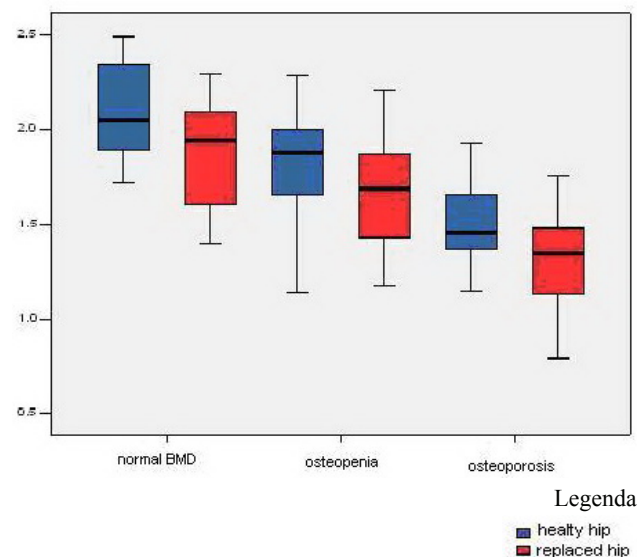


Fig. 5 – Comparison between the mean BMD of the small areas corresponding to the Gruen zones (rm) depending on the diagnosis made by DXA, in the two hips

Subsequently, we tried to obtain BMD cut-off values for the seven periprosthetic zones (without having a T score for these zones) in the studied patients with different diagnoses (normal BMD/osteopenia/osteoporosis), using the T score for the healthy contralateral hip.

The statistical procedure used was represented by the ROC curves; the area under the curve proved to be statistically different from the area under the diagonal, so that cut-off values could be determined.

The cut-off values found for the BMD of the



periprosthetic areas were 1.6 and 1.24 for the Gruen zones; 1.98 and 1.68 for the small areas corresponding to the Gruen zones.

Interpretation of these results for the Gruen zones: if the mean BMD was higher than 1.6, the patient was probably diagnosed with normal BMD; if the mean BMD was lower than 1.6 and higher than 1.24, the patient was probably diagnosed with osteopenia; if the mean BMD was lower than 1.24, the patient was probably diagnosed with osteoporosis.

For the small areas corresponding to the Gruen zones, we interpreted the results in accordance with the values obtained: if the mean BMD was higher than 1.98, the patient was probably diagnosed with normal BMD; if the mean BMD was lower than 1.98 and higher than 1.68, the patient was probably diagnosed with osteopenia; if the mean BMD was lower than 1.68, the patient was probably diagnosed with osteoporosis.

The cut-off values were verified for the healthy hip with the contingency table I (Table I) for the Gruen zones and the contingency table II (Table II) for the small areas corresponding to the Gruen zones.

The results of the verification for the Gruen zones were as follows: 11 of the 16 patients diagnosed with normal BMD were classified as normal based on the BMD values of the periprosthetic zones, 17 of the 24 patients diagnosed with osteopenia were classified as osteopenic based on the BMD values of the periprosthetic zones, 14 of the 18 patients diagnosed with osteoporosis were classified as osteoporotic based on the BMD values of the periprosthetic zones. The other patients were misclassified. The accuracy of the classification using the BMD cut-off values of the periprosthetic zones was 72.41% (representing the number of correctly classified patients of all patients based on periprosthetic BMD).

**Table I**  
Classification of patients using the BMD cut-off values of the periprosthetic Gruen zones

Values	BMD	normal	osteopenia	osteoporosis	Total
Cut-off	normal	11	4	0	15
	osteopenia	5	17	4	26
	osteoporosis	0	3	14	17
Total		16	24	18	58

The results of the verification for the small areas corresponding to the Gruen zones were as follows: 11 of the 16 patients diagnosed with normal BMD were classified as normal based on the BMD values of the periprosthetic zones, 12 of the 24 patients diagnosed with osteopenia were classified as osteopenic based on the BMD of the periprosthetic zones, 15 of the 18 patients diagnosed with osteoporosis were classified as osteoporotic based on the BMD values of the periprosthetic zones.

The other patients were misclassified. The accuracy of the classification using the BMD cut-off values of the periprosthetic zones was 65.52%.

**Table II**  
Classification of patients using the BMD cut-off values of the small areas corresponding to the Gruen zones

Values	BMD	normal	osteopenia	osteoporosis	Total
Cut-off	normal	11	6	0	17
	osteopenia	5	12	3	20
	osteoporosis	0	6	15	21
Total		16	24	18	58

The comparison of the healthy hip and the replaced hip evidenced the following results for the Gruen zones:

- 3 of the 15 patients considered to have normal BMD in the healthy hip were considered to have osteopenia in the replaced hip;
- 3 of the 26 patients considered to have osteopenia in the healthy hip were considered to have osteoporosis in the replaced hip;
- 6 of the 26 patients considered to have osteopenia in the healthy hip were considered to have normal BMD in the replaced hip;
- 8 of the 17 patients considered to have osteoporosis in the healthy hip were considered to have osteopenia in the replaced hip (Table III).

**Table III**  
Comparison between the two hips depending on the BMD cut-off values of the Gruen zones

	Healthy hip				Total
	BMD	normal	osteopenia	osteoporosis	
Replaced hip	normal	12	6	0	18
	osteopenia	3	17	8	28
	osteoporosis	0	3	9	12
Total		15	26	17	58

La compararea șoldului fără ETS cu șoldul endoprotezat, pentru zonele mici corespondente zonelor Gruen, au fost obținute următoarele rezultate:

The comparison of the healthy hip and the replaced hip evidenced the following results for the small areas corresponding to the Gruen zones:

- 5 of the 17 patients considered to have normal BMD in the healthy hip were considered to have osteopenia in the replaced hip;
- 3 of the 17 patients considered to have normal BMD in the healthy hip were considered to have osteoporosis in the replaced hip;
- 11 of the 20 patients considered to have osteopenia in the healthy hip were considered to have osteoporosis in the replaced hip (Table IV).

**Table IV**  
Comparison between the two hips depending on the BMD cut-off values of the small areas corresponding to the Gruen zones

	Healthy hip				Total
	BMD	normal	osteopenia	osteoporosis	
Replaced hip	normal	9	0	0	9
	osteopenia	5	9	0	14
	osteoporosis	3	11	21	35
Total		15	17	20	21

## Discussion

The knowledge of reference values, i.e. T scores for periprosthetic bone mineral density, would better evidence periprosthetic bone mass loss, allowing for an optimal therapeutic approach, at the most appropriate time for the patient (Smolders et al., 2010, Cushnaghan et al., 2007).

The life duration of an endoprosthesis depends on a number of factors, and periprosthetic bone mineral density is one of the most important; thus, the knowledge of the densitometric values of the Gruen zones becomes extremely important, even before the making of a diagnosis of low skeletal BMD (osteopenia/osteoporosis) according to WHO criteria is possible (Hakulinen et al., 2010).

Knowing these aspects will enable an effective therapeutic approach of the rehabilitation of patients with hip arthroplasty, creating the premises for a normal hip functionality and for an optimal performance of domestic, professional and sports activities by the patients.

The results obtained, the accuracy of 72.41% for the Gruen zones and 65.52% for the small areas corresponding to the Gruen zones, oblige us to perform further studies in order to establish reference values for these areas, given that the proportion of misclassified patients based on the reference values for the other areas (the spine and the healthy contralateral hip) is rather high.

The mean periprosthetic BMD values were lower in the case of osteoporosis compared to osteopenia, and lower in the case of osteopenia compared to normal skeletal BMD.

## Conclusions

1. The replaced hip has statistically significantly lower mean periprosthetic BMD values compared to the contralateral hip.

2. The degree of bone mineralization in the replaced hip is correlated with the diagnosis of normal BMD/osteopenia/osteoporosis of the entire skeleton.

3. The BMD value of the periprosthetic Gruen zones better coincides with the diagnosis made based on the T score in the healthy hip (compared to the small areas corresponding to the Gruen areas).

4. Reference values for periprosthetic bone mineral density are needed.

## Conflict of interests

Nothing to declare.

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# **The impact of exercise based on the Eshkol-Wachman movement notation on general coordination**

## **Impactul exercițiilor bazate pe sistemul de notare a mișcărilor Eshkol-Wachman asupra coordonării generale**

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### **Abstract**

**Background.** Coordination is a fundamental physical ability in everyday activities or in performing complex motor skills. It refers to the synchronization between different limbs of the body. The *Eshkol-Wachman Movement Notation* (EWMN) is a numerical notation method that can be used for the analysis and documentation of the movement phenomenon. This method is capable of representing complex movement events, especially those that are performed in simultaneous form, which can be seen in the execution of coordinative movements.

**Aims.** The aim of this research was to examine whether physical practice, based on EWMN, can improve general coordination ability.

**Methods.** 40 college students, which were diagnosed with Attention Deficit Hyperactivity Disorder (ADHD), divided into three groups, participated in the research. The student practiced the exercises during 13 weeks, 3 times per week. The *Matorin* test was conducted at the beginning and at the end of that period for measuring general coordination.

**Results.** The results indicate that the performances were significantly improved ( $Z=1.89$  and  $Z=1.73$ ;  $p<.05$ ) after practicing exercises based on EWMN.

**Conclusion.** Coordinative practice based on EWMN improved general coordination. The significant improvement can be attributed to the conceptual framework of the intervention program that emphasizes the simultaneous and automatic performance of physical exercises.

**Key words:** coordination, EWMN, ADHD, motor skill.

### **Rezumat**

**Premize.** Coordonarea este o calitate fizică de bază, întâlnită în activitățile de zi cu zi sau în efectuarea de mișcări complexe. Presupune sincronizarea dintre diferitele segmente ale corpului. Sistemul de notare Eshkol-Wachman (EWMN) este o metodă de înregistrare a mișcărilor, utilizată pentru analiza și documentarea fenomenului mișcare. Această metodă este capabilă de a reprezenta evenimente de mișcare complexe, în special cele care sunt efectuate în formă simultană, întâlnite în executarea mișcărilor coordonative.

**Obiective.** Scopul acestei cercetări a fost de a examina dacă practicarea exercițiilor fizice, bazată pe metoda EWMN, poate îmbunătăți capacitatea de coordonare generală.

**Metode.** La cercetare au participat 40 de studenți, diagnosticați cu Tulburare hiperkinetică cu Deficit de Atenție (ADHD), împărțiți în trei grupe. Aceștia au practicat exercițiile pe parcursul a 13 săptămâni, de 3 ori pe săptămână. Testul *Matorin* a fost efectuat la începutul și la sfârșitul studiului, pentru a măsura coordonarea generală.

**Rezultate.** Rezultatele indică faptul că după practicarea de exerciții bazate pe EWMN performanțele au fost îmbunătățite în mod semnificativ ( $Z=1.89$  și  $Z=1.73$ ;  $p<.05$ ).

**Concluzii.** Practicarea exercițiilor de coordonare bazate pe metoda EWMN a contribuit la îmbunătățirea coordonării generale. Îmbunătățirea semnificativă poate fi atribuită cadrului conceptual al programului de intervenție, care pune accentul pe performanța simultană și automatizată a exercițiilor fizice.

**Cuvinte cheie:** coordonare, EWMN, ADHD, calități motrice.

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## Introduction

Coordination ability is one of the motor characteristics that can be seen as having both a quantitative and qualitative nature, and is described by terms of efficiency and graceful movements. Coordination is considered to be a complicated ability, having an elusive quality and a variety of classifications. Therefore, it is evident in everyday life (tying shoelaces, driving), in sports (soccer, gymnastics etc.), and in general activities (playing piano, dancing etc.). Moreover, it is regarded as a combination of cognitive and physical properties of the neuromotor system (Summers & Pressing, 1994), representing the qualitative component of psychomotor activities (Pehoiu, 2010). Most of the researches that studied the subject of coordination examined one specific motor activity [for example, Serrien (2008), who studied finger tapping during bimanual and unimanual conditions] or used an existing sport program [for example, Budde et al. (2008), who studied soccer coordination training]. Here we offer a unique set of physical exercises that are based on *Eshkol-Wachman Movement Notation* (EWMN), and are aimed at improving coordination ability.

EWMN is one of the three movement notations that are accepted today in the western world. It was created in Israel by Prof. Noa Eshkol in collaboration with Prof. Abraham Wachman. Over the years, it has been used for analyzing, documentation and creation in varied movement disciplines. EWMN is a numerical notation method proposing a system of symbols which represent basic values that describe human movement in time and space (Eshkol & Wachman, 1958). EWMN is capable of representing complex movement events, including movements that are performed in a simultaneous form. The structure of the notation exposes different coordination layers and enables many types of coordination combinations. Starting from the basic principles of EWMN (body, space and time), within its unique structure, almost endless coordination combinations can be created.

The method relies on the premise that physical movement phenomena can be analyzed and symbolized within a framework of a concise system of defined symbols (Eshkol & Wachman, 1958). The elementary units that are essential to describe human movement are defined by EWMN and can be represented in the desired level of details. The writing is done by numbers and common graphic symbols

that are written on a designated manuscript page. In this way, the system enables one to write every movement event that can be seen by human eyes (Eshkol & Harries, 1998). Ofer (2009) further emphasizes that EWMN enables to encode the movement information, conceptualize and represent it ('writing'), decode it ('reading') and perform the represented movement ('moving').

Because of its unique structure, EWMN exposes and enables many coordination layers. In the manuscript page (Figure 1), the body segments are organized in vertical columns, like in a music score. Each body part has its own horizontal line which describes the movement course in time. This unique representation allows to compose coordination exercises that utilize multiple body parts simultaneously and varied time possibilities. The combination of motor exercises with their reading and writing adds a deeper significance to the process of learning.

In view of its structure, EWMN summons deconstruction of a movement phenomenon to its basic components and afterwards reconstructs those components, or just several of them. Thus, it creates new combinations – both chords (vertical column) and lines (horizontal line). This concept per se creates new coordination ensembles (Al-Dor, 2004). According to Al-Dor, the ability to deconstruct and reconstruct basic components makes motor coordination work unique. The possibility of deconstruction and reconstruction of movement components creates a new way of thinking about coordination that integrates different combinations of limbs over different durations.

This study examined the impact of a structured intervention program on general coordination among college students with ADHD (Attention Deficit Hyperactivity Disorder). This subject may raise new possibilities of improving coordination ability through varied freestyle physical exercises. The exercises are built on the representation of the body's limbs on the manuscript page. This way of representation organizes the exercises in a clear way, expresses the coordination complexity and demands a cognitive and motor response.

## Hypothesis

Our main hypothesis is that practicing coordination exercises based on EWMN will have an impact on general coordination among students with ADHD.

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## Materials and methods

The study was approved by the Ethics Committees of *Kibbutzim College of Education, Technology and Arts* and *Orot Israel College of Education*. The ethical principles of confidentiality, anonymity and informed consent were applied to the study subjects.

### Research protocol

#### Period and place of the research

The study took place between 25.2.2013-20.6.2013 at Kibbutzim College of Education, Technology And Arts, Tel-Aviv, Israel.

#### Subjects and groups

The research subjects consisted of 40 female college students (mean age 25.9), which were diagnosed with attention deficit hyperactivity disorder (ADHD). The students were medically diagnosed with ADHD before beginning their graduate studies, and were learning a full time program. The average prevalence of adult ADHD is estimated to be between 2.5 and 4.9% (Franke et al. 2012). The students were volunteers recruited from two colleges of education in Israel: Kibbutzim College of Education, Technology and Arts, Tel-Aviv (8000 students), and Orot Israel College of Education, Elkana (2000 students).

The subjects were randomly divided into three groups, two experimental groups and one control group: students in the first experimental group (N = 13, mean age 26.8) practiced coordination exercises based on EWMN; students in the second experimental group (N = 14, mean age 25.2) practiced general coordination exercises [for example: skipping, jumping rope, bouncing steps (Ben-Sira, Tenenbaum & Lidor, 1998)]; and the control group (N = 13, mean age 25.8) did not practice coordination in any form.

#### Tests applied

To assess the level of manifestation of coordination we used the *Matorin Test*. The aim of this test is to measure gross motor coordination. Description: from standing position performing a jump with rotation along the longitudinal axis of the body. During the jump, the examinee must not lose balance and land with feet together, as in the original position. A circle with a diameter of 40 cm and a jump start line are drawn on the ground. The examinee is standing with feet placed either side of a line drawn on the floor, arms relaxed. Then, he will execute a jump back to the right. After the jump, the examinee will remain in place in landing position and the examiner will measure the return angle. This test was measured twice: one jump in clockwise direction and the second jump in counterclockwise direction. Each score was taken separately.

#### Statistical processing

A series of non-parametric tests (Wilcoxon) were conducted in order to examine whether there was an improvement among the subjects following the intervention. The Wilcoxon test is a non-parametric method for comparing two related samples, in this case, the repeated measurement of a single sample. We chose to conduct a non-parametric test due to the small size of the groups, which prevents the assumption of normal distribution of residuals. The software used was SPSS.

### Experimental procedure

At the beginning and end of the study period, the students were tested for general coordination. The students of the two experimental groups met with the instructor once a week, at the beginning of every week. During this group meeting, they learned and practiced coordination exercises. Throughout the week after, the students were asked to practice the exercises individually, during their own time, another two practices. The students of the control group met with the instructor only two times – at the beginning and end of the research.

### Intervention program

The exercises of the first experimental group are part of the *Sapir Method* (Sapir & Blum, 2002) that is intended to improve basic abilities of the learning process. The method was created by Tirza Sapir and was developed by the author. The physical and motor performance of physical exercises gives an indication of the performer's abilities. Moreover, physical performance requires high levels of attention and concentration and by practicing the exercises, one can improve them.

The program is based on learning and practicing 2-3 new coordination exercises every week (a total of 31 exercises). A three stage process (Figure 2) occurs every time when performing a new exercise. The first stage deals with learning the exercise, which requires physical and cognitive decoding. This is done by performing each coordination layer separately. The next stage is practicing the exercise by performing the motor layers together, simultaneously. The aim is to succeed in performing simultaneous movements and by that, to correctly execute the coordination challenge. The third stage is directed at reaching the automatic performance of the exercise. When the exercise is performed automatically, one must move on to a new exercise that contains other coordination combination (different limbs, different duration, different coordination classification), and start the cycle again.

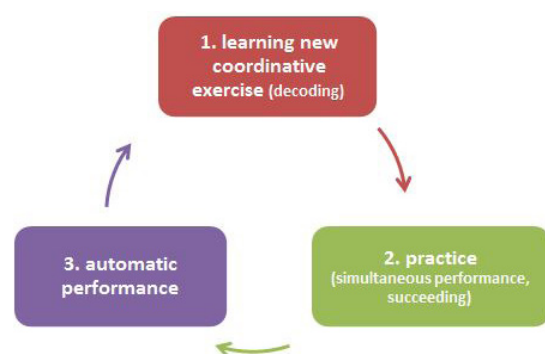


Fig. 2 – A circular model for coordination exercises (intervention program based on EWMN)

## Results

Table I presents the mean scores and standard deviation of the *Matorin Test* for general coordination (clockwise) at the pre-test and the post-test phases in the three research groups. Also, the *Wilcoxon* test results comparing the performance of each group before and after the intervention are presented.

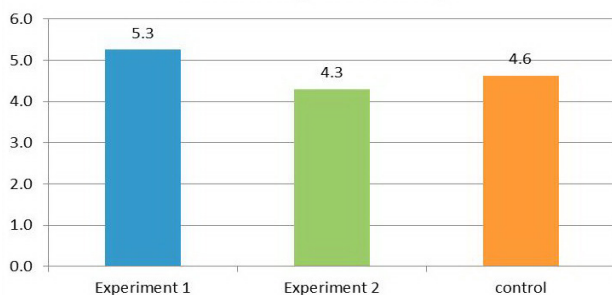
**Table I**  
Means and standard deviation of the Matorin test for general coordination (clockwise) at the pre-test and post-test phases among the groups, and Wilcoxon test results assessing the degree of progress of each group

Groups	Pre-test		Post-test		Z
	SD	M	SD	M	
Experiment 1 (N=13)	49.14	370.38	48.07	350.08	1.89*
Experiment 2 (N=14)	44.88	356.79	48.68	343.93	1.63
Control (N=13)	42.63	346.15	43.23	332.31	1.63

\*p<.05

As expected, the results presented in Table I show a significant improvement following the intervention in the performance of the first experimental group. No significant improvement was found in the performance of the second experimental group and the control group.

Figure 3 presents the degree of improvement of the *Matorin Test* for general coordination (clockwise) among the three research groups.



**Fig. 3** – Degree of improvement in percentage - *Matorin* test (clockwise)

As shown in Figure 3, the first experimental group had the highest improvement (5.3%) in the *Matorin test* (clockwise) as compared to the second experimental group (4.3%) and the control group (4.6%).

The next table presents the mean scores and standard deviation of the *Matorin Test* for general coordination (counterclockwise) at the pre-test and post-test phases among the three research groups. Also, the Wilcoxon test results comparing the performance of each group before and after the intervention are presented.

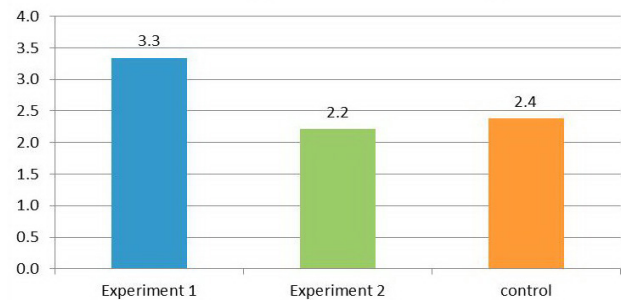
**Table II**  
Means and standard deviation of the Matorin test (counterclockwise) at the pre-test and post-test phases among the groups, and Wilcoxon test results assessing the degree of progress of each group

Groups	Pre-test		Post-test		Z
	SD	M	SD	M	
Experiment 1 (N=13)	39.47	335.77	37.44	325.38	1.73*
Experiment 2 (N=14)	38.47	337.50	41.80	331.07	1.41
Control (N=13)	28.37	328.85	31.00	321.92	1.41

\*p<0.5

Table II shows that a significant improvement was found in the performance of the first experimental group following the intervention. No significant improvement was found in the performance of the second experimental group and the control group.

Figure 4 presents the degree of improvement of the *Matorin Test* for general coordination (counterclockwise) among the three research groups.



**Fig. 4** – Degree of improvement in percentage - *Matorin* test (counterclockwise)

As shown in Figure 4, (counterclockwise), the first experimental group had the highest improvement (3.3%) in the *Matorin test* as compared to the second experimental group (2.2%) and the control group (2.4%).

## Discussion

Regarding general coordination, the findings showed a significant improvement in both tests in the first experimental group who practiced coordination exercises based on EWMN. The improvement of the first experimental group can be explained by the structure of the intervention program.

The general structure of the program was compatible with the three main phases of motor skill acquisition that were described by Puttemans et al. (2005). At the proposed intervention, each exercise stands on its own and matches the phases of motor skill acquisition. Moreover, the whole program as a complete unit matches those phases. In that sense, the subjects improved their physical abilities (Hötting & Röder, 2013).

The learning process of each and every one of the exercises can be examined according to the phases of motor skill acquisition. The participants started by learning the exercise, which required highly attentional demands (early phase); continued on by practicing the exercise and establishing the level of performance (intermediate phase); and then reached automatic performance (final phase). This course happened again and again with each new exercise during the entire period of the intervention program. An additional perspective can be gained by examining the process of the whole program in light of the phases mentioned above. The program lasted for 3 months. At the beginning (first month), the students experienced difficulties, both motor and cognitive. The students “learned” the program, its requirements and demands. Each student needed to make certain adjustments to complete the program. This stage matches the first phase of high attention demands. The second month can be characterized by balancing. The students already knew the course of the program and could begin focusing on the motor performance of the exercises. This stage matches the established performance level. The third month can be described as fluent practicing and mostly involved physical



practice. This stage matches the automatic performance phase (it is important to notice that it does not mean that the exercises were immediately performed automatically). The intervention program can be seen as a process of sequential elaboration and stabilization of different states of coordination. The process of changes in coordination among the subjects took place during the development of the coordination skill (Temprado et al., 1997).

In the proposed intervention program, there was a large emphasis on the practice of every exercise. Through practice, the ability to perform several tasks simultaneously can improve (Swinnen & Wenderoth, 2004; Kahneman, 2011). Furthermore, one of the main findings in the study about the impact of learning EWMN on the development of coordination (Al-Dor, 2004) was that a significant gap in physical performance was evident between the first and second time of each coordination performance. The physical goal of practice within the intervention program was succeeding in performing the coordination combination (right performance of the simultaneous movement sequences, “cracking” the coordination combination) until a “reasonable degree of success” was obtained (Walter & Swinnen, 1994). Till then, the participant did not move on to the next exercise. This kind of oriented practice may probably lead to the improvement of coordination. The progressive improvement of performance following practice of a new complex motor skill was also explained by Rémy et al. (2008), who indicated the transition from attention-demanding to more automatic performance throughout the learning.

The intervention program dealt with the subject of “part-whole training” (Walter & Swinnen, 1994) but from a different perspective. The authors offered a training technique based on decomposing a skill into logical separate components and then reassembled them into the “whole” skill. The intervention program offers exercises that are initially built from separate layers of movement (“parts”) that are performed simultaneously and by that create a united performance (“whole”). Walter & Swinnen assumed that their technique may promote the acquisition of some multicomponent skills by simplifying its performance. The results of this research take this assumption one step further by suggesting that not only the acquisition can be promoted, but the coordination ability itself is improved.

In addition to the importance of practicing mentioned earlier, it is not enough to practice coordination per se. Following Doidge (2007), it can be said that practice must include new learning so that the general effect will be meaningful. In this study, the program of the first experimental group consisted of learning several new exercises each week. This enabled the existence of several processes such as new learning and improving coordination skills. The program was based on 31 basic exercises (and several more variations of each exercise) that were composed of new combinations of movements. Not only new exercises were learned and practiced, but also, each exercise contained a different coordination combination and by that increased the level of new learning. The intervention program of the second experimental group consisted of practicing the same previously learned coordination exercises. As a result, the subjects repeated

the same movements and it can be assumed that no new learning occurred.

## Conclusions

1. Students with ADHD can improve their general coordination ability by physical exercising. Among female students, the coordination ability can be significantly improved.

2. Significant improvement in general coordination can be achieved by practicing exercises based on EWMN. The significant improvement can be attributed to the conceptual framework of the intervention program. The exercises emphasize the different movement sequences that can be performed separately and simultaneously, and by that can enhance the coordination ability. Moreover, the exercises were aimed at an automatic performance that reflects both the success of the coordination execution and the improvement of the ability. These exercises might serve as a useful intervention to improve general coordination.

## Conflicts of interest

There are no conflicts of interest.

## Acknowledgement

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## Clinical effects of multimodal therapy in patients with knee osteoarthritis

### Efectele clinice ale terapiei multimodale la pacienții cu gonartroză

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#### **Abstract**

**Background.** Osteoarthritis (OA) is considered to be the most common rheumatologic disease which affects more than 80% of the population above 55 years. Destruction and loss of articular cartilage is a central feature of OA and chronic pain its cardinal symptom, compromising the mobility and the quality of life of those affected. The failure of conventional treatments, analgesics or nonsteroidal anti-inflammatory drugs (NSAIDs) to satisfactorily control OA progression, combined with their frequent adverse side effects, may explain the increasing use of such SYSADOA (Symptomatic Slow-Acting Drugs for Osteoarthritis) therapies as glucosamine sulfate (GS). Physiotherapy is one of the recommended no pharmacological management options in patients with OA.

**Aims.** The aim of the study was to demonstrate effectiveness of multimodal therapy for patients with knee OA.

**Methods.** 30 patients, diagnosed with knee OA according to the American College of Rheumatology, stage 2 or 3 (modified Kellgren-Lawrence classification) on frontal knee radiography, were enrolled in the cohort prospective study and were treated with multimodal therapy: 10 days ultrasound therapy, laser therapy, thermotherapy and physical exercises associated with short periods of NSAID (10 days) and GS 1500 mg daily for six months. Pain on visual analogue scale (VAS) and WOMAC score (WS) were evaluated prior to and at the end of therapy. SPSS software version 17 was used for statistical analysis.

**Results.** At the end of therapy a statistical significant decrease of pain on VAS ( $p=0.045$ ) and WS ( $p=0.007$ ) was observed. No adverse effects were observed.

**Conclusions.** The multimodal therapy which combines ultrasound therapy, laser therapy, thermotherapy and physical exercises associated with short periods of NSAID (10 days) and GS 1500 mg daily for six months is effective and safe for patients with knee OA.

**Key words:** osteoarthritis, multimodal therapy, glucosamine, physiotherapy.

#### **Rezumat**

**Premize.** Artroza este considerată cea mai frecventă boală reumatologică, care afectează mai mult de 80% din populația de peste 55 de ani. Degenerarea și mai apoi pierderea cartilajului articular sunt elementele centrale în patogeniza artrozei, iar durerea cronică este simptomul cardinal, care compromite mobilitatea articulară și calitatea vieții la cei afectați. Eșecul tratamentelor convenționale, medicamente analgezice sau antiinflamatoare nesteroidiene (AINS), în a controla satisfăcător progresia artrozei, combinat cu efectele lor secundare frecvente, poate explica utilizarea tot mai largă a medicamentelor de tip SYSADOA (Symptomatic slow acting drugs for OA), așa cum este glucozamina sulfat (GS). Fizioterapia este una dintre cele mai recomandate opțiuni de management nonfarmacologic la pacienții cu artroză.

**Obiective.** Scopul studiului a fost de a demonstra eficiența terapiei multimodale la pacienții cu gonartroză.

**Metode.** 30 de pacienți, diagnosticați cu gonartroză conform criteriilor Colegiului American de Reumatologie, grad 2 sau 3 pe scala Kellgren Lawrence modificată, apreciată pe radiografia frontală de genunchi, au fost înrolați într-un studiu prospectiv de cohortă și au fost tratați printr-un program de terapie multimodală, care a inclus ultrasonoterapie, biostimulare laser, termoterapie și exerciții fizice asociate cu AINS, toate administrate timp de 10 zile și GS 1500 mg/zi administrată timp de șase luni. Durerea pe scara analog vizuală (VAS) și scorul WOMAC (WS) au fost evaluate înainte și după terminarea tratamentului. Programul SPSS, versiunea 17, a fost utilizat pentru analiza statistică a datelor.

**Rezultate.** La sfârșitul tratamentului s-a observat o scădere semnificativă statistic a durerii pe VAS ( $p=0,045$ ) și a WS ( $p=0,007$ ). Nu au fost observate efecte adverse.

**Concluzii.** Terapia multimodală, care combină ultrasonoterapia, biostimularea laser, termoterapia și exercițiile fizice asociate cu perioade scurte de AINS (10 zile) și GS 1500 mg/zi, timp de șase luni, este eficientă și sigură pentru pacienții cu gonartroză.

**Cuvinte cheie:** artroză, terapie multimodală, glucozamină sulfat, fizioterapie.

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## Introduction

Osteoarthritis (OA) is considered to be the most common rheumatologic disease. Destruction and loss of articular cartilage is a central feature of OA and chronic pain is its cardinal symptom, compromising the mobility and the quality of life of the affected subjects. The goal of treatment, therefore, is to help reduce pain, prevent reductions in functional ability and maintain or increase joint mobility (Ng et al., 2010). The failure of conventional treatments, analgesics or non-steroidal anti-inflammatory drugs (NSAIDs), to satisfactorily control OA progression, combined with their frequent adverse effects, may explain the increasing use of SYSADOA (Symptomatic Slow-Acting Drugs for Osteoarthritis) therapies such as glucosamine sulfate (GS) (Calamia et al., 2010). Because no single therapy is adequate in OA, the major clinical guidelines for the management of OA generally agree that therapy should involve a combination of non-pharmacological and pharmacological therapies (i.e., multimodal therapy) (Altman, 2010). The ACR recommendations for hip and knee OA management refer to non-pharmacological therapies as the „cornerstone of OA management,” and state that pharmacological therapies should function as add-on therapy to non-pharmacological treatment, the latter of which should be maintained throughout the course of the disease (\*\*\*, 2000). In accordance with Osteoarthritis Research Society International (OARSI), physiotherapy is one of the recommended non-pharmacological management options in patients with OA. It includes physical exercise (aerobic activity, muscle strengthening, and range-of-motion exercises), local thermotherapy (ice or heat), electrotherapy (TENS) (Zhang et al., 2008). Ultrasound (US) therapy and low-level laser therapy (LLLT) were not included in OARSI recommendations for patients with knee osteoarthritis although, in the last years, many studies have demonstrated clinical (Loyola-Sánchez et al., 2010; Hegedus et al., 2009) and biological (Guo et al., 2011; da Rosa et al., 2012) benefits of these procedures in OA.

## Hypothesis

The aim of this study was to evaluate the effects of multimodal therapy, which includes short periods of NSAIDs (10 days) and GS 1500 mg daily for six months, physical exercise, US therapy, LLLT and hot pack, on pain and joint function in patients with knee osteoarthritis.

## Material and methods

According to the Helsinki Declaration, the approval of the Ethics Committee of the “Iuliu Hatieganu” University of Medicine and Pharmacy Cluj-Napoca (Romania) regarding research on human subjects was obtained. All study participants gave their written informed consent.

### Research protocol

*Period and place of the research.* The study took place between September 2009 and August 2011 in the outpatient department of the Rehabilitation Hospital Cluj-Napoca.

*Subjects and groups.* Following a 10 day washout period (NSAIDs or analgesics), 30 patients (aged between 40 and 70 years) from the Rehabilitation Hospital Cluj-

Napoca, diagnosed with knee OA according to the American College of Rheumatology criteria, stage 2-3 (modified Kellgren-Lawrence classification) on a frontal knee radiography, with normal values of erythrocyte sedimentation rate and C-reactive protein, were enrolled in a cohort prospective study. The exclusion criteria were: inflammatory rheumatic disease, infectious or endocrine-related arthropathy, gout, chondrocalcinosis, diabetes mellitus, unstable medical illness, any contraindication to physical therapy, lower limb arthroplasty, intra-articular knee injections (viscosupplement or corticosteroids) or physical therapy in the preceding six months. The study was approved by the local Ethics Committee and the informed consent of the patients was obtained.

*Interventions.* The 30 patients of the experimental group were treated for 10 days by US therapy, LLLT, thermotherapy and physical exercise, associated with NSAIDs and, for six months, with GS (Dona) 1500 mg daily. LLLT was performed with Ga-Al-As diode laser (BTL-Romania), power 50 mW, continuous wave, wavelength 830 nm, 6J/point (8 point).

Continuous ultrasonic waves with  $850 \pm 5\%$  KHz frequency and 0.5 watt/cm<sup>2</sup> power were applied with a transducer that had an effective radiating area of 6.4 cm<sup>2</sup> (Misonic 12M, Misonix -Romania), 5 minutes/day. Thermotherapy consisted of wax package at 45 degrees Celsius for 20 minutes/day. Physical exercise was conducted for 20 minutes/day and included range-of-motion exercises, muscle strengthening and aerobic activity. All physical procedures were performed five times a week for two weeks, excluding weekends, for a total of 10 sessions.

*Tests applied.* Patients were evaluated prior to and at the end of therapy by the visual analogue scale (VAS) and WOMAC score (WS). WS was appreciated on the Likert scale. WOMAC subscores for pain (WSP), stiffness (WSS) and function (WSF) were calculated.

*Statistical processing.* Prior to the testing of the hypothesis, all variables were tested for the normality of distribution using the Kolmogorov-Smirnov test. For repeated measurement testing, the Wilcoxon test was used. Data were illustrated using bar charts with error bar marks. For data analysis, the SPSS software version 17 was used. P values < 0.05 were considered statistically significant.

## Results

WS presented a significant decrease after multimodal treatment ( $p=0.037$ ) (Table I). Also, the comparison of values recorded prior to and after the end of treatment showed a significant decrease in WSP values immediately after treatment ( $p=0.007$ ). However, the differences between WSS and WSF values recorded prior to and after the end of treatment were not significant (WSS:  $p=0.929$ , WSF:  $p=0.117$ ) (Table I). Similarly to WS, multimodal treatment induced significant differences in the values of pain on VAS recorded prior to and after the end of treatment ( $p=0.045$ ) (Table I).



**Table I**  
WS and VAS before and after multimodal therapy  
and statistical differences (p value)

Scores	Recorded values (mean±SD)		Wilcoxon test: p value
	Before multimodal therapy	After multimodal therapy	
WS	37±10.45	29±9.83	0.037*
WSP	8±2.32	4,5±2.75	0.007*
WSS	1±1.83	1±1.32	0.929
WSF	28±7.65	23,5±7.94	0.117
VAS	8±1.50	6,75±1.37	0.0450*

\* = statistically significant

## Discussion

OA is the single largest cause of disability in elderly persons. With the acceleration of the ageing processes, the impairment of activities of daily living induced by OA has brought heavy burdens to society, families, and patients (Wei et al., 2012). Even though OA has always been classified as non-inflammatory arthritis, increasing evidence has shown that inflammation occurs as cytokines and metalloproteinases are released into the joint. The main cytokines involved in OA are interleukin-1 $\beta$  (IL-1 $\beta$ ) and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) (Kapoor et al., 2011). Their synthesis and activation are dependent on nuclear factor- $\kappa$ B (NF- $\kappa$ B) activation. These agents are involved in the excessive matrix degradation that characterizes cartilage degeneration in OA. As OA progresses, the level of proteoglycans drops very low, causing the cartilage to soften and lose elasticity, thereby further compromising joint surface integrity (Lozada, 2012).

NSAIDs are symptom modifying drugs. These treatments have been shown to improve pain and disability effectively. NSAIDs decrease prostaglandin (PG) synthesis by inhibiting cyclooxygenase, the key enzyme required for the conversion of arachidonic acid to PGs (Alvarez-Soria et al., 2006), and have a critical role in many pathophysiological ways, implicated in OA.

The effectiveness of US therapy on pain and functional score improvement immediately after treatment in knee OA was demonstrated both for single treatment (Ozgonenel et al., 2009) and for associated treatment with hot pack therapy and isokinetic exercises (Huang et al., 2005). It was shown that US stimulates chondrocyte metabolic activity (Naito et al., 2010), increases chondrocyte proliferation (Korstjens et al., 2008) and viability (Gurkan et al., 2010), reduces proinflammatory cytokine synthesis in cartilage (Guo et al., 2011) and improves plasma antioxidant capacity in OA patients (Ungur et al., 2011).

For LLLT, previous studies demonstrated the capacity to improve pain and microcirculation in knee OA (Heisel & Kipshoven, 2011). Associated with exercises, LLLT is effective in yielding pain relief, function and activity improvement in patients with knee OA (Alfredo et al., 2012).

GS, which occurs naturally in the body, plays a key role in the construction of cartilage (Rovati et al., 2012). A recent study showed the superiority of the association of NSAIDs and GS compared with GS administered alone (Selvan et al., 2012). GS was shown to inhibit IL-1-induced activation and nuclear translocation of active NF- $\kappa$ B family members in human osteoarthritic chondrocytes (Largo et

al., 2003) and to reduce phospholipase A2 activity (Piperno et al., 2000) and PGE2 release from articular cartilage cells (Kapoor et al., 2012). Previous studies demonstrated that GS is effective for WOMAC score improvement after three years of treatment (Reginster et al., 2001).

Our results demonstrated that multimodal therapy associating GS with NSAIDs, continuous US, LLLT, wax package and physical exercise for 10 days relieved pain and improved functional capacity in knee OA patients after only 6 months of therapy. These effects persisted after the cessation of the analgesic effect induced by NSAIDs and physical therapy, suggesting that clinical effects were generated by metabolic and biochemical changes, independently of tissue warming up and analgesia induced by physical therapy.

Although both VAS and WOMAC score found a statistically significant improvement of pain, the measurement of pain on VAS ( $p=0.045$ ) was different from that on Likert scale ( $p=0.007$ ), measured for WSP. This aspect was in accordance with other studies (Kersten et al., 2010; Altman & Moskowitz, 1998). Different pain scales measure different aspects of pain experience in knee OA (Creamer et al., 1999). The discrepancy between the self-evaluated pain severity on VAS and WSP suggests that there may be other factors than pain that patients consider when evaluating the severity of their disease (Chan & Chan, 2011).

No stiffness reduction effects suggest that 10 days of physical exercise are insufficient for knee OA patients. No drop out, adverse event, serious adverse event or withdrawal due to adverse events occurred in our study.

The limitations of the study are the absence of a control group and the small number of patients. To our knowledge, this is the first study evaluating multimodal therapy in knee OA.

## Conclusion

1. Multimodal therapy, which includes short periods of NSAIDs, physical exercise, US therapy, LLLT and hot pack administered for 10 days and GS 1500 mg daily for six months, is effective for pain relief and safe in knee OA patients.

2. For stiffness reduction and functional improvement, 10 days of physical exercise are insufficient and multimodal therapy must include a more comprehensive program of physical exercise.

3. Pain improvement after multimodal therapy may be an effective method for decreasing NSAIDs administration in knee OA patients.

4. Further studies are necessary to assess multimodal therapy, with an extended period of physical exercise for the improvement of joint stiffness and function of knee in OA patients.

## Conflict of interests

Nothing to declare.

## Acknowledgements

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## **Evaluation of PubMed publications concerning dance, injury, pain and stress subjects**

### **Evaluarea publicațiilor PubMed din perspectiva conexiunilor între dans, leziune, durere și stres**

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#### **Abstract**

*Background.* Dance (D) represents a type of sport that can lead to injuries, pain and that is associated with stress (S).

*Aims.* The aim of the present research is the evaluation of research concerns for the relationship between stress and dance.

*Methods.* An analysis of keyword combinations, namely: "stress and dance" (S+D), "stress and dance and injury" (S+D+I), "stress and dance and pain" (S+D+P), "stress and dance and cortisol" (S+D+C), "stress and dance and anxiety" (S+D+A) and "stress and dance and professional" (S+D+PS) was evaluated.

*Results.* There were significant differences between the S+D and the other chosen keyword combinations, S+D+I (0.031), S+D+P (0.006), S+D+C (0.021), S+D+A (0.004) and S+D+PS (0.003).

*Conclusions.* 1) The largest number of publications appeared in the "stress and dance and injuries" keyword combination, which proves the importance of dance and injuries connection. 2) Research concentrates on the connection between dance and pain, the proof being their numerical location, in second place. 3) The analysis of stress elements, such as cortisol and anxiety, can be found in studies relating to dance, the emotional component being more extensively analyzed. 4) The importance of professional dance can be found in the number of publications corresponding to this keyword association, as well as in the percentage of publications including the stress and dance association.

**Key words:** dance, stress, injury, pain, cortisol, anxiety, professional dance

#### **Rezumat**

*Premize.* Dansul (D) reprezintă un tip de sport care poate conduce la leziuni, durere și care este relaționat cu stresul (S).

*Obiective.* Scopul lucrării prezente îl constituie evaluarea preocupărilor de cercetare pentru relația dintre stres și dans.

*Metode.* A fost făcută analiza pentru unele combinații de cuvinte cheie și anume: "stres și dans" (S+D), "stres și dans și leziune" (S+D+L), "stres și dans și durere" (S+D+P), "stres și dans și cortisol" (S+D+C), "stres și dans și anxietate" (S+D+A), "stres și dans și profesional" (S+D+PS).

*Rezultate.* Există diferențe semnificative între S+D și celelalte combinații de cuvinte cheie alese, S+D+I (0,031), S+D+P (0,006), S+D+C (0,021), S+D+A (0,004) și S+D+PS (0,003).

*Concluzii.* 1) Numărul cel mai mare de publicații apărut pentru combinația de cuvinte cheie „stres și dans și leziuni”, dovedește importanța legăturii între dans și leziuni. 2) Cercetările acordă atenție conexiunii dintre dans și durere, dovadă fiind situarea lor numerică, într-un mod logic, pe locul doi. 3) Elementele de analiză a stresului, cum sunt cortizolul și anxietatea, se întâlnesc în studiile referitoare la dans, componenta emoțională fiind mai intens analizată. 4) Importanța aspectului profesionist al dansului se regăsește în numărul publicațiilor corespunzător asocierii cu acest cuvânt cheie, precum și în procentul pe care acesta îl reprezintă din asocierea stres și dans.

**Cuvinte cheie:** dans, stres, cortizol, leziune, durere, anxietate, dans profesional.

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## Introduction

Dance, one of the oldest cultural forms of emotions expression, represents a sport category (Russell JA, 2013). Injuries are a major concern among dancers, and a high frequency of their appearance is currently reported (Baker et al., 2010). Perhaps this is why pain experienced by dancers has been a research topic of continuing growth in recent years (Tajet-Foxell & Rose, 1995). Thus, while regular exercise is beneficial to health, dance, especially competitive dance, has shown a susceptibility to suffering because it is a chronic stress that can lead to significant functional consequences (Berndt, 2012). In terms of physical performance, anxiety has been profusely researched in sport psychology (Walker & Nordin-Bates, 2010).

The present article is a continuation of previous research carried out by the authors concerning the assessment of stress in situations of physical exertion (Jurcău et al., 2011; Jurcău et al., 2012a; Jurcău et al., 2012b; Jurcău et al., 2013b; Jurcău & Jurcau, 2012), injury (Jurcău et al., 2013a) and pain (Jurcău & Jurcau, 2013b) in terms of physical exertion, and the relationship between exercise and stress, based on the analysis of PubMed publications (Jurcău & Jurcau, 2013a).

## Hypothesis

In terms of physical exercise, dance, especially professional and competitive dance, can be accompanied by injuries, therefore by pain, and can be associated with stress, so with anxiety.

## Objectives

The aim of the present research is the evaluation of research concerning the relationship between stress and dance based on the use of several keywords.

## Material and methods

The „stress and dance” (S + D) relationship was analyzed for specific keyword combinations: „stress and dance” (S+D), „stress and dance and pain” (S+D+P), „stress and dance and injury” (S+D+I), „stress and dance and cortisol” (S+D+C), „stress and dance and anxiety” (S+D+A), „stress and dance and professional” (S+D+PS). Injuries and the resulting pain are commonly found in dance, especially in professional dance. On the other hand, cortisol and anxiety are important parameters in stress evaluation.

Evaluation was conducted over a period of 53 years, between 1966-2013, and had the following elements of analysis:

a) the average number of publications per annum, for decades 1960-69, 1970-79, 1980-82, 1990-99, 2000-2009; and the number of publications per year for the years 2010, 2011, 2012 and 2013;

b) the percentage % of the total number of publications, for sub-filters and keyword combinations, for the whole 1960-2013 period, as well as for the decades and years taken into consideration.

### Statistical evaluation

The results obtained were analyzed using the SPSS 13.0. statistical package. For continuous data examination,

Student's t test was used. The differences were considered significant at a  $p < 0.05$ .

## Results

Data collection was performed in December 2013. For all groups, data distribution was normal, according to the Kolmogorov-Smirnov test. The analysis was made for the chosen time periods.

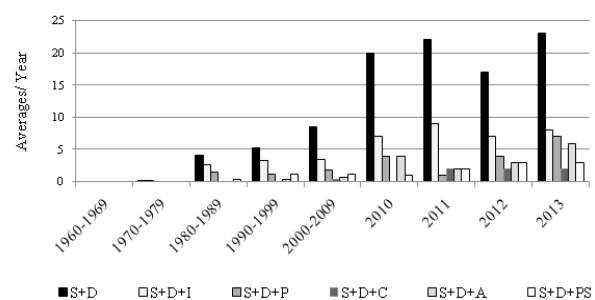
The comparative analysis involved the keyword combinations (Table I, Fig. 1) „stress and dance” (S+D), „stress and dance and injury” (S+D+I), „stress and dance and pain” (S+D+P), „stress and dance and cortisol” (S+D+C), „stress and dance and anxiety” (S+D+A), „stress and dance and professional” (S+D+PS).

The total number of publications over 53 years (Table I), for S+D+I (126), representing 48.3% of S+D, was greater than for: S+D+P (57), 22.2% of S+D; S+D+C (10), 3.9% of S+D; S+D+A (26), 10.3% of S+D; and S+D+PS (38), 14.2% of S+D.

**Table I**  
Total number of publications and % of N for the chosen keyword combinations

Analysis	S+D = N	S+D+I	S+D+P	S+D+C	S+D+A	S+D+PS
1960-2013	259	126	57	10	26	38
% of N	100	48.3	22.2	3.9	10.3	14.3

Differences were noted for the averages/year between S+D and the other chosen keyword combinations (Table II). These were moderately significant for S+D+I (0.031) and S+D+C (0.021); highly significant for S+D+P (0.0006), S+D+A (0.004) and S+D+PS (0.003). The dynamic analysis of the mean number of publications over 53 years (Fig. 4) shows that the maximum values were found for S+D+I, in 2011 (9); for S+D+P (7), in 2013; for S+D+C, in 2011, 2012 and 2013 (2); for S+D+A (6), in 2013; for S+D+PS, in 2012 (3) and 2013 (3). The values of the keyword combination S+D+C were low over the entire analyzed period, and between 1960-1989 no records were found.



**Fig. 1** – Dynamic analysis of the mean number of publications per year for the chosen keyword combinations

The analysis of the percentage (%) of S+D (=N) (Table III) for sub-filters shows that the highest % were recorded: in 1960-2013, for S+D+I (52.1%); in 2012, for S+D+C (11.7%) and S+D+PS (17.6%); in 2013, for S+D+P (30.4) and S+D+A (26%). Although the mean percentage of publications/year with S+D+I was the highest in 2012,

the % of S+D was moderate (40.9%) compared with other periods. % for S+D+I were higher than for S+D+C, S+D+P, S+D+A and S+D+PS, for all periods.

**Table II**  
Averages/year for the chosen keyword combinations  
Comparison of S+D

Time period	S+D	S+D+I	S+D+P	S+D+C	S+D+A	S+D+PS
1960-1969	0.1	0	0	0	0	0
1970-1979	0.3	0.2	0	0	0	0.1
1980-1989	4.2	2.6	1.4	0	0.1	0.5
1990-1999	5.3	3.3	1.1	0.1	0.4	1.3
2000-2009	8.5	3.5	1.8	0.4	0.8	1.2
2010	20	7	4	0	4	1
2011	22	9	1	2	2	2
2012	17	7	4	2	3	3
2013	23	8	7	2	6	3
Mean	11.13	4.44	2.24	0.71	1.83	1.34
Standard deviation	8.83	3.12	2.19	0.93	2.02	1.07
P-value		0.031	0.006	0.021	0.004	0.003

**Table III**  
Percentage of S+D for the chosen keyword combinations

Time period	S+D	S+D+I	S+D+P	S+D+C	S+D+A	S+D+PS
1960-2009	100	<b>52.1</b>	23.3	2.8	7.1	16.8
2010	100	35	20	0	20	5
2011	100	40.9	4.6	9.1	9.1	9.1
2012	100	41.1	23.5	<b>11.7</b>	17.6	<b>17.6</b>
2013	100	34.8	<b>30.4</b>	8.7	<b>26</b>	13

## Discussion

The comparative analysis involved the keyword combinations „stress and dance” (S+D), „stress and dance and cortisol” (S+D+C), „stress and dance and pain” (S+D+P), „stress and dance and injury” (S+D+I), „stress and dance and anxiety” (S+D+A), „stress and dance and professional” (S+D+PS).

The dynamic evolution of M, F and MF shows that between 1960-1979, so over a 20 year period, the number of studies including these sub-filters was reduced. There was no mention: for S+D+C, between 1960-89; for S+D+I, between 1960-69; for S+D+P, between 1960-79; for S+D+A, between 1960-1979; for S+D+PS, between 1960-1969. Interest began to grow: for S+D+C, starting with 1990; for S+D+I, S+D+P, S+D+A, S+D+PS, starting with 1980. The average number of publications per annum was the largest: for S+D+I, in 2011; for S+D+P, in 2013; for S+D+C, in 2011, 2012 and 2013; for S+D+A, in 2013; for S+D+PS, in 2012 and 2013. Differences between S+D and the other chosen keyword combinations were significant.

*Injuries* may be present during dancing. We quote below some important references:

In the case of dancesport, „common injuries affected the neck, shoulder, spine, knee, lower leg, and foot” (McCabe, 2013). In fact, „injury rates in contemporary dance are high; notably, 89% of dancers reported one or more injuries; this problem is particularly evident in the lower limb” (Baker et al., 2010). Thus, for the 42 dancers of a modern dance organization, it was proved that “the majority of new injuries occurred in younger dancers, most injuries involved overuse of the lower extremity, similar to patterns reported in ballet companies” (Bronner, 2003). In another research, it was found that for “breakers, popper/lockers,

and new schoolers, lower extremity injuries were 52% and upper extremity injuries 32% of total injuries” (Ojofeitimi, 2012). In addition, “break-dancing carries many of the risks of conventional dance and gymnastics, most injuries resulting from break-dancing are minor, such as sprains and strains, but there is great potential for dance participants to sustain severe and life-threatening conditions, such as cervical cord injuries” (Cho et al., 2009a). “The frequency of injury in break-dancers depended on the site and was as follows: wrist (69.0%), finger (61.9%), knee (61.9%), shoulder (52.4%), lumbar spine (50.0%), elbow (42.9%), cervical spine (38.1%), ankle (38.1%), foot (28.6%) and hip (16.7%). Sprain, strain and tendinitis were the most common injuries, accounting for the most cases” (Cho et al., 2009b). In the case of “dance students, professionals, and former dancers in the UK, 90% of the sample had experienced an injury (now or in the past), and the lower back and knee were among the most common sites of current pain and injury” (Thomas & Tarr, 2009). For “one hundred and forty-seven professional dancers belonging to the three major companies in Sweden”, it was found that “the low back was the site provoking most complaints (70%) followed by complaints from ankles/feet (65%) and neck (54%); there were no significant differences between the sexes” (Ramel & Moritz, 1994). It was highlighted that “competitive ballroom dancers show evidence for hypoactivity in stress systems and peripheral inflammation along with more self-reported physical complaints” (Berndt, 2012).

In the case of our research, an important percentage of S+D, 48.3%, refers to S+D+I.

Due to possible injuries, *pain* is a symptom commonly encountered in the field of dance. The association between stress, dance and pain has been little explored. We quote below some important references:

“Like sports professionals, dancers were found to have higher pain and pain tolerance thresholds than age matched controls and also reported a more acute experience of the sensory aspects of the pain” (Tajet-Foxell & Rose, 1995). In this respect, “qualitative descriptions of pain and injury indicated that dancers tend to define injury as something that stops them from dancing or from moving normally” (Thomas & Tarr, 2009). However, a research showed that in the case of “dancers in a professional ballet company, there was significantly less pain the week after the première, for the study population taken as a whole” (Ramel, 1997). It has been demonstrated that there is a “relationships between the type of pain experienced (performance pain and injury pain) and a cognitive appraisal of pain and pain coping styles in dancers”. Thus, “dancers with performance pain of either low or high severity were more likely to dance in pain than dancers experiencing injury pain”. But “dancers may not differentiate between performance pain and injury pain, or modify their appraisal and coping strategies according to the characteristics of the pain experienced” (Anderson & Hanrahan, 2008).

In the case of our research, an important percentage of S+D, 22.2%, was related to pain.

*Cortisol* is an important biological marker of stress. We quote below some important references:

“Higher psychological need satisfaction was associated with lower cortisol responses” (Questaed, 2011). In 2004,



West J observed that "cortisol increased in African dance and decreased in Hatha yoga" (West, 2004). Three years later, it was stated that "competitive dancing produced substantial increases in cortisol compared to a control day, not due to the physical strain of dancing and greater than those found during social-evaluative laboratory stressors" (Rohleder, 2007). However, after a few years, Berndt found that "diurnal cortisol significantly lower in ballroom dancers" (Berndt, 2012).

In the case of our research, only 3.9% of investigations that have targeted both stress and dance were related to cortisol.

*Anxiety* can be associated with dance, especially in situations of demonstrations or competitions. We quote below some important references:

"Higher psychological need satisfaction was associated with lower anxiety intensity" (Quested, 2011). Thus, "anxiety and performance-avoidance goals may hinder dancers' ability to cope with the physical stress associated with a dance career" (Lench, 2010). There are also situations in which dance reduces anxiety. For example, "both African dance and Hatha yoga reduced perceived stress and negative affect" (West, 2004). Similarly, in the case of "Greek traditional dances, old people's anxiety state and psychological distress decreases, and their quality of life and positive well-being improved" (Mavrovouniotis, 2009). Instead, "ballroom dancers described themselves as being more anxious and reported more physical health complaints" (Berndt, 2012). In this sense, "a study that explored ballet dancers' anxiety experiences of performance", revealed that "cognitive anxiety was more dominant than somatic anxiety, and was unanimously interpreted as debilitating to performance; somatic anxiety was more likely to be interpreted as facilitative, with the majority of dancers recognizing that a certain amount of anxiety could be beneficial to performance; principal dancers suffered from higher intensities of performance anxiety than corps de ballet members" (Walker & Nordin-Bates, 2010).

In the case of our research, only 10.3% of S+D investigations were related to anxiety.

*Professional dance* represents a special category of dance, illustrating the variety and importance of sportsmanship. We quote below some important references:

Professional dancers "experience high rates of musculoskeletal injuries" (Bronner, 2003). One explanation would be "the angle of turnout, that is thought to predispose professional dancers to overuse musculoskeletal injuries of the lower limb" (Cimelli & Curran, 2012). It is known that "professional dance training is a long process of physical, intellectual, and psychological preparation, through physical exercise, often beginning in childhood and continuing until retirement"; thus "classical ballet training, rehearsal, and performance often demonstrate strength at the hip joint" (Twitchett, 2009). In addition, "results suggest that supplementary strength training for hamstring and quadriceps muscles is beneficial to professional ballerinas and their dancing; weaker individuals are more likely to benefit from such regimens than their stronger counterparts, whereas increases in thigh-muscle strength do not alter selected aesthetic components" (Koutedakis

& Sharp, 2004). Another study demonstrated that "among elite Brazilian professional female ballet dancers, the lifetime prevalence of body dysmorphic disorder and eating disorders was higher than in the general population" (Nascimento, 2012). In addition, it was observed that "common injuries in professional dancers affected the neck, shoulder, spine, knee, lower leg and foot" (McCabe, 2013).

In the case of our research, 14.3% of S+D investigations were related to professional dance.

The evaluation elements for dance stress (via cortisol and anxiety), for the presence of injuries and pain in dance, as well as for professional dance, although modest numerically compared to the total stress - dance related publications, are all important through the role granted to these parameters.

## Conclusions

1. The largest number of publications was found for the „stress and dance and injuries” keyword combination, demonstrating the importance of the connection between dance and injuries.
2. Research pays attention to the connection between dance and pain, which is proved by their ranking, in a logical way, on the second place.
3. The analysis of stress elements, such as cortisol and anxiety, can be found in studies relating to dance, the emotional component being more extensively analyzed.
4. The importance of professional dance can be found in the number of publications including this keyword association, as well as in the percentage of publications including the stress and dance association.

## Conflicts of interest

Nothing to declare.

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## **Benefits of a postoperative rehabilitation program on strength recovery after total knee arthroplasty**

### **Beneficiile unui program de reabilitare postoperatorie asupra recuperării forței musculare după artroplastia totală de genunchi**

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#### **Abstract**

*Background.* Total knee arthroplasty is the gold standard treatment for patients with advanced knee osteoarthritis. However, a significant muscle weakness, particularly in the quadriceps, is noted early after surgery, reflected in functional deficits and quality of life alteration. Physical therapy is necessary to address these problems, nevertheless rehabilitation service utilization has been one of the least studied aspects of medical care after total knee arthroplasty.

*Aims.* To comparatively evaluate the evolution of isokinetic strength parameters in patients that were and in those that were not included in the rehabilitation program after total knee arthroplasty.

*Methods.* 50 patients undergoing total knee arthroplasty for advanced osteoarthritis were distributed in 2 groups. 33 patients that accepted to take part into a standardized postoperative rehabilitation program were included into the rehabilitation group. The non-rehabilitation group consisted of 17 patients that refused any postoperative rehabilitation program. Isokinetic evaluation of knee extensor and flexor muscles was performed preoperatively and 6 months postoperatively by a Gymnax Iso 2 Dynamometer at angular velocities of 90°/s and 180°/s.

*Results.* Strength improvement from preoperatively to 6 months postoperatively was observed in all patients and for both extensors and flexors, but it was statistically significant only in rehabilitation group, for extensors, at 180°/s. At 6 months postoperatively, extensor strength was significantly higher in the rehabilitation group, for both testing velocities.

*Conclusions.* Six months after surgery, quadriceps strength was higher in patients included in the postoperative rehabilitation program, justifying strengthening exercise prescription. Further research is required for optimizing actual strengthening protocols.

**Key words:** arthroplasty, knee, strength, isokinetic, osteoarthritis.

#### **Rezumat**

*Premize.* Artroplastia totală de genunchi reprezintă standardul de aur în tratamentul pacienților cu gonartroză avansată. Un deficit muscular important se constată însă în perioada postoperatorie imediată, implicând alterarea funcțională și a calității vieții. Kinetoterapia este necesară în soluționarea acestor probleme, totuși reabilitarea acestor pacienți a fost foarte puțin studiată.

*Obiective.* Prezentul studiu și-a propus evaluarea izocinetică comparativă a musculaturii coapsei la pacienții care au efectuat și la cei care nu au efectuat un program de recuperare după artroplastia totală de genunchi.

*Metode.* 50 de pacienți propuși pentru artroplastie totală de genunchi au fost distribuiți în 2 loturi. În Lotul cu Recuperare au fost incluși 33 de pacienți, care au acceptat să participe la un program standardizat de recuperare postoperatorie. Lotul Non-Recuperare a constat din 17 pacienți, care au refuzat recuperarea postoperatorie. Evaluarea izocinetică pe extensorii și flexorii genunchiului a fost efectuată preoperator și la 6 luni postoperator, pe un dinamometru Gymnax Iso 2, la vitezele unghiulare de 90°/s și 180°/s.

*Rezultate.* La toți pacienții s-a constatat ameliorarea forței extensorilor și flexorilor genunchiului la 6 luni după intervenție față de valorile preoperatorii, dar aceasta a fost semnificativă statistic doar la pacienții cu recuperare, pentru extensori, la 180°/s. La 6 luni postoperator forța extensorilor a fost semnificativ mai mare la pacienții cu recuperare, pentru ambele viteze.

*Concluzii.* La 6 luni postoperator forța cvadricepsului a fost mai bună la pacienții incluși în programul de recuperare postoperatorie, justificând prescrierea exercițiilor de tonizare. Sunt necesare studii ulterioare pentru optimizarea protocoalelor actuale de tonizare musculară.

**Cuvinte cheie:** artroplastie, genunchi, forță musculară, izocinetic, gonartroză.

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## Introduction

End-stage knee osteoarthritis is a significant health problem all over the world, resulting in pain and limited participation in many activities of daily living and functional activities (Pozzi et al., 2013). Total knee arthroplasty (TKA) is the gold standard treatment for these patients and the annual worldwide incidence of this intervention has continuously increased over the past decade (Kurtz et al., 2007). In 2010-2011 more than 762,000 TKA were performed in Canada and the U.S.A. (Westby et al., 2014). It is expected that the demand for primary TKA in U.S.A. might approach 1.5 million procedures in 2020, because of the aging of population, with the subsequent increase of the number of revision procedures (Kurtz et al., 2007). Even more, the demand for these procedures in patients younger than 65 years is projected to exceed 50% of all TKA by 2016 (Kurtz et al., 2009). TKA has been shown to be a cost-effective treatment for the refractory pain and activity limitations of advanced osteoarthritis (Ethgen et al., 2004; Losina et al., 2009). Evaluating the effectiveness of TKA surgery is mainly based on patient-centered outcome measures, such as pain and physical function (Jones et al., 2007), depending not only on surgery-related factors (technique, the surgeon's experience and skill), but also on the physical rehabilitation process.

Physical therapy is necessary because of the significant weakness noted in the musculature after TKA, particularly in the quadriceps. Quadriceps strength has been shown to decrease by 62% after surgery, compared to preoperative values (Mizner et al., 2005a). In another study, quadriceps strength in the operated limb was reduced by 40% one month after TKA, compared to the non-operated limb (Mizner et al., 2005b). The difference between limbs regarding quadriceps strength decreased within 1 to 3 years of TKA, but this was the result of not only increased strength in the operated limb, but also of a progressive decline of strength in the non-operated limb (Zeni et al., 2010; Yoshida et al., 2012).

Even if these problems are well known, rehabilitation focused on specific deficits has not been systematically studied, neither is it routinely prescribed. Moreover, the conclusion of the consensus conference of the National Health Institute of U.S.A. in 2003 was that the use of rehabilitation services was one of the least studied aspects of medical care after total knee arthroplasty and that there was no proof sustaining the generalized use of some specific type of preoperative or postoperative rehabilitation intervention (\*\*\*, 2003). Subsequent studies led to contradictory results, some of them showing the benefits of an intensive rehabilitation program, focused on the deficits found (Bade et al., 2011; Petterson et al., 2009), others being unable to evidence such advantages (Minns Lowe et al., 2007).

In this context, we tried to prove the benefits of the rehabilitation program that we applied to our patients after total knee replacement, based on specific muscle strengthening and functional improvement.

## Hypothesis

The purpose of the study was to comparatively evaluate

the evolution of isokinetic strength parameters in patients that were and were not included in a rehabilitation program after total knee arthroplasty. We assumed that participation in the rehabilitation program would generate a better recovery of muscle strength after TKA.

## Materials and methods

### *Research protocol*

We mention that the research protocol was in conformity with the Helsinki Declaration, the Amsterdam Protocol and Directive 86/609/EEC, and the approval of the Ethics Committee of the University of Medicine and Pharmacy Cluj-Napoca regarding research on human subjects was obtained. The research procedures were explained to all the study participants and an informed consent was also obtained from all patients prior to the study.

The research was structured as a prospective cohort study.

### *a) Period and place of the research.*

The study was conducted between June 2011 and June 2012 in the Rehabilitation Hospital Cluj-Napoca.

### *b) Subjects and groups.*

The study included 50 patients undergoing total knee arthroplasty for knee osteoarthritis. Patients were recruited from the 3 orthopedic departments of Cluj-Napoca. The inclusion criteria were: end-stage knee osteoarthritis (according to ACR criteria), with TKA indication; age between 50 and 85 years. The exclusion criteria were: uncontrolled hypertension or diabetes, BMI greater than 35kg/m<sup>2</sup>, significant neurological impairments, significant contralateral knee osteoarthritis (Kellgren-Lawrence stage 3 or 4), or other unstable lower extremity orthopedic conditions.

The patients were distributed into 2 groups.

The first group (rehabilitation group - RG) consisted of 33 patients (24 women and 9 men), with a mean age of 67.4±7.3 years, who accepted to be included after TKA in a standardized 2-week rehabilitation program, performed at the Rehabilitation Hospital Cluj-Napoca. Its objectives were pain control, increase of the knee range of motion, strengthening of quadriceps, hamstrings, hip abductors, hip extensors and ankle plantar flexors, gait correction.

The second group (non-rehabilitation group - NRG) consisted of 17 patients (12 women and 5 men), with a mean age of 66.4±9.9 years, who did not agree to participate in any postoperative rehabilitation program.

### *c) Tests applied*

The patients were assessed at 2 moments: preoperatively, and at 6 months postoperatively. Strength testing of knee extensor and flexor muscles was performed isokinetically, using a Ginnex Iso 2 dynamometer. The evaluation protocol included a session of warm-up and familiarization, consisting of a set of 10 submaximal repetitions of knee flexion and extension at a velocity of 240°/sec. After a rest period of 2 minutes, muscle performance was assessed by a set of 10 repetitions at a velocity of 180°/sec, followed by 5 repetitions at 90°/sec. A rest interval of 2 minutes between the sets reduced the effects of fatigue. For both extensor and flexor muscles, the dynamometer automatically recorded the following parameters: peak torque, angle at peak torque, maximal power, total work, flexor/extensor



ratio (for peak torque). Of these, statistical analysis was based on peak torque (PT).

#### d) Statistical processing.

Quantitative variables were expressed as mean  $\pm$  standard deviation (SD). Once the normal distribution of data was confirmed by the Kolmogorov-Smirnov test, statistical analysis of differences between the two groups was carried out using Student t test for independent samples (variance was previously tested). Sex and side distribution between the groups was tested using a Pearson chi-squared statistic. The statistical significance threshold was at  $p \leq 0.05$ . The software used was Microsoft Excel 8.0 for Windows and MedCalc 12 (trial version).

## Results

There were no differences in age, gender or body mass index (BMI) between the two groups of patients included in the research. The distribution of arthroplasty between the two sides was balanced in both groups (Table I).

**Table I**

Patient demographic characteristics

Variable	RG (mean $\pm$ SD)	NRG (mean $\pm$ SD)	Statistical significance (p)
Age (years)	67.4 $\pm$ 7.3	66.4 $\pm$ 9.9	0.9106
BMI (kg/m <sup>2</sup> )	31.8 $\pm$ 4.9	33.3 $\pm$ 6.1	0.7265
Gender (male/female)	9/24	5/12	0.8627
Affected side (left/right)	17/16	10/7	0.8480

When extensor strength was compared isokinetically, there was no significant difference between the groups at the baseline (preoperatively). Nevertheless, 6 months after TKA, patients who participated in the rehabilitation program had a significant advantage over those who refused participation (Table II). This advantage was obvious for both testing velocities (180°/sec and 90°/sec).

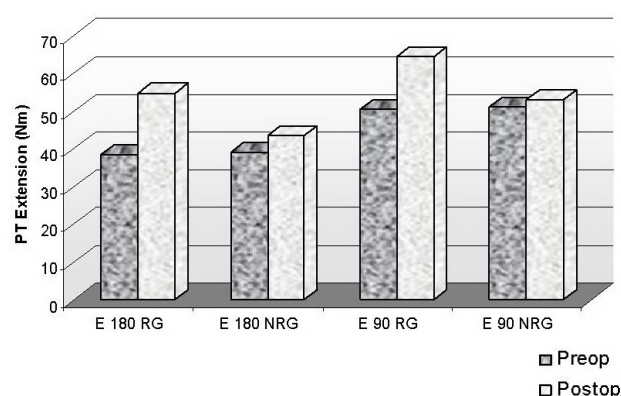
**Table II**

Extensor strength before and 6 months after TKA, in the 2 groups

Parameter (Nm)	Assessment point	RG (mean $\pm$ SD)	NRG (mean $\pm$ SD)	Statistical significance (p)
PT E 180 °/s	Preoperatively	38.4 $\pm$ 9.9	39.1 $\pm$ 8.7	0.1338
	At 6 months	54.8 $\pm$ 6.2	43.6 $\pm$ 7.3	<b>0.0379</b>
	p	<b>0.0423</b>	0.1012	
PT E 90 °/s	Preoperatively	50.5 $\pm$ 11.5	51.1 $\pm$ 9.6	0.0973
	At 6 months	59.6 $\pm$ 10.7	53.2 $\pm$ 5.3	<b>0.0447</b>
	p	0.6282	0.0847	

A comparison of the preoperative and 6 month postoperative values of extensor isokinetic strength shows that even if patients without rehabilitation had a slight strength improvement, this was not significant for either of the 2 testing velocities (Fig. 1, Table II).

On the other hand, for patients included in the rehabilitation program, strength improvement from preoperatively to 6 months postoperatively was more consistent, but unfortunately, it reached statistical significance only when isokinetic testing was performed at a higher velocity (180°/sec), and not at a lower one (90°/sec) (Fig. 1, Table II).



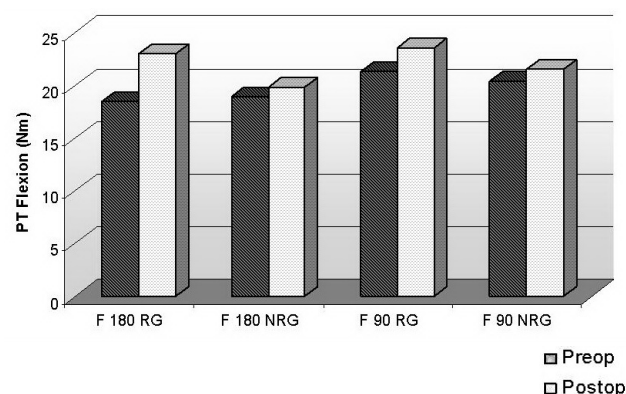
**Fig. 1** – Comparative evolution of extensor strength after TKA in patients with and without rehabilitation

**Table III**

Flexor strength before and 6 months after TKA, in the 2 groups

Parameter (Nm)	Assessment point	RG (mean $\pm$ SD)	NRG (mean $\pm$ SD)	Statistical significance (p)
PT F 180 °/s	Preop	18.5 $\pm$ 5.1	18.9 $\pm$ 6.2	0.1538
	At 6 months	23.0 $\pm$ 3.7	19.8 $\pm$ 4.5	0.0883
	p	0.4895	0.5374	
PT F 90 °/s	Preop	21.3 $\pm$ 8.4	20.4 $\pm$ 10.9	0.7219
	At 6 months	23.6 $\pm$ 6.1	21.5 $\pm$ 5.3	0.6048
	p	0.4365	0.2725	

Regarding flexor strength, it may be observed that a certain improvement from preoperatively to 6 months postoperatively was present in all the situations, with a slight advantage for the rehabilitation group (Fig. 2, Table III), but statistical significance was not reached in any case ( $p > 0.05$ ).



**Fig. 2** – Comparative evolution of flexor strength after TKA in patients with and without rehabilitation

Even if the 6 month postoperative strength values were obviously higher in the rehabilitation group than in the group without rehabilitation, there was no statistical significance at either of the isokinetic testing velocities (Fig. 2, Table III).

Isokinetic strength values recorded at the angular velocity of 90°/sec were always higher than those recorded at 180°/sec (Figs. 1 and 2). Muscle strength was always higher in extensors than in flexors.

## Discussions

In the present study, the evolution of muscle strength in patients that were included into a rehabilitation program after total knee arthroplasty was compared to that of patients who had no rehabilitation after the same intervention. An improvement of isokinetic strength from preoperatively to 6 month postoperatively was observed in all patients, with or without postoperative rehabilitation, for both extensor and flexor groups. Nevertheless, this improvement was statistically significant only in the rehabilitation group, for extensors, when isokinetic testing was performed at a higher velocity (180°/s).

Six months after arthroplasty, the strength of extensor muscles was significantly higher in patients included in the rehabilitation program compared to those with no rehabilitation after surgery, for both testing velocities. At the same evaluation, when flexor strength was analyzed, even if a slight advantage of the rehabilitation group was noted, this was not statistically significant for either of the two testing velocities.

These findings are similar to those reported by Petterson, who compared the outcomes of patients that followed progressive strengthening protocols after TKA with those of control patients that received standard rehabilitation based on functional training (Petterson et al., 2009). It was highlighted that one year after TKA, subjects of the progressive strengthening group had significantly higher quadriceps strength and better performance-based test results (Timed Up and Go - TUG, Stair Climbing Test - SCT, Six Minute Walk - 6MW). Quadriceps strength predicted 28% of the variability in TUG, 26% of that in SCT and 37% of that in 6MW, indicating that quadriceps strength is the strongest predictor of functional performance following TKA. Therefore, recovery of quadriceps strength after TKA is imperative.

In another research (Moffet et al., 2004), an intensive functional rehabilitation protocol (including a warm-up, specific strengthening exercises, functional task-oriented exercises, endurance exercises and a cool-down period) was compared with a standard rehabilitation protocol after TKA. The intensive rehabilitation group had better outcomes for the 6MW test and for the Western Ontario McMaster Universities Arthritis Index (WOMAC) 4 months and 6 months after surgery, but these improvements were not maintained at the 12-month follow-up.

In a very recent study (Ardali, 2014), it was found that the use of a daily adjustable progressive resistance exercise protocol early after TKA was free of adverse events and improved quadriceps strength and functional performance.

In a systematic review on lower limb strength following TKA (Schache et al., 2014), it was shown that muscle weakness was particularly obvious for quadriceps and less obvious for hamstrings. There was a tendency towards hamstring weakness in these patients, but there were not enough studies and the existing ones were very heterogeneous, so conclusions based on strong evidence could not be drawn. Reduced hamstring strength along with reduced quadriceps strength may affect balance, as co-contraction of the two muscle groups is important for knee proprioception and stability. In the same review, location

of surgical incision and prosthesis design characteristics were mentioned as possibly affecting the strength recovery of lower limb muscles following total knee replacement.

So, in a prospective study performed on patients undergoing TKA by minimally invasive surgical techniques (Schroer et al., 2010), it was demonstrated that quadriceps strength returned to preoperative levels by 3 months postoperatively and was 17% stronger at 6 months and 30% stronger at 1 year than preoperative levels. The recovery of extensor and flexor strength was more rapid and more complete than that previously demonstrated after TKA with a medial parapatellar arthrotomy.

On the other hand, it was shown that knee flexion torque on the TKA side was positively associated with bone strength in the same leg and, therefore, successful rehabilitation might diminish bone loss in the operated leg (Rantalainen et al., 2012).

In another systematic review focused on physical exercise after TKA (Pozzi et al., 2013), the authors concluded that an optimal outpatient physical therapy protocol should include progressive strengthening and intensive functional exercises, that outpatient physical therapy performed in a clinic under the supervision of a trained physical therapist may provide the best long-term outcomes after surgery, and that telerehabilitation does not improve the range of motion, strength and functional impairments to the same extent as supervised physical therapy sessions that include progressive exercises.

An expert consensus on best practices for post-acute rehabilitation after total hip and knee arthroplasty was an important step toward reducing practice variations and improving the quality of rehabilitation services after these surgical interventions (Westby et al., 2014). It was stated that patients should be offered structured post-acute rehabilitation, provided by trained professionals.

## Conclusions

1. Six months after TKA, quadriceps strength was higher in patients that were included in the postoperative rehabilitation program.
2. As quadriceps deficit has been proved to be important immediately after TKA and related to functional impairments, strengthening exercise protocols should be prescribed after this type of surgery.
3. Current strengthening protocols should be improved in order to more efficiently increase quadriceps strength, therefore further research is required to determine the optimal exercise prescription that can safely lead to better functional outcomes.

## Conflicts of interest

There are no conflicts of interest.

## Acknowledgement

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## **Mountain tourism - practice and effects**

### **Turismul montan - practică și efecte**

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#### **Abstract**

*Background.* With the development of modern society, sport also has evolved into a multifaceted reality, both in terms of: actual movement, characteristics of the subjects and of the motivation for participation. In recent years, tourism (including mountaineering) has been analyzed mostly in economic, social, and environmental terms. We believe that the adaptive effects on individuals and/or groups of practitioners can be analyzed in the same way.

*Aims.* The research aims to highlight the extent occurring or not of adaptive effects in terms of socialization, communication, integration, motivation, self and peer knowledge, personal involvement etc., by practicing mountain tourism in an organized form.

*Methods.* The research was conducted during the course of the practical application of Mountain tourism and sport orientation in the Padiș massif from Apuseni mountains. Subjects were 52 students in the first year of FEFS Oradea. To conduct this research aspect, we used the questionnaire as a sociological survey, applied before and after the activity. Responses were pooled, interpreted and analyzed by graphs.

*Results.* There were considerable changes regarding aspects considered important in mountaineering (motivation), some important components of personality and interpersonal interaction and group processes, ultimately resulting in a better physical and mental condition.

*Conclusions.* Leisure sports - a category that includes mountaineering - is a socio-cultural aspect of society, but at the same time a factor of development. One of the most important aspects is the diversity of motor skills, an aspect that determines the high degree of accessibility for all persons, regardless of age, sex or aptitude.

**Key words:** leisure, mountain tourism, adaptive effects.

#### **Rezumat**

*Premize.* În condițiile de dezvoltare a societății contemporane, sportul a evoluat și el într-o realitate multiformă, atât din perspectiva mișcării propriu-zise, a caracteristicilor subiecților, cât și din cea a motivației pentru participare. În ultimii ani, turismul (inclusiv turismul montan) a fost analizat preponderent din perspectiva efectelor generate în plan economic, social și ecologic. Considerăm că în aceeași măsură pot fi analizate și efectele de tip adaptativ produse asupra indivizilor și/sau grupului de practicanți.

*Obiective.* Cercetarea și-a propus să scoată în evidență măsura în care se produc sau nu efecte de tip adaptativ în planul socializării, comunicării, integrării, motivării, cunoașterii de sine și a aproapelui, implicării personale ș.a, prin practicarea turismului montan în formă organizată.

*Metode.* Cercetarea a fost realizată pe parcursul desfășurării aplicației practice de Turism montan și orientare sportivă în zona Padiș din munții Apuseni. Subiecții au fost 52 de studenți în anul I la FEFS Oradea. Pentru realizarea acestei cercetări, am utilizat ancheta sociologică sub forma unui chestionar de opinie, aplicat înainte și după desfășurarea activității. Răspunsurile au fost centralizate, interpretate și analizate prin metoda grafică.

*Rezultate.* Se constată modificări considerabile în privința: aspectelor considerate a fi importante în turismul montan (motivație), a unor componente importante ale personalității, proceselor reglatoare și relațiilor interpersonale și de grup, în final rezultând o stare de bine, atât în plan fizic, cât și psihic.

*Concluzii.* Sportul de loisir - categorie în care includem și turismul montan - reprezintă un aspect socio-cultural al societății, dar în același timp un factor de dezvoltare. Unul din aspectele cele mai importante este reprezentat de diversitatea actelor motrice ce pot fi practicate în cadrul său, aspect care determină gradul ridicat de accesibilitate pentru toate categoriile de persoane, indiferent de vârstă, gen ori aptitudini motrice.

**Cuvinte cheie:** loisir, turism montan, efecte adaptative, curriculum.

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## Introduction

Sport for all means a socio-cultural aspect of society, but also a factor of development (Minciu, 2002). Dragnea (2002) defines this category as a generally non-competitive form of sport that is practiced both in clubs and in unorganized forms. More recently, this type of activity has been identified with the notion of *leisure motor activity* (Bota, 2006).

By the mere enunciation of the words above, we think that the content of this type of practice becomes obvious (simple or complex motor actions borrowed from specific techniques of some branches or sports, practiced under regulatory or simplified conditions, in the absence of competitive characteristics, organized or not, during the spare time). Dynamic leisure activities use very different exercises, their choice being determined by economic, geographic, cultural and social conditions, etc. In another perspective, its contents can be practiced in unorganized and non-competitive forms and may consist of the full range of motor acts performed indoors or outdoors, the latter responding very well to the need to return to nature (Diehl & Ludington, 1998) and to do sports in camps or during holidays, camping by the sea or by the mountain peaks.

Without making an exhaustive list, we can enumerate the whole range of classic sports (sport games, swimming, cycling, rowing etc.), others which open up new fields of activity (athletics, jogging, skiing, sailing etc.), or intense activity, even extreme (free climbing, extreme skiing, paragliding etc.).

To justify the role and place of mountain tourism in the curriculum of the Department of Physical Education, Sport and Physical Therapy by the inclusion of the discipline "Mountain tourism and sport orientation", we appeal to the opinion of recognized experts (Cârstea, 1993; Dragnea et al., 2006), which classifies the components of the educational process of physical education and sport (which we believe can include specific objectives such as mountain tourism) as follows:

- a) specific knowledge (theoretical: documentation about equipment and materials, transport, camp organization, buildings and constructions, field orientation, monuments, environmental protection etc.);
- b) body morphofunctional indices, high but mostly harmonious somatic and functional indices, developed by mountain tourism;
- c) physical skills, especially coordination (moving in special circumstances, climbing, building specific facilities, etc.), and resistance/endurance (routes lasting from 1-2 up to 6-8 hours with different configurations);
- d) special skills (movement acts performed in specific mountain relief: climbing, weight transport, various jumps etc.);
- e) content items specific to other components of education, by developing important intellectual features (actions and decisions involving the whole community, because "the mountain will not forgive"), moral features (personality, character, attitudes), aesthetics (beauty of nature in pure form, if preserved).

## Objectives

The presence of "Mountain tourism and sport orientation" in the curriculum of the Faculty of Physical Education and Sport in Oradea is found starting with the first series of students (1960-1963), with a break of seven years (1983-1990), being reintroduced with the revival of activity after 1990. Although at first glance one might think that all is the result of an inertial behavior, the presence of this activity as a study subject is fully justified, which is also proved by the delayed reactions of successive generations of students who performed this work.

Without pleading *pro domo*, we try to justify with arguments - adaptive effects determined by participation in specific mountain tourism activities (Lucaciu, 2009), the need for the presence of this discipline in the University curriculum, supporting at the same time the need to streamline all this activity by adapting the content, strategies (didactic and managerial), and even improving the aspects of technical support.

From this perspective, we wanted to know the position of some "beneficiaries" of this activity regarding its content and structure, the consequences felt in terms of socialization, communication, motivation, self-knowledge (Dragnea, 2006), involvement in joint activities, and regarding the management of all activity.

## Hypothesis

Addressing mountain tourism at an institutional level by including it into the curriculum of the Department of Physical Education, Sport and Physical Therapy determines, thanks to the impact of this activity on a growing number of people from various categories, the capitalization of the influences of mountain tourism in terms of recreation (no stress), motor skills, psychosocial abilities (communication, collaboration), aesthetics (natural beauty), and equally, the multiplication of opportunities for professional inclusion (professions such as mountain guide, mountain camp instructor, etc.).

On the other hand, we think we can assume that the objectives of the course of Mountain tourism and sports orientation involve specific components of the university educational process of physical education and sport (mentioned above).

## Material and methods

We mention that according to the Helsinki Declaration, the Amsterdam Protocol and Directive 86/609/EEC, the approval of the Ethics Commission of the Department of Physical Education, Sport and Physical Therapy of the University of Oradea regarding research on human subjects was obtained, and the persons participating in the research gave their informed consent.

### Research protocol

#### a) Period and place of the research

The study was conducted over two 9 day periods, during 07-15.07.2008 and 06-14.07.2009, in the context of the practical application of "Mountain tourism and sport orientation" held in the Padiș Massif from Apuseni Mountains.

### b) Subjects and groups

The analyzed sample consisted of 52 subjects (28 boys and 24 girls) in the first period and 54 subjects (29 boys and 25 girls) in the second period, aged between 19 and 27 years, 1<sup>st</sup> year students at the Faculty of Physical Education and Sport from Oradea.

### c) Tests applied

For this approach, we used as a sociological survey the questionnaire (Questionnaire I applied before work and Questionnaire II applied after work), targeting personal experience in this type of activity, assessing individual and group relations (aspects of leadership and communication), evaluating the relationship with proponents, estimating the effects of the activity at physical and mental level and on attitudes, beliefs, motivation, etc. In this way, we wanted to highlight the evolution of the studied items.

### d) Statistical processing

The questionnaires applied in the two phases of the study were composed of 33 and 25 items, respectively. After completion, the responses were pooled, and in order to highlight the variables, they were translated into graphs using the Excel program. To calculate the error estimate (0.05), we used Taro Yamane's formula:  $n = N / (1 + e^2 N)$ , where  $n$  is the number of cases in the sample,  $N$  is the population size, and  $e$  is representativeness error (Rotariu & Iluț, 1997). For various reasons, out of 120 students (60 in the first period and 60 in the second period), 6 (2 girls and 4 boys) had no activity, and 8 - 4 girls (3+1) and 4 boys (1+3) - discontinued the activity (disease-3, accident-2, family problems-3), the number of remaining respondents being 106.

## Results

The study aimed to highlight the changes in the following aspects:

- important issues for the subjects, pursued in mountain tourism (Fig. 1);

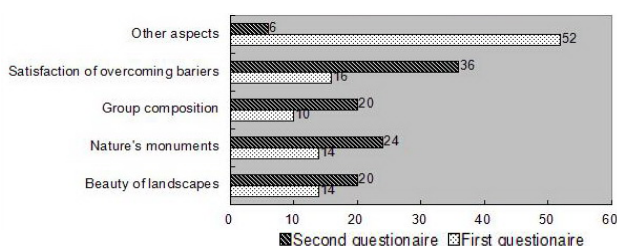


Fig. 1 – What do you appreciate mostly during mountain tourism?

Thus, if before work, for 52 (49%) of the subjects other matters were more important, in the end, the situation was as follows: the interest in the beauty of natural landscapes increased by 42% (from 14 to 20), "spectacular" monuments of nature captured more than 71% of interest (from 14 to 24 positive feedbacks), the importance of group composition increased by 50% (from 10 to 20), while the most important change (from 16 to 36, meaning a more than 2 times increase) was recorded for the satisfaction of overcoming obstacles; tourist trails marked or not, often very complex, with a difficulty level 4 or even 5, which prima facie seemed inaccessible, offered once the

difficulties were overcome a different perspective on the self and personal abilities, while giving another meaning to mutual aid, solidarity, team spirit, etc.

- aspects of personality (temperament, character, skills), the self-regulation process (motivation, volition) and interpersonal and group relations (Fig. 2);

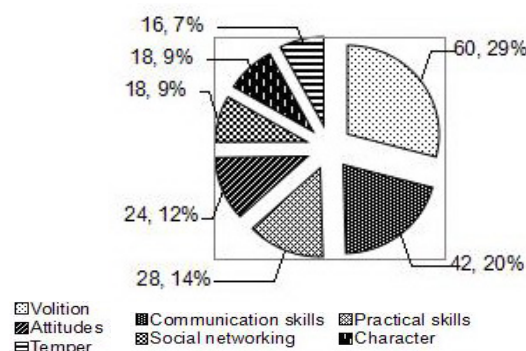


Fig. 2 – What aspects do you consider were changed after the "Mountain tourism and sport orientation" activity?

Tent camping specific living conditions, more Spartan than urban life, as well as the program of activities did not cause a reaction of rejection, but on the contrary, these conditions contributed to the shaping of character, behavior, attitude, and ability to communicate in the case of most of the subjects. A total of 98 of the respondents considered that there was a mutation in at least one or more of the issues. Note that multiple answers were possible.

- cumulative effects of activities at the end of the period, assimilated to psychological stress (Fig. 3);

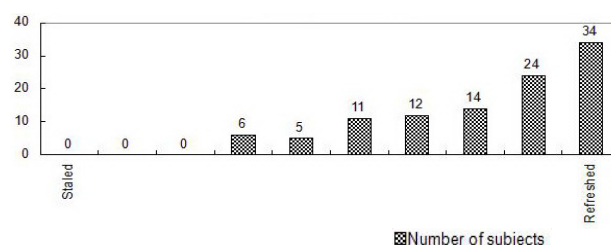


Fig. 3 – On a scale of 1 to 10 (1=stale, 10=refreshed), how do you evaluate your mental state?

Talking about the effects manifested at this level, the majority of the subjects (72, representing 68%) considered that they were refreshed or fully refreshed, physically and mentally restored, and therefore ready for any other activities, while only 21 of them (19%) reported a relative accumulation of mental fatigue.

## Discussions

Adventure tourism (including mountaineering) is a rapidly expanding segment of tourism; it is estimated that adventure tourism alone contributes to the U.S. economy with over 220 billion dollars annually, direct and collateral costs (Cater, 2006). Our position is halfway between that of researchers who highlight the negative impact (Geneletti & Dawa, 2009) of tourism - especially for destinations in developing countries - and those who emphasize the

social and economic benefits of tourism (rational and well planned tourism).

In recent years, new (mentalizing) theories have outlined with increasingly stronger arguments that the effects of landscapes (mediated by tourism action) directly influence the physical and mental state of tourist groups (Rose, 2012). The author claims that natural landscapes contribute to a better self-understanding and improve the capacity of empathy with others.

Despite the large amount of research in the field of tourism, there is little investigation aimed at recreational effects (Valtonen & Veijola, 2011), feelings, emotions, the impact of individual behavior on others, the individual-individual and individual-environment interaction (Houge Mackenzie & Kerr, 2013).

Mountain tourism, especially that organized as tent camping (due to the opportunity of combining different types of activities), is an important means of complex education - motor, aesthetic, moral, etc., for all categories of people, especially young people (Frazzei, 2004; Roșu, 2008).

### Conclusions and proposals

1. The research showed that most of the activities that were not liked were activities with appliances, such as food preparation, dish washing, wood cutting, etc., that is - we suppose - activities with which the subjects were not familiar.

2. The responses and opinions regarding the reasons that led the subjects to alter or refine their views on mountain tourism, the mountain, themselves or their teachers must be a guide for us in the organization of future activities.

3. We believe that the feedback effect must be highlighted by the formulation of proposals, as follows:

- the mountain tourism activity content should be not only educational, but also pleasant, agreeable, because subjects can become prospective promoters of this activity by influencing their future students or athletes;
- we support the need for popularizing and promoting the effects and benefits of mountain tourism "more aggressively", because of the presence of a neutral attitude that is most often due to the lack of information;
- the institutional provision of the basic material infrastructure would ease the financial burden on all participants and could make this activity more attractive, subsequently leading to a deeper involvement of our students - future teachers - in organizing and carrying out mountain tourism specific activities.

### Conflicts of interests

Nothing to declare.

### Acknowledgments

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## **The influence of specific football training methods during the preparation period upon the physical and motor development of 17-18 year-old juniors**

### **Influența mijloacelor antrenamentului sportiv specific jocului de fotbal din perioada pregătitoare, asupra dezvoltării psihomotrice la juniorii de 17-18 ani**

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#### **Abstract**

*Background.* In conducting the research, we start from the premise that the football game is perfectible, and the introduction of specially designed exercises structures for the optimization of some psychomotor skills can lead to a player's progress and make a difference in competition.

*Aims.* The research aims to achieve a significant increase in psychomotor skills for junior footballers aged 17-18 years, by introducing in the preparatory period microcycles some special technical-tactical exercise structures, demonstrating the beneficial effects of their application in practice, with direct implication in the participation in official competitions.

*Methods.* We used the practicing in standard conditions method, so that in the preparatory period microcycles two complex technical and tactical exercises were introduced, to be repeated daily for 6 weeks during July 15-August 25, 2013. The study was conducted on an experimental group (E) consisting of 18 juniors and a control group (C) of 18 juniors.

*Results.* The values obtained for assessing the technical and tactical exercise actions in the two complexes, as well as those for the experimental group exercise capacity are a strong argument for the efficiency of the methods and means used in this research.

*Conclusions.* The individualization of training, with specific technical and tactical exercise structures demonstrates the correctness of the methodology used, being the concrete way of increasing the quality level of training.

**Key words:** football, microcycle, training, A juniors.

#### **Rezumat**

*Premize.* În efectuarea cercetării se pornește de la ideea că jocul de fotbal este perfectibil, iar introducerea unor structuri de exerciții, special create pentru optimizarea unor calități psihomotrice, poate duce la progresul jucătorilor și să facă diferența în competiție.

*Obiective.* Cercetarea urmărește să realizeze creșterea semnificativă a unor calități psihomotrice la fotbaliștii juniori de 17-18 ani, prin introducerea în microciclurile din perioada pregătitoare a unor structuri de exerciții speciale cu caracter tehnico-tactic, care să demonstreze efectele benefice ale aplicării acestora în antrenament, cu implicație directă în participarea acestora în competițiile oficiale.

*Metode.* În cercetare a fost utilizată metoda exersării în condiții standard, astfel că, în microciclurile din perioada pregătitoare au fost introduse două complexe tehnico-tactice, care au fost repetate zilnic pe durata a 6 săptămâni, în perioada 15 iulie - 25 august 2013. Studiul s-a efectuat pe un lot experimental (E) format din 18 juniori și un lot de control (C) format tot din 18 juniori.

*Rezultate.* Valorile obținute pentru aprecierea acțiunilor tehnico-tactice din cadrul celor două complexe, cât și cele privind capacitatea de efort a lotului experimental, reprezintă un argument solid în privința eficienței metodelor și mijloacelor folosite în cadrul prezentei cercetări.

*Concluzii.* Individualizarea pregătirii, cu ajutorul structurilor tehnico-tactice specifice jocului de fotbal, demonstrează justetea metodologiei de pregătire folosite, aceasta constituind modalitatea concretă de creștere a nivelului calitativ al pregătirii.

**Cuvinte cheie:** fotbal, microciclu, antrenament, juniori A.

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## Introduction

In current football training, there are a series of training and facilitating factors, an important role being played by the continuous improvement of planning and selection strategies, addressed through the adaptation theory (Calinescu, 2004). Most technicians in the field believe that this game is in its era of maturity in terms of field organization and the possibilities of expression of the players (Radulescu, 2009).

Therefore, the fundamental goal of any act of learning is the future utility of the results obtained; as the acquired concept is more important, the applicability to new problems will be larger (Bruner, 1970).

Today, the rigid separation between defenders and strikers is losing its validity, in the sense that each of them can adapt to the requirements of the other category, becoming the striker - defender and vice versa, which emphasizes the collective aspect of the game of football (Rădulescu, 2009).

The increase of efficiency is achieved under carefully prepared performance planning, which is defined as the work to develop detailed and accurate training targeting performance objectives, and the means, methods and organizational forms appropriate to the goals (Dragnea & Teodorescu, 2002 quoted by Ciolcă 2006).

Currently, when rigor characterizes all fields, football cannot be an exception, the coaches' work being carried out on a serious, well thought out schedule, with realistic goals that are strictly based, formulated and pegged (Miu & Velea, 2002). Sports planning has several components, from thinking as a whole, to the daily, hourly planning of the means (macrocycle, mesocycle, microcycle and lesson plan) (Achim, 2005).

Planning as a complex dynamic process of development and monitoring of an attainment plan leverages information obtained through forecasting and feedback, resulting in a clear record of the previous work. (Teodorescu, 2009a).

The microcycle is the most important tool of the planning function, because its structure and content determine the quality of training. Within the microcycle, the lesson type varies by objectives, volume, intensity and methods, each of which may predominate in a certain stage of preparation. (Bompa 2002, quoted by Niculescu & Vladu, 2009).

Microcycles include weekly trainings and are customized according to the objectives and means specific to the stages referred to: microcycle training, microcycle accommodation or approach, microcycle competition and microcycle recovery (Motroc, 1994), being divided into long microcycles (5-9 lessons), which alternate effort with recovery, and short microcycles, representing assemblies, (3-4) training sessions, with different objectives, solved systematically (in a certain order in 2-3 days) (Colibaba-Evuleț & Bota, 1998).

Basically, a weekly cycle includes a number of lessons, placed in a certain order and sequence, lessons having tasks arising from the content of the training plan, within the stage (Nicu, 1999). The weekly cycle is the operative tool, its content including the elements necessary to establish concrete methods and means to be used, the volume and

intensity of effort, (Apolzan, 1996), and is elaborated from week to week, taking into account the period of preparation, the previous cycle, opponents, etc., including the chained contents of all planned training sessions within the week in progress (Cernaianu, 1997). The weekly cycle structure has become increasingly loaded by increasing the number of training lessons, repetitions and the duration of efforts (Nicu, 1999).

The microcycle effort dynamics is determined by the training task means and methods used in training. For high performance athletes, the general and specific means of physical preparation dominate the early preparatory period and during the competitive period, specific means and competition means hold the leading role (Dragnea, 1996). For junior football players aged 17-18, the introduction in the training program of technical and tactical exercise structures such as those presented in this paper is aimed at increasing the effectiveness of training in a short time and the acquisition of sports fitness, shortly before the start of the championship. The microstructure planning must take into account more the sportsman's personality features (Teodorescu-Mate, 2001), and therefore proofreading the guidelines on implementation will be done taking into account this aspect.

The role of the training plan is to create guidance signals: information on the methods used in training, the means, the volume and intensity of effort, the duration of breaks, energy exchanges, the estimated amount of stress, the preparation which must be made taking into account how the athlete responds to requests (Teodorescu, 2009b). The following must be rigorously provided: what you want to achieve, where *you want to lead* the team; *the planning* must clearly *present* the objectives (Miu, 2001). Following a logical judgment, the macrocycle reflects the dynamic vision of effort and of the other sports training substructures, and the microcycle and lesson content materializes the entire content and organization of training (Dragnea & Teodorescu, 2002).

As the first part of training, volume is a prerequisite for quantitative highly technical, tactical and physical achievements. As an athlete becomes able to achieve high levels of performance, the total volume of training is becoming more important (Muraru, 2008). Lyakh & Witkowsky (2007) show that coordination skills in soccer players are determined primarily by inherited factors. We agree, with the addition that they increasingly develop due to a process of proper training and appropriate training volume.

Determining the optimal combination between volume and intensity is a complex task, the athlete accumulating the effort capacity indices in regularly increasing qualitative steps, not in a straight line (Bompa, 2002). The criterion for the training lessons in a microcycle includes the dominant factors or biomotor qualities specific to the sports concerned. The optimal sequence is: learning and improving the technique in mild conditions, followed by the technique improvement (Ozolin 1971, quoted by Bompa, 2001).

All these considerations lead us to believe that planning in complex training structures, mainly technical and tactical training, will have a particularly important effect on the

efficiency of the game completion, the main objective of the game of football.

### The aim of the research

The aim of the research is to optimize the football game didactic methodology, by developing microcycles with tasks that result from the content of the training plan according to the stage, so that the technical exercises used in the preparatory period such as those presented in this paper will increase the efficiency of training.

### Hypothesis

It was felt that by structuring the microcycles within the annual planning system, using technical and tactical exercises to increase the efficiency of training (physical technical and tactical training), corresponding to the general demands of training and the degree of preparedness of juniors, can significantly improve sports performance in 17-18 year-old juniors.

### Materials and methods

In this research we used the method of exercising under standard conditions (Dragnea & Mate-Teodorescu, 2002). The conditions of training applied to the junior football players using the standard method were:

- carrying out movements, components of structures that were practiced in a predetermined order, always the same;
- the amount and intensity of effort were set precisely;
- the length of the breaks and their character (active or passive) were established with precision;
- the organizational and material conditions favoring optimal repetitions, to the extent to which they were conceived, including every measure and control device

necessary to be created.

#### Research protocol

We mention that according to the Helsinki Declaration, the Amsterdam Protocol and Directive 86/609/EEC, the approval of the Ethics Commission of the Department of Physical Education and Sport of the "Gică Popescu" Football School regarding research on human subjects was obtained, and the participants in the study gave their informed consent.

#### a) Subjects and groups

The study was carried out in a group of 18 junior football players aged between 17 and 18 years, members of the „Gică Popescu” College in Craiova, the experimental group (E), and the control group (C) consisting of 18 juniors of the same age, members of the group of junior Republicans „A” of the School Sports Club Craiova.

#### b) Period and place of the research

The study was conducted in the preparatory period, for a period of six microcycles, between July 15 and August 25, 2013, on the field of the „Gică Popescu” College for the experimental group, and on the CSS Craiova field for the control group, under the same working conditions.

#### c) Tests applied

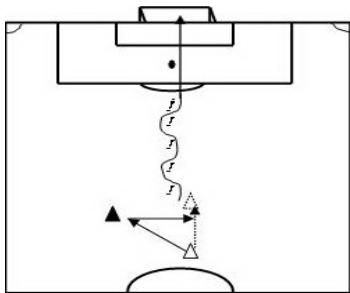
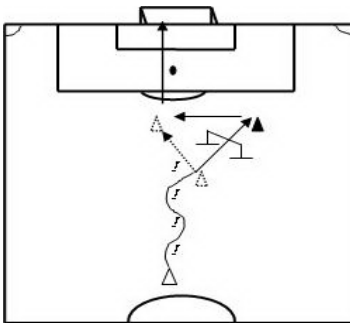
The details of the research team training program consisted of using two modes of technical and tactical training and development of motor skills (Table I). These were applied only to the experimental group, after the completion of a 20 minute warm-up, while the control group ran these complexes only within the tests.

The two technical and tactical complexes were the following (Table I):

#### d) Statistical processing

The mathematical and statistical calculations were performed using SPSS 10.1.

**Table I**  
The two technical and tactical complexes used in group E

Technical description	Graphical representation	Dosage
<p><b>Technical and tactical complex 1</b></p> <p>The player is at a distance of 15 m from the first pole. He passes the ball to a teammate located diagonally at a distance of 10 m and 10 m left from the first pole, then gets the ball into position next to it (one-two). He takes the ball on the run, after which he drives it at maximum speed to the right of the first pole. A passage through the 5 poles located perpendicularly in the middle of the goal line and positioned at a distance of 3 m between them follows. After the last pole located at a distance of 5 m from the 16.5 m line, there is a shot to the goal, the ball passing over the goal line in the air. The arithmetic mean of the five executions was recorded. The test was carried out against time.</p>		<p>The arithmetic mean of the five executions was recorded.</p>
<p><b>Technical and tactical complex 2</b></p> <p>The player standing at 1.5 m in front of the first pole goes driving the ball through the four poles located at a distance of 3 m between them and perpendicularly to the middle line. After the last pole, located at a distance of 25 meters from the 16.5 m line, he passes the ball right laterally or to the left side to a teammate through a picket fence 1.50 m wide and 1m high, at a distance of 15 m from the last pole and at a 45° angle towards the perpendicular in the middle of the goal drawn from the last pole. After passing the ball to enter the race, he continues a combination (one-two) with a teammate located at 1.5-2 m behind the fence, takes the ball passed to it, then shoots to the goal from outside the area of 16.5 m. The ball must cross the goal line in the air. The test is considered successful when the player passes the ball forward to a teammate through the air beyond the goal line. The number of successful executions out of 10 attempts was recorded. The test was not carried out against time.</p>		<p>The number of successful executions out of 10 attempts was recorded</p>

## Results

Table II

Comparative indices of technical-tactical data n=18

Parameter	Group	TI	TF	TF-TI	TF-TI (%)	p
Technical and tactical complex 1 (sec)	E	8.3	7.4	0.9	10.84	$p=5.87 \times 10^{-11}$
	C	8.5	8.2	0.3	3.52	$p<0.001$
Technical and tactical complex 2 (ex.)	E	5.3	8.7	3.4	64.15	$p=9.67 \times 10^{-14}$
	C	4.9	6.1	1.2	24.48	$p<0.001$

Table III

Comparative indices for the effort test applied n=18

Parameter	Group	TI	TF	TF-TI	TF-TI (%)	p
30 m running (sec)	E	4.69	4.19	0.68	14.49	$p=1.33 \times 10^{-9}$
	C	4.85	4.68	0.17	3.50	$p<0.001$
60 m running (sec)	E	8.65	8.0	0.65	7.51	$p=4.59 \times 10^{-9}$
	C	8.78	8.62	0.16	1.28	$p<0.001$
Cooper Test (m)	E	3076	3289	213	6.92	$p=5.33 \times 10^{-6}$
	C	3016	3054	38	1.25	$p<0.001$

## Discussion

In the case of motor indices for the development of speed and strength, the experimental group had superior indicators for all tested parameters, the differences between the two groups at the final testing being significant in all cases,  $p<0.001$  (Table III). This is a major advantage for the players. In the current football game held at high speed, the athletes had good speed, especially in one-to-one duels, which were decisive in the game economy (Dumitrescu, 2009). Dynamism, sustained pace, with all players participating in the deployment phases of the game, contributed to the increase of effort, which was done on account of the main functions of the body, strengthening them considerably (NET, 2008), which entitles us to believe that the predominant use of technical-tactical exercises during preparatory training will have a positive effect on the manifestation of players in competition.

Regarding the progress made between the two tests, initial and final, it appears that both arithmetic means and the percentage difference were in favor of the experimental group. All this was due to the interest in psychological recovery during the research, knowing that nerve cell regeneration is seven times slower than muscular regeneration (Krestvonicov 1938, quoted by Bompa 2002). The null hypothesis was thus rejected, the training program applied to the experimental group proving to be effective.

Regarding the progress made on the two technical and tactical complexes, it can be observed that the results of the experimental group were superior to those of the control group, the differences between them, in the final testing, being in all cases significant:  $p<0.001$  (Table II).

In all 5 motor tests, the differences between the averages of the two groups were significant, demonstrating that specific structures applied to the experimental group in the training process had a much higher efficiency than the training programs in the control group. The null hypothesis was rejected, the research hypothesis was confirmed.

Due to the large number of repetitions within the preparation microcycles and the careful planning based on streamlined and standardized resources, the exercise capacity of the experimental team as well as the level of technical and tactical actions evolved

significantly both qualitatively and quantitatively. Within the preparation microcycles during training, increasing the volume of work effort in the experimental group, introducing two technical and tactical training complexes, while gradually increasing the intensity, was a primary factor in improving the exercise capacity of players, thus influencing the physical performance and technical tactical skills of the players in the field.

## Conclusions

1. Increasing the workload in training microcycles by using mostly the technical and tactical means set, i.e. prolonged effort, in the juniors of the experimental group, significantly contributed to enhancing the effort capacity of the 17-18 year-old junior players.

2. The significant increase in the indices of the dynamics of both the technical and tactical complexes was due to the volume and intensity of effort, depending on the complexity of the means selected, aspect confirming the effectiveness of the program used.

3. In the educational process within the preparatory period microcycles, we need documentation and an accurate recording of the effort made by the players, which certifies the need for training planning, with the introduction of predominantly technical and tactical complexes such as those presented in this paper, to achieve maximum efficiency in the competition.

## Conflicts of interests

Nothing to declare.

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## CASE STUDIES STUDII DE CAZ

# Depression or addiction in athletic training - a case study Depresie sau adicție în antrenamentul sportiv - studiu de caz

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### Abstract

**Background.** Although numerous studies underline the fact that sport helps reducing depressive symptoms, there are many different points of view. Beginning from 1976, specialized literature has emphasized the risks of positive addictions like sports, sexual intercourse and shopping. No screening method for exercise addiction has been developed yet, but first steps in this direction have been taken in the case of football and athletic races. Case studies show suggestive examples demonstrating that soon, there might be sufficient criteria to support the diagnosis of new psychiatric disorders such as "exercise addiction".

**Aims.** A specific purpose of this study was the assessment of reciprocity between psychiatric disorder and performance in football. The general objective was to distinguish predisposing factors for suicidal behavior in this specific case. A secondary objective was refining the diagnosis of the teenager using the new edition of the Diagnostic and Statistical Manual of Mental Disorders DSM-V.

**Methods.** Psychopathological parameters associated with the deterioration of athletic performance and the onset of suicidal behavior in the 19-year old football player of the "U-Cluj – Junior team" were analyzed using the Qualitative Method. The semi-structured interviews used for psychiatric diagnosis were: the Mini-International Neuropsychiatric Interview (M.I.N.I.) and the Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II). Clinical scales were: the Temperament and Character Inventory (TCI) developed by Cloninger et al., the Beck Hopelessness Scale, the Life Events Scale by Holmes and Rahe, for the evaluation of the stress accumulated in the year preceding the suicide attempt. The case was evaluated in two distinct moments of time: in 2006, during psychiatric care after attempted suicide, and in 2013.

**Results.** Athletic performance declined significantly, resulting in total abandon of all implications in football. The results of this case study analysis led to the refinement of the diagnosis in compliance with the new classifications of DSM-V: the diagnosis of dysthymia was completed by the specification "anxious distress". The diagnosis of exercise addiction was presumably present in 2006. This diagnostic presumption requires further discussions in light of suicidal vulnerability in the studied case.

**Conclusions.** Dysthymia has a negative impact on athletic performance. Dysthymia as a comorbidity in exercise addiction leads to an increase in suicidal risk.

**Key words:** football, dysthymia, comorbidity, exercise addiction, suicidal risk, diagnostic specifiers.

### Rezumat

**Premize.** Numeroase studii susțin că sportul ajută la reducerea simptomelor depresive. Există însă și puncte de vedere diferite. Literatura de specialitate, încă din anul 1976, atrage atenția asupra adicțiilor cu valență pozitivă, precum sportul, sexul, shopping-ul. Nu sunt screening-uri pentru dependența de activitatea fizică, dar primele semnale pe această direcție au fost în cazul alergării și a fotbalului. Studiile de caz sunt mărturii grăitoare că în viitor s-ar putea să avem suficiente criterii pentru a susține în psihiatrie existența unei alte tulburări psihiatrice, precum dependența de activitatea fizică.

**Obiective.** Obiectivul specific al studiului a fost de a evalua intercondiționările dintre tulburarea psihiatrică și performanța în fotbal. Obiectivul general al studiului de caz este evidențierea factorilor predispozanți pentru comportamentul suicidal la un tânăr sportiv de 19 ani, diagnosticat cu distimie. Un obiectiv secundar a fost acela de a se rafina diagnosticul la caz, din perspectiva apariției noii ediții a Manualului de Diagnostic și Statistică a Tulburărilor Mentale DSM-V.

**Metode.** Cu ajutorul metodei calitative de analiză de caz s-au studiat parametri psihopatologici implicați în deteriorarea performanței sportive și în declanșarea comportamentului suicidal, la un tânăr în vârstă de 19 ani, fotbalist în echipa "U Cluj - Juniori". Interviuurile semistructurate de diagnostic psihiatric folosite au fost: Interviuul Structurat de Diagnostic Neuropsihiatric (M.I.N.I.) și Interviuul Clinic Structurat pentru Tulburările de Personalitate de pe Axa II (SCID II). Scalele clinice folosite au fost: Inventarul de Temperament și Caracter (TCI) alcătuit de Robert Cloninger, Scala disperării (Beck Hopelessness Scale), Scala evenimentelor de viață (Holmes și Rahe) pentru a investiga nivelul de stres în anul anterior evenimentului suicidal. Cazul a fost analizat în două momente diferite de timp: în anul 2006, în timpul îngrijirilor medicale psihiatrice post-tentativă suicidală

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prin spânzurare și în anul 2013.

**Rezultate.** Performanța sportivă la cazul studiat a avut grav de suferit, tânărul ajungând să abandoneze fotbalul. Rezultatul analizei de caz a condus la rafinarea diagnosticului actual, în lumina noilor clasificări din psihiatrie. Astfel, diagnosticul de distimie este completat cu specificantul anxietate tip distres. În ceea ce privește diagnosticul de dependență de sport, a fost prezent cu mare probabilitate în 2006 la caz. Această prezumție diagnostică merită discutată din perspectiva vulnerabilității la sinucidere la cazul studiat.

**Concluzii.** Distimia are impact negativ asupra performanței sportive. Distimia în comorbiditate cu dependența de sport conduce la creșterea riscului suicidal.

**Cuvinte cheie:** fotbal, distimie, comorbiditate, dependența de activitatea fizică, risc suicidal, specificanți diagnostici.

## Introduction

A specialized article published in 2009 in Scientific American (Ballantyne, 2009) revealed the findings of the US Public Health Service run by William Haskell of Stanford University on physical activities and physical exercise. The conclusion was that aerobic exercise helps reduce depressive symptoms. The study, conducted by Blumenthal et al. (1999), proved that 16 weeks of aerobic exercise were just as effective as 16 weeks of treatment with Zoloft for depression. All these proofs support the protective role of physical exercise on mental health, provided that this activity is characterized by control and moderation.

Nevertheless, a completely different point of view is also being promoted: since 1976, the specialized literature has been drawing attention to positive addictions (such as sport, sexual intercourse or shopping). This type of addiction was first described in top athletes (Glasser, 1985), the most popular standpoint being that excessive training is a form of addiction. Those who practice running, fitness or body-building excessively not only put themselves in physical danger, but they also consider training to be more important than family, health and career. Exercise addiction has not been screened until now, probably because it is difficult to apply available tools and the interpretation of the results based on score hierarchy is not always obvious (\*\*\*, 2013).

Exercise addiction, as it was characterized, was subsumed to the category of addictions that do not involve the use of exogenous substances, next to food addiction, starving, shopping, sexual intercourse or gambling (Klein, 2004).

The characteristics of body-building and fitness addiction include: training more than five times a week, for at least a few hours; continuing training despite illnesses (in non-severe forms) or injuries; estrangement from family and society for the purpose of training more; feeling guilty for missing training sessions for objective reasons (Vélé, 2002; Valleur & Vélé, 2002; Mirescu et al., 2008).

The most important adverse effects of exercise addiction are: physical and mental damage reflected by symptoms such as anemia, immunodeficiency, menstrual disorders, irritability, anxiety, depression (Leuenberger, 2006; Albreicht et al., 2007). Over recent years, a growing interest in rudimentary, subclinical forms of depression such as dysthymia has been noted because of the decrease in daily functionality and vocational-professional performances caused by these mood disorders. Moreover, DSM-V [Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition] – published in 2013 – brings important

clarifications mainly regarding the severity specifiers that may characterize the clinical presentation of dysthymia (\*\*\*, 2013). These specifiers may precipitate highly severe psychopathological presentations such as suicide attempts (Martunnen, 1991; Cosman, 2006; Cosman, 2009).

## General objective

The general objective of this case study is to highlight the predisposing factors of the suicidal behavior of a young 19-year-old athlete diagnosed with dysthymia.

## Specific objectives

- Assessing the distinctive features of *persistent depressive disorder* such as intensity, duration, clinical presentation, symptoms, severity specifiers, comorbidity.
- Highlighting the *dimensional features of the personality* of this patient, who developed a highly severe form of suicidal behavior – suicide attempt by hanging.
- Assessing the correlation between the values obtained for personality dimensions and *distress*.
- Assessing the impact of some interfering factors such as *life events* or *comorbidity* on this young athlete's predisposition to suicide.
- Investigating if *excessive training* or the *decrease in athletic performance* has an impact on the onset of depression and implicitly, on suicidal attempt.

## Hypothesis

We assessed the *psychopathological parameters* that may have contributed to the onset of suicidal behavior in a 19-year-old teenager, student and football player for the junior "U" Cluj team, using the qualitative case study methodology in order to establish if dysthymia was the only factor explaining the suicide attempt of this young football player, whose training lasted several hours a day.

## Material and methods

The study was approved by the Ethics Committee in accordance with the Good Practice Guide, by approval number 458A/28.11.2011. It complied with the conditions of the Helsinki Declaration, the Protocol of Amsterdam, Directive 86/609/EEC, and the "Iuliu Hațieganu" University of Medicine and Pharmacy Cluj-Napoca Bioethics Commission regulations.

### Research protocol

#### Period and place of the research

The patient was assessed at two different stages: in 2006, during the psychiatric care received after his suicide attempt by hanging, and in 2013.

#### Subjects and groups

The case study presents the patient (D.S.B.), a 19-year-

old male student and football player, member of the "Universitatea" Cluj Sports Club, who was diagnosed with early-onset persistent depressive disorder (F.34.1). Suicide attempt by hanging (X.60) (\*\*\*, 1992).

#### Tests applied

The objective evaluation of psychopathological syndromes and personality dimensions was performed using specific clinical tests.

The psychiatric case study was approached as follows:

1. The psychiatric diagnosis was made in compliance with the ICD-10 criteria, by the primary care psychiatrists who treated the patient during his hospitalization (\*\*\*, 1992).

2. The screening for the categorical diagnosis of the patient with mood disorder was made in compliance with DSM-IV-TR, using the Structured Clinical Interview for DSM SCID II, an additional tool to the 2<sup>nd</sup> diagnosis Axis of DSM-IV-TR, which fully complies with the diagnosis criteria applied to personality disorders Cluster A, B and C (\*\*\*, 2003; \*\*\*, 2013).

3. The assessment of the patient's suicidal behavior was conducted using specific scales.

4. The scales and assessment tools used were the following:

a) Structured Clinical Interview for DSM Axis 2 Personality Disorders (SCID II) (\*\*\*, 2003)

b) Mini-International Neuropsychiatric Interview (M.I.N.I.)

c) Temperament and Character Inventory of Robert Cloninger et al. (Cloninger et al., 1994)

d) Beck Hopelessness Scale (Beck et al., 1974)

e) Holmes & Rahe stress scale

#### Statistical processing

The study case analysis was conducted using qualitative methods: psychiatric interview, semi-structured interview, life history, clinical scales. Some of these methods were repeated at two different stages of the assessment (Manea, 2010).

## Results

#### Reasons for hospitalization

D.S.B., aged 19 years, freshman at the Faculty of Economic Sciences, without any noteworthy personal pathological history, was brought to the Emergency Room on December 24, 2006 (on Christmas Eve), at 07:00 p.m., after he attempted suicide by hanging. He was resuscitated effectively and in time and admitted to the Intensive Care Unit in a state of deep coma. The patient woke up after four days of respiratory and cardiovascular monitoring and was transferred to the Clinical Psychiatry Unit 3.

#### Living and work conditions

D.S.B. was a teenager issued from a good family. His father was a construction engineer and his mother, an economist. They were well off - his parents had their own business. D.S.B. had a younger sister, still in school. He lived with his extended family (including his paternal grandparents) in an 8-room mansion. He "still" played for the Universitatea Cluj junior football team, but he had been on the bench for one year because the coach had warned him on several occasions that he was no longer communicating as he should have been with the rest of the

team during football games.

No hereditary, collateral or personal pathological history.

#### A day like any other?!

Given that it had been quite hard to work with the patient during the first days, it was the family who recounted the unfolding of the day of the suicide attempt to the medical staff. According to them, it seemed *a day like any other* and there were no hints that such a serious event was about to happen. In the morning, D.S.B. left with his father for the family store. On the way, D.S.B. insisted that they stopped at a store selling leather jackets. The boy told his father that he wanted a certain *leather jacket*, but his father refused to buy him the jacket, offering him nothing but a brief explanation. The consequences were dramatic: he returned home alone, he meticulously took off his coat and his belt and used the latter to hang himself from the staircase. His grandmother related that she was in the kitchen, preparing for Christmas, when he entered the house. He did not greet her. She heard the noise, which allowed her to save him by finding him immediately after his suicide attempt.

#### Case-related note

It was not the first time that his father noticed such discontentment. It had already occurred in the year preceding the suicide attempt, sometimes because of ordinary facts. However, the discontentment mostly had to do with the *football field*, training sessions or sport-related failures.

The teenager practiced two or three hours a day, five days a week. He felt that his effort was not going to pay off (Manea, 2010).

#### Diagnosis on discharge

Early-onset dysthymia (early-onset persistent depressive disorder) (F.34.1). Suicide attempt by hanging (X.60) (\*\*\*, 1992).

*Psychiatric assessment (anamnestic, hetero-anamnestic)*

- Depressive mood, dysphoria during hospitalization and for approximately one year before. However, Stelian's family did not consider that he had a problem. They thought that this *state of mind* was caused by the lack of recognition of his value as a football player.

- The clinical observation and assessment highlighted: depressive mood, fatigability, low self-esteem and poor focus; there were no signs of distress or suicidal intention.

- The Mini-International Neuropsychiatric Interview (M.I.N.I.) confirmed the diagnosis of *dysthymia*.

- The dimensional personality assessment (Temperament and Character Inventory - Cloninger) revealed a profile that did not raise the suspicion of a personality disorder. High self-directedness (33) and cooperation (36) scores were obtained, *despite the fact that the novelty seeking score obtained by the teenager was also high* (30) (Cloninger et al., 1994).

- The categorical assessment using the Structured Clinical Interview for DSM Axis 2 Personality Disorders (SCID II) did not validate any personality disorder.

- Beck Hopelessness Scale = 1 (a low score which is not correlated with high suicide risk, or at least it does not predict such a severe suicide attempt) (Beck et al., 1990).

- Suicide Intent Scale = 0 (practically no suicide

intention)

- The Life Event Scale revealed a low stress level for the year preceding the suicide attempt, 51 LCU (Life Change Units). For a high stress level, the score should have exceeded 250 LCU. The way in which the patient perceived stress was not assessed, for it would have involved the use of perceived stress scales, which was impossible, given that out of 50 patients who developed suicidal behavior, he obtained the lowest score in the Life Event Scale test.

#### *Dysthymia specifiers*

- Observation: irritability in children and teenagers must last for at least 1 year.
- We can talk about an early onset of the disease only if it occurs before the age of 21.
- The onset of dysthymia is often insidious in early life stages (childhood, adolescence) and has, by definition, a chronic course.
- An early onset increases the likelihood of comorbidity with personality disorders and drug abuse.
- Case-related observation: We note the absence of both personality disorder and drug abuse diagnoses.

## Discussions

### *1. Refining diagnosis using the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM V). The issue of specifiers.*

Today, DSM-V brings a series of novelties such as diagnosis clarifications provided by specifiers. In DSM-V, these specifiers were added to mood disorders. They are valuable because they offer potential explanations for suicidal behavior.

#### *Resumption of the case discussion in 2013*

*Seven years after the incident, he came back to the outpatient psychiatric unit, asking me to examine his mother, who was lately having trouble sleeping. I diagnosed her with anxiety disorder and treated her consequently. I also went over the circumstances of that day with D.S.B., who told me that he had felt on the edge. He had thought that his future was compromised and that his father was surely no longer going to support his football career if he was not willing to do such a minor thing for him. He could not see any other solution, he could not control himself. Now, he could not explain his decision and thanked his family, his doctors and God for the fact that he was still alive. He went to psychotherapy sessions, dropped football, graduated from college and he now kept the books of the family business.*

*You dropped football??? I asked surprised.*

*Yes Doctor.....*

*He confessed to me that he had dropped football because shortly after his suicide attempt, he became aware that it was practicing this sport that almost cost him his life. He could not stand being a substitute player. He felt the need to be on the field at all times and to keep possession of the ball in order to save the team through the goals he scored (he was playing forward). He did not miss any training session, even if he caught a cold, was tired, had to study for his exams or it was raining outside. His coach believed that he was out of shape for several weeks in a row prior to his suicide attempt, so he mostly sat on the*

*bench. Shortly after being discharged from psychiatry, he realized that playing football had become a problem, in a way that he could not define. He did not have a girlfriend; he did not go out with people other than his team mates; he felt sad every time he was prevented from playing and he was in a good mood only when the coach allowed him to play; he often fought with his father, who was no longer willing to fund his sports competitions because his entire life revolved around football and nothing else.*

*DSM-V – A new perspective on the diagnosis of dysthymia*

Taking into account the activation event, which generated frustration and distress, potentially leading to the following erroneous cognitive interpretation caused by overgeneralization: “my father does not value me if he does not buy me a jacket on Christmas Eve”, “the coach keeps me on the bench all the time”, “my father will no longer support my participation in sports competitions”.

Could we have added one more specifier to the assessment of this case?

ICD-10; DSM-IV-TR does not allow any other specifiers than the age of onset. Nevertheless, DSM-V offers us today the possibility of some psychopathological clarifications in the case of depressive disorders, such as *dysthymia with anxious distress*.

**Table I**

The “anxious distress” specifier (according to DSM-V)

Anxious distress is defined as the concurrence of at least 2 of the following symptoms:

1. The feeling of edginess \*
2. The feeling of inexplicable restlessness\*
3. Finding it hard to focus due to anxiety\*
4. The feeling that something bad is going to happen
5. The feeling that he/she is going to lose control\*

**Note:** High levels of anxiety are correlated with a higher suicide risk, a longer illness and a higher chance of unresponsiveness to treatment.

#### **Degree of severity:**

- Mild - 2 symptoms;
  - Moderate - 3 symptoms,
  - Moderate-severe - 4-5 symptoms,
  - Severe - 4-5 symptoms coupled with motor agitation
- \* symptom encountered in D.S.B. case

The answer to the question *Could D.S.B. have committed suicide because of a leather jacket?* is NO, this could not have been the ONLY cause. However, the presence of this “detail”, considered a specifier according to the new diagnosis manuals, aggravated the disorder. This detail became an acute stressor agent given that there was no chronic stress in this case. In the year preceding the suicide attempt, the patient faced a small number of stressful events. In fact, we cannot talk about burn-out, in his case. From our point of view, the explanation of his suicidal behavior lies in the fact that, in 2006, the persistent depressive disorder occurred at a time when the teenager was shaping his personality. However, we cannot state that we had answers to all of our questions, back in 2006.

### *2. Refining primary diagnosis using the new clarifications: the issue of comorbidity*

a) *Early-onset dysthymia with anxious distress. Major depressive episode in comorbidity with dysthymia (double depression). Suicide attempt by hanging (X.60)*



or

b) *Early-onset dysthymia with anxious distress.* Major depressive episode in comorbidity with dysthymia. *Exercise addiction.* Suicide attempt by hanging (X.60)

According to Glasser (1985), perseverance and excessive training in any sport which primarily involves running (e.g. football, in the case of our teenager) may cause addiction. Moreover, slowing down or, even worse, stopping entails true weaning symptoms specific to the clinical presentation of depression. A paradox of drug addiction behavior thus appears: athletes, marathon runners, football players stop drinking alcohol and smoking, habits which are considered to be negative addictions, but develop another form of addiction instead, that of achieving an ever higher athletic performance, athletic bodies like the ones of those practicing body-building. This addiction is based on a strong pathophysiological mechanism – that of reward circuitry with an intermediary stop in the accumbens nucleus located in the limbic system – involving endogenous endorphins and a body perception disturbance that affects one's view of oneself, more precisely dysmorphobia.

**Table II**  
Exercise addiction criteria (Veale, 1991)

1. Stereotypical physical activity performed more than once a day.
2. Emotional investment in physical activity.
3. Growing tolerance to ever more intensive exercises.
4. Weaning symptoms such as sadness, anxiety, feelings of depreciation and guilt, lack of appetite triggered by the voluntary or imposed discontinuation of training.
5. Alleviation or disappearance of the weaning symptoms upon resumption of training.
6. Subjective perception of the compulsive need to work out.
7. Rapid resumption of the compulsively-practiced activity after a temporary disruption.
8. Intense training despite severe physical illness and the ban of physical activity by doctors or coaches.
9. Family conflicts caused by the practicing of the physical activity.
10. The subject forces himself to lose extra weight to improve his athletic performance.

*Case-related note: The teenager who is the subject of this case study meets 7 of the 10 criteria (1,2,3,4,5,7,9), which most likely indicates exercise addiction.*

The endogenous opioids referred to above are  $\beta$ -endorphin, enkephalin and dynorphin.

The release of  $\beta$ -endorphin plays a major role in addictive behaviors. Training increases the release of  $\beta$ -endorphin which, by binding to the  $\mu$ -opioid receptors of the accumbens nucleus and the ventral tegmental area, helps produce *hedonic effects*. Moreover, endorphins also bind to the periaqueductal grey matter  $\mu$  receptors, where they have an analgesic effect, or to the locus caeruleus, where they help produce sedative effects and the weaning reaction (Nestler et al., 2009). We note that this is the same pathophysiological mechanism as the one involved in opioid addiction (e.g. heroine). The  $\mu$  receptors are located in the GABAergic interneurons which inhibit the dopaminergic neurons of the ventral tegmental area. By inhibiting GABAergic neurons, opioids stop the inhibition of dopaminergic neurons. Due to this fact, opioids have an addictive effect. Only opioids acting on  $k$  receptors

inhibit dopamine release in the synaptic cleft and they do not have any motivating or exhilarating effects. Due to this fact, naloxone and naltrexone (opioid receptor antagonists) are used in the short- or long-term treatment of addiction (Dehelean, 2010).

Nowadays, this pathophysiological hypothesis also applies to the treatment of alcohol addiction. It is probably just a matter of time before these pharmacological treatments start being applied to other forms of addiction as well (Griffith et al., 2005).

It must be said that DSM-V has not included *other* types of addictions – such as the ones mentioned hereinbefore (sport - fitness or running, sexual intercourse, shopping) – on the list of positive addictions *yet*, next to the “classical” pathological game use (casino, roulette, cockfights, slot machines, blackjack). As a matter of fact, the listing of computer game addiction (e.g. World of Warcraft) among psychiatric diagnoses has been long awaited, but has not been achieved yet.

This discussion is worth having, for two reasons:

a) It is a fact that addiction and suicidal behaviors are intertwined – more than half of the classical gamblers have suicidal thoughts and approximately 17% of them develop suicidal behavior (according to DSM-V).

b) There has been an increase in the number of cases of exercise addiction described in the literature, and in France, there are even rehab centers for exercise addiction (Château de Thianty).

## Conclusions

1. Depression bears the germ of suicide. It represents, for this reason, one of the most redoubtable disorders of the modern world, being at the same time one of the most frequent. The development of suicidal behavior in specific cases is far from being understood and solutions are yet to be found.

2. Persistent depressive disorder is an intense disorder which affects several functioning areas and has a negative impact on vocational performance. The presence of dysthymia in comorbidity with another dysfunctional addictive behavior such as exercise addiction increases suicide risk in geometric progression.

## Conflicts of interests

There are no conflicts of interest.

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## REVIEWS

## ARTICOLE DE SINTEZĂ

### A study regarding alveolar-capillary gas exchanges in hyperbarism

### Studiu privind schimburile gazoase alveolo-capilare în condiții de hiperbarism

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#### Abstract

Professional divers are exposed to possible important negative effects of hyperbaric oxygen and this is the reason for research in specialized centers to find objective tests which can predict and prevent major hyperbaric effects.

The studies of oxygen diffusion in hyperbaric conditions and of the effects of different O<sub>2</sub> saturations on respiratory exchanges and clinical consequences were performed both under laboratory conditions (on white NMRI mice) and under real clinical conditions (on healthy experimented divers).

The authors propose a synthesis of the physiology and pathology of continuous or intermittent exposure to hyperbaric oxygen on the cardiorespiratory system. Based on laboratory and histological results, the conclusions of the study give a practical solution for testing hyperbaric hyperoxia tolerance in order to minimize and prevent diving accidents, being useful for all specialists involved in this field.

**Key words:** hyperbaric hyperoxia; oxygen tolerance test.

#### Rezumat

Scafandrii profesioniști sunt expuși unor posibile efecte negative cu implicații majore asupra sănătății datorate oxigenului hiperbaric, motiv pentru care, de-a lungul anilor, s-au desfășurat cercetări în centre specializate, pentru a găsi teste obiective care pot preveni accidentele hiperbare.

Studiile de difuziune ale oxigenului în condiții de hiperbarism, a efectelor diferitelor saturații de oxigen asupra schimburilor respiratorii și a consecințelor clinice s-au desfășurat atât în condiții de laborator (pe șoareci albi rasa NMRI), cât și în condiții clinice (pe scafandrii sănătoși profesioniști).

Colectivul de autori propune o abordare sintetică a fiziologiei și patologiei expunerii prelungite sau intermitente a sistemului cardio-respirator la acțiunea oxigenului hiperbar.

Bazate pe rezultate de laborator și histologice, concluziile studiului reprezintă o soluție practică de a testa toleranța la hiperoxia hiperbară, astfel minimizând sau prevenind accidentele de scufundare și putând fi de un real folos tuturor specialiștilor implicați în acest domeniu.

**Cuvinte cheie:** hiperoxia hiperbară, test de toleranță la oxigen.

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## Introduction

The entrance and activity in underwater conditions has always been a challenge, breathing and hyperbaric adaptation possibilities representing a major concern in a continuous evolution. The list of present current hyperbaric activities includes sport diving, commercial, military or industrial purposes, archeological and experimental diving and also, assistive and therapeutic hyperbaric medicine (Gill & Bell, 2004; Khandelwal & Kaide, 2008).

There are three major categories for underwater interventions (Bove & Davis, 2003):

a) *Direct diving*: the most used type of intervention, based on direct contact with water. Depending on the depth of diving, it can be classified into:

- Direct diving at small and medium depths – can be free diving in apnea (limited by the time of breath keeping and by the mechanical effect of lung distortions under pressure) or diving using special equipment to increase the underwater time (SCUBA=self contained underwater breathing apparatus – with an underwater autonomous breathing unit using air/oxygen, with a light or heavy diving suit) (Kayle, 2009).

- Direct diving at great depths – unit diving in a decompression chamber or saturation diving

b) *Indirect diving*: in rigid, sealed, pressure-resisting chambers, where the diver breathes in normal atmospheric pressure. Underwater devices with men on board can be non-autonomous (linked to surface by communication cables) or autonomous (with atmospheric regeneration and rescue possibilities, self-propulsion, navigation, communication).

Breathing is the fundamental problem on which life and work in hyperbaric conditions depend and is the reason for which the gas mixture breathed by the diver has a major importance (Tezlaff & Thorsen, 2005). The most used gases in hyperbaric conditions are:  $O_2$ ,  $H_2$ ,  $CO_2$ ,  $CO$ ,  $N_2$ ,  $He$ ,  $Ar$ ,  $Ne$ , and the gas mixtures are double-gases (Nitrox –  $N_2/O_2$ , Heliox –  $He/O_2$ ,  $H_2/O_2$ ) or triple-gases ( $N_2/He/O_2$ ,  $Ne/He/O_2$ ). Particularities (Edmonds et al., 2005):

- $O_2$  breathed at high pressure has a toxic effect on the body. The tolerance time depends on its partial pressure from inspired air. Because  $O_2$  is not practically dissolving in the blood, it is not included in decompression tables.

- $CO_2$  concentration over 5% in an inhaled gas mixture will determine hyperventilation, which will reach the maximum at the concentration of 9%  $CO_2$ . Because of its toxicity,  $CO_2$  can be used in diving activities only under some limits of  $ppCO_2$ , between 6 mbar (optimum percentage) and 70 mbar (maximum percentage) in a chamber.

- $CO$  has a 210-300 times greater affinity for hemoglobin than  $O_2$ , forming with it carboxyhemoglobin (HbCO), which at 5-10% concentration in peripheric blood determines clinical manifestations of CO poisoning, and at 40% HbCO concentration, loss of consciousness and death will occur. CO toxicity is based on an extremely slow speed for HbCO dissociation, the half-time is 4 hours in normal ventilation persons and 1 hour in pure  $O_2$  atmospheric breathing. In saturation chambers,  $pCO$  must be under 30  $\mu$ bar.

- $N_2$  has a relatively slow diffusion and a slower pulmonary release. The density of gas  $N_2$  increases significantly with depth, hindering the ventilation mechanical work. The increase of  $pN_2$  during breathing at 5-6 ATA will have a negative effect known as nitrogen narcosis. It is demonstrated that the first performance decrease appears at  $pN_2 = 3.2$  ATA, corresponding to 30 m depth.

- *Helium* is the most used inert gas for gas mixtures in diving at great depth, because of some advantages: it is the lightest gas after  $H_2$  and has a low density compared to  $N_2$ , these properties ensuring a better comfort at higher pressures, when lower densities of inhaled gases decrease the nitrogen effect by using it as an  $O_2$  diluent in experiments and saturation operations.

- $H_2$  is the lightest gas, cheap and easy to get. Its low density recommends it for usage at medium and great depths instead of helium. It has low narcotic properties – only a quarter of the CNS depression capacity of  $N_2$ .

- *Ar*, *Xe*, *Ne* have been experimented for being used as oxygen-diluents in gas mixtures for deep immersions. Some of them have serious disadvantages – argon is narcotic even at 1 ATA.

## Pulmonary ventilation under hyperbaric conditions

During hyperbarism, there are many particularities of ventilation physiology (Carmichael, 2008):

- *Respiratory type*: In upside-down diving, abdominal breathing is accentuated and the inferior pulmonary lobes are more ventilated, compared to the relative decrease of the pulmonary apex, due to intense diaphragm contraction. At the comeback ascent, with head up, the base of the thorax is constrained, superior rib breathing appears, with a higher thoracic antero-posterior diameter, diaphragm ascension and a relative hyperventilation of the lung apex.

- *Inhalation*: During immersion, the inhalation phase has a bigger amplitude, and the increase of the air/gas mixture density will put a higher strain on inhalation at greater depths. Forced inhalation can appear in divers as a result of effort dyspnea or  $CO_2$  intoxication dyspnea.

- *Exhalation*: Its amplitude is increased proportionally to respiratory gas density and it can be noticed at small depths (nitrox or air diving) or bigger depths (heliox diving). Active exhalation can prevent overpressure during diving.

- *Respiratory frequency*: In hyperbarism using air, the respiratory frequency decreases during rest, posing the problem of adaptation of ventilation through exercise for professional divers. The reduction of breathing frequency at 3-5 ATA with air compared to 1 ATA is obvious during rest and also, during maximal effort. The increase of respiratory movement amplitude and the decrease of ventilation frequency during air inhalation in hyperbarism appear as a spontaneous adaptation of the diver's body to mechanical work. The increase of ventilation frequency during diving may appear during effort or an accidental increase of  $CO_2$ .

- *Changes in pulmonary volumes and capacities*: The decrease of vital capacity (VC) by 8-9% and reduced changes of residual volume (RV) due to the respiratory factor (hydrostatic pressure exerted on the thorax and

abdomen determines diaphragm ascension) and to the blood factor (redistribution of blood volume due to hydrostatic pressure, with thoracic blood volume and decrease of pulmonary blood volume). In 1973, Dahlback and Lundgren (Wattel, 2006) demonstrated that diving up to shoulder level can produce the "air trapping" phenomenon (like in emphysematous people) because of the reduction of transmural forces in the airways when the torax is compressed by the surrounding water and the reduction of pulmonary volume. For preventing "air trapping" signs, the pulmonary volume must be raised at 40% of vital capacity, and breathing must have a higher frequency for opposing partial airflow obstruction.

- *Respiratory flow*: minimum changes occur during rest in hyperbarism, variations being noticed after effort or heliox exposure. Decreases in the respiratory flow may appear at a higher gas density and hydrostatic pressure; increases in the respiratory flow may appear due to heat loss through convection. Maximum expiratory volume per second decreases in air hyperbarism even up to 70% of the inferior normal limit, representing a decrease of the bronchial permeability index. Maximum ventilation decreases too, in hyperbarism, because of the decrease of the current volume and of the respiratory rate.

### **Effects of hyperbaric oxygen exposure and reactive oxygen species**

Using hyperbaric oxygen at high pressures and concentrations over long diving periods is limited and requires prudence due to its toxicity (Christiani, 2011). Partial oxygen pressure (ppO<sub>2</sub>) in air increases with depth, so at 10 ATA corresponding to 90 m, ppO<sub>2</sub> will be 2.1 ATA O<sub>2</sub>. Using O<sub>2</sub> at a pressure higher than 0.4 ATA can produce acute or chronic hyperoxia, depending on the time of exposure.

*Acute hyperoxia*: known as the Paul Bert effect or hyperoxic seizures, first described in 1873 as a form of CNS hyperbaric oxygen toxicity at 1.7-2 ATA. Based on observations on humans and mice (Tache et al., 1994), there are three stages of symptoms:

a) The stage of metabolic cellular changes, when metabolic disruptions are initiated in most of the organ's essential parts implicated in energy production, essential for a good cellular functionality.

b) The prodromal stage with the first clinical signs of oxygen toxicity (nausea, trembling, dizziness, retrosternal pain, breathing acceleration, tachycardia, cramps in facial and limb muscles, discomfort, cold sweating, problems of concentration and work, mydriasis, tinnitus, visual field narrowing with tunnel effect, anxiety, confusion, fatigue, euphoria or depression, amnesia). Physical effort during underwater work increases the susceptibility to oxygen toxicity, and the increase of oxygen consumption by trembling can double toxicity.

c) The clinical stage consists of a tonic period followed by a clonic period and loss of consciousness (Dean et al., 2003). Continuing inhalation will decrease the intervals between seizures, until death, because of tissue hypoxia due to hyperbaric hyperoxia. Stopping inhalation and reducing pO<sub>2</sub> may stop the seizures without consequences. Short exposures to an increased pO<sub>2</sub> atmosphere are not

harmful, but useful by increasing tissue oxygenation due to the increase of arterial pO<sub>2</sub> – the result of the increase of plasma dissolved O<sub>2</sub>, the good effect used in hyperbaric oxygen therapy.

*Chronic hyperoxia*, known as the Lorrain Smith effect, first described in 1897, appears after multiple and long exposures (hours) to pO<sub>2</sub> at 0.4-1.7 ATA, especially after saturation diving, in hyperbaric chambers with hyperoxic atmosphere for the persons inside (Christiani, 2011). Clinical signs are called "oxygen pneumonia", with specific pulmonary lesions - congestion, bronchoalveolar edema, epithelial degeneration and scaling, fibrin deposits on the airways and pneumonia. The small bronchi obstruction, accentuated by bronchospasm, is followed by atelectasis due to gas resorption in non-ventilated areas. The first pathological changes are those of the pulmonary surfactant, followed by capillary endothelium disruption and invasion of blood elements in the alveolae and pulmonary interstitium.

Hyperbaric oxygen has a bi-stressing effect, meaning it has a double toxicity for the human body due to the hyperbaric factor and due to the hyperoxic factor (Mathieu et al., 2006).

*The hyperbaric factor* is directly proportional to depth, with every 10 meters underwater the pressure increases by 1 ATA. The air from the chamber or in the breathing mask for divers must be at the same pressure as that of the water around the divers, to prevent thorax flattening. This means that for every 10 meters underwater, pO<sub>2</sub> will increase by 1 ATA (ATA = absolute atmosphere, a term used for working divers). At sea level, the pressure is 1 ATA, and at 10 meters depth the pressure reaches 2 ATA. Working divers, who breathe pure oxygen from closed devices, have a limitation at 7 meters depth for a safety immersion. (Mitchell & Bennett, 2008).

*The hyperoxic factor* – the experiments that tried to dissociate hyperoxia from hyperbarism, showed that the major disturbances were due to hyperoxia. The term "oxygen intoxication" or "oxygen toxicity" and its effects must be well understood. Different intoxication levels are tolerated by different tissues when hyperoxia is used in therapy or usual diving operations. Oxygen toxicity studies on pulmonary tissue have described three stages (Clark & Whelan, 2004):

- Initial disturbances consist of histological changes that occur 40-60 hours post-exposure to 1 ATA O<sub>2</sub> 100%: endothelial cell tumefaction, neutrophil aggregation, cytoplasmic vacuolization and the first hyperoxic pulmonary lesions.

- The transitional stage consists of the increase in the number of cells in the alveolar interstitium due to inflammatory cells accumulated in the capillaries, endothelial cell swelling and major disturbances of liquid permeability.

- The late stage is characterized by a destructive endothelial process expansion to type 1 and 2 pneumocytes and basal membrane exposure, with the increase of cellular infiltrate and interstitial matrix volume.

Clark and Lambertsen demonstrated in 1971 that breathing pure oxygen at 1 ATA for longer periods of time will determine most frequently death through alveolar



flooding (Gocan et al., 1993). In mice, the exposure is deadly through pulmonary edema in 50% of animals after 66-72 hours. The lung is the only organ in direct contact with the atmosphere and is the most exposed to hyperoxic attack. Under hyperoxia conditions, the  $O_2$  amount that reaches other organs is due to the high plasma dissolved form of the gas. Beyond 2.5 ATA  $O_2$ , oxygen toxicity can cause death through CNS effects - seizures and coma (Newton, 2001).

Hyperbaric oxygen is a form of oxidative stress, an extensively studied phenomenon in the last 20 years for its biochemical and pathophysiological aspects. The weapons of hyperbaric hyperoxia at cell level are the so-called "reactive oxygen species" – singlet oxygen, superoxide anion, oxygenated water and hydroxyl radical (Clark & Whelan, 2004). The reactive  $O_2$  species have a common characteristic – the presence of an uneven electron called "bachelor electron" on the last orbital, whose presence is noted by a point in the right upper part of the substance's chemical symbol. These active oxygen derivatives are formed by different processes (Courtiere, 2006):

a) Activation of atmospheric oxygen, which cannot be used in this form by the cells and needs to be activated through a reduction process, consisting of electron attachment:

- One electron attached – superoxide anion ( $O_2^{\cdot -}$ )
- Two electrons attached – form peroxide, which in conjunction with water forms oxygenated water ( $H_2O_2$ )
- Three electrons attached form hydroxyl radical ( $OH^{\cdot}$ )
- Four electrons attached – form water ( $H_2O$ )

b) Under the action of ultraviolet rays or hypochloride anion, it will form singlet oxygen or molecular activated oxygen ( $^1O_2$ )

c) Nitric oxide (NO) is considered another reactive oxygen species, with an uneven electron on the last orbital.

Reactive oxygen species or active oxygen derivatives last only for a few seconds, but are extremely toxic by attacking different structural parts of the cell, with a major impact on cell functionality (Clark & Whelan, 2004; Courtiere, 2006):

- On DNA: oxidative lesions on nucleic acids are cumulative and are implicated in cancer genesis and aging.
- The reaction of active oxygen derivatives on proteins will form carbonylated proteins, which partially lose the functional properties of the initial proteins (contractility, electric charge, ion channel function, receptor function).
- Glycoproteins are also a target for reactive oxygen species, with functional disturbances for cells.
- The effects of active oxygen derivatives on lipids are extremely toxic, because lipids are important components in the structure of all cell membranes and in the myelin sheath of nervous fibers. The results are lipoperoxides, very harmful for cell membrane function. A stable derivative of the lipo-oxygenation process is malondialdehyde, which persists for a long time in the serum and which can be measured as an indirect sign of the oxidative attack intensity.

Endogenous and exogenous aggression of the reactive oxygen species on metabolic active cells has different oxidative stress forms and determines the activation of all antioxidant defense mechanisms in order to prevent or limit

oxidative lesions (Tache et al., 1994). These antioxidative mechanisms prevent the formation of free radicals, transform the oxidants into less toxic species and repair molecular lesions induced by free radicals. Preventing excessive free radical formation is the first major step for living cells, because potential toxic  $O_2$  metabolites are continuously forming in the breathing process during normal oxidative phosphorylation. Mitochondrial cytochrome oxidase is using 90% of  $O_2$  in pulmonary cells and for the metabolization of excess free radicals. The partitioning of free radical formation through metal ions such as iron and copper may have an important role in oxidant-induced tissue lesions through lipid peroxidation stimulation, which generates cytotoxic aldehydes. The antioxidants are called "free radical scavengers" and represent the most significant defense mechanisms for oxidative stress. For lungs, the major antioxidants are:

- Enzymatic systems: catalase, superoxide dismutase, glutathione redox cycle GSH-GSH peroxidase, G-6-PDH
- Liposoluble antioxidants: vitamin E, beta-carotene, bilirubin
- Hydrosoluble antioxidants: vitamin C, uric acid, glucose, glutathione, cysteine and cysteamine, taurine
- High-molecular weight antioxidants: albumin, tracheobronchial mucus.

The selection of divers must be based on individual antioxidant capacity, especially for those who perform physical effort underwater (Tache & Manea, 1996).

### Oxygen tolerance test

Oxygen tolerance may be formulated in terms of biochemical and microbiological, mathematical and graphical aspects, as a dose-effect relationship, meaning administered dose ( $pO_2$ ) and pharmacological/toxic response/effect. Like in every dose-effect relationship, in hyperbaric hyperoxia the effects of small doses tend to be unmeasurable, even if they exist, and these very small initial  $O_2$  effects are the most important for trying to stop the toxic effect and to extend oxygen tolerance (Piantadosi, 2008).

Regarding oxygen, the toxic dose capacity is related to  $pO_2$  (Ratzenhofer-Komenda et al., 2006). In continuous exposures, the effect is extended to the characteristics of the dose-effect relationship, meaning that for the initial phase, it is also influenced by pressure and the time of exposure. These three-dimensional circumstances of initial oxygen toxicity have been since 1962 the base for Dickens' concept regarding the hyperbolic rectangular relationship between the time of  $pO_2$  exposure and death. Based on this concept, Lambertsen and Clark designed in 1967 the pulmonary  $O_2$  tolerance test for the human body during rest, with a 5% reduction of vital capacity observed in the groups after exposure to  $pO_2$  less than 1 ATA. The data indicated the absence of objective changes after exposures to less than 0.6 ATA (Tache & Manea, 1996). These oxygen tolerance tests are widely used in diving, spatial medicine and clinical hyperbaric medicine, where exposure to more than 1 ATA is needed for work or therapy. The tolerance curves during continuous exposure to hyperoxia are statistical regression lines. For measuring the toxicity of oxygen at different pressures and during different periods of time,

the unit pulmonary toxic dose (UPTD) and the cumulative pulmonary toxic dose (CPTD) (Piantadosi, 2008) are defined.

Different oxygen intoxication levels are tolerated in tissues when hyperoxia is used in usual diving or in therapy (Hardy, 2008). In order to compare the response of different tissues and organs to the hyperoxic attack, real sensitivity must be differentiated from the oxygen exposure dose.

The objective toxicity changes observed by researchers are: decreased vital capacity, breathing frequency perturbation, increased airway resistance, decrease of maximum expiratory volume per second, increase of residual expiratory volume and decrease of CO<sub>2</sub> diffusion capacity. These disturbances appear 4-6 hours after exposure to 2 ATA O<sub>2</sub>, or after saturation exposures of 45 ATA for 11 days, or 48 hours after finishing a 12-day exposure to 45 ATA (Levett & Miller, 2008). If we accept that the decrease of vital capacity is more than just fatigue, atelectasis and direct pulmonary lesions can be incriminated in these changes. The attack oxygen dose is not a standard value for an organ in case of exposure to a constant medium or to a constant pO<sub>2</sub> over lungs. The morphological and functional particularities of the response are the result of exposure to hyperbaric hyperoxia. The maximum hyperbaric O<sub>2</sub> dose acts on the cells exposed to equal doses of inhaled pO<sub>2</sub> at arterial and alveolar level: tracheobronchial epithelium, alveolar-capillary membrane, venous pulmonary endothelium, endocardium, arterial endothelium, renal glomerular capillaries, carotid corpuscle, microcirculation (Jain, 2009).

Correlating theory with practice, we can express oxygen tolerance during a prolonged exposure in quantitative terms such as the decreasing speed of a mathematical function. The tolerance of tissues and cells varies quantitatively and qualitatively for different pO<sub>2</sub> - the reason for expressing oxygen tolerance depending on its pressure.

Individual correlations regarding hyperbaric oxygen tolerance based on latency time for intoxication signs imposed testing divers for oxygen tolerance as a selection probe. The oxygen tolerance test, first used by the American Navy, is used nowadays in all control and selection centers for professional divers and as a mandatory test for those who stop diving for more than a year (Kayle, 2009).

The test is performed in a dry hyperbaric chamber, where the subjects are exposed to conditions that simulate diving at 18 meters underwater (2.8 ATA) and they breathe pure oxygen through a tight facial mask for 30 minutes. Cardiac frequency is also monitored in order to prevent a hyperoxia crisis and to stop hyperbaric O<sub>2</sub> administration in time. Seizures are a major sign of toxicity and also, the presence of muscular cramps, which are considered signs for stopping the test. Data from Butler and Knafelc (1986) show that the reproducibility of oxygen sensitivity in the examined American marine divers is not identical to that from the initial oxygen tolerance test. Other conclusions (Tache & Manea, 1996):

- Tolerance varies due to individual variations.
- The test does not identify all oxygen-susceptible subjects.
- Subjects who successfully passed the tolerance test and who use pure oxygen have an acceptable oxygen

security level.

- CNS toxicity signs are limiting factors during diving operations.

### **Control tests of diver's training**

The diversity of human diving activities at different depths underwater imposes severe rules for somatic and physical health safety, which should be periodically tested. Mandatory periodic control of divers includes (Tache & Manea, 1996; Edmonds et al., 2005): history of diving activities, medical diving-related problems, personal and family medical problems and a complete clinical examination regarding:

- General examination – anthropometry, somato-sensory integrity (ophthalmology, ENT, cardiovascular, respiratory, renal, gastrointestinal, dermatological, endocrine, locomotor, neurological control) and mental integrity (psychological and psychiatric control).

- Non-specific tests: swimming test, effort tests (ASTRAND and MARGARIA), underwater activity tests and EEG changes induced by hyperpnea.

- Specific tests: oxygen tolerance test, narcosis test, CO<sub>2</sub> tolerance test, heliox tolerance test, apnea test.

*Personal studies.* Under real diving conditions, when using hyperbaric O<sub>2</sub>, besides the depth of the water and O<sub>2</sub> pressure, there are also some contributing factors to acute intoxication risk, such as water contact, decrease of blood pH, increase of pCO<sub>2</sub>, the diver's physical activity.

The authors aimed to evaluate the training level of divers based on complex additional tests, which can be used to predict hyperbaric O<sub>2</sub> toxicity signs and to prevent possible accidents. This was the reason for a study carried out by the researchers on three groups of professional divers, in the Naval Medicine Center in Constanta (Tache & Manea, 1996). Each group consisted of 20 healthy male subjects, with a mean age of 28 years and 7-8 years of experience in diving.

Training and physical status control was performed by exposure to hyperbaric conditions, preceded and followed by the ASTRAND test for submaximal physical effort. Exposure lasted 30 minutes, in a dry hyperbaric chamber RDO 1500 Ulis Comex, at the Hyperbaric Center. The subjects were medically assisted and underwent hyperbaric exposure in groups of two, as follows:

Group A – continuous exposure to 5.2 ATA Nitrox

Group B – continuous exposure to 2.8 ATA O<sub>2</sub> – oxygen test

Group C – intermittent exposure to 2.8 ATA O<sub>2</sub> with the program on/off for 10 minutes at 2.8 ATA O<sub>2</sub> / 5 minutes at 1 ATA air, total period of exposure to 2.8 ATA O<sub>2</sub> lasting 30 minutes.

Breathing pure oxygen during the test was possible by using a facial tight mask, during rest, in recumbent position, with heart rate monitoring at 5 minutes (radial allure).

Before and after exposure to hyperbarism, the subjects were tested for submaximal effort during cycling on an ergobike for 5 minutes at 1 ATA air, keeping constant the effort intensity at 150 watts and speed at 60/minute (Astrand test). Before and after the effort test, cardiac frequency and brachial arterial pressure at rest were measured, within 15 seconds post-effort and 5 minutes post-effort,

and urine samples during rest and one hour post-effort were also analyzed. Based on anthropometry and heart rate, using Astrand tables and nomograms, the following were determined: maximal effort oxygen consumption –  $\dot{V}O_{2max}$ , expressed in ml/kg, also used for determination of ideal vital capacity values, expiratory maximal volume and expiratory maximal volume per second.

After finishing the effort test, the spirometric values of pulmonary volumes - current volume (CV), vital capacity (VC), inhaling and exhaling reserve volumes (IRV and ERV) and also, the respiratory capacities – maximum expiratory volume per second (MEVS) and maximum ventilation per minute (MVM) were determined. Real values of vital capacity, maximum expiratory volume per second and maximum ventilation per minute were referred to ideal values for each person and expressed in percentage. Real values (ATSP-Ambient Temperature and Saturated Pressure) of vital capacity, maximum expiratory volume per second and maximum ventilation per minute were corrected for BTPS (Body Temperature and Saturated Pressure). Based on the recorded indices, other important values were measured:

- Maximal oxygen consumption in effort (ml/kg and ml/min)
- Difference between maximum and minimum arterial pressure values (mmHg)
- Tiffneau-Pinelli index (in percentage) after the formula  $MEVS \times 100/VC$
- Effort respiratory economy, in absolute values, using the formula of Anthony ventilation equivalent =  $MEV (l) / \dot{V}O_{2max} (l)$

The urine dosages of urinary amines – adrenaline, noradrenaline, their basic and acid catabolites, histamine, serotonin, thiamine were analyzed. The dosing used the Kakimoto & Armstrong method, with values expressed in microg/min. The data of the study were statistically processed using the Wilcoxon test and the results were presented as tables, graphics and probability curves.

Continuous exposure to hyperbarism, for 30 minutes, at 5.2 ATA Nitrox and 2.8 ATA  $O_2$ , and also, intermittent exposure to hyperbarism at 2.8 ATA  $O_2$  determine significant decreases of radial pressure compared with pre-exposure after 5-10 minutes of hyperbaric exposure, with the restoration of rest values at 10 minutes post-exposure. The normal bradycardic effect of hyperbarism, more intense in trained subjects, is not a permanent effect; it was first described by Hardenbergh in 1973, Pastuch in 1974 and Schipke & Pelzer in scuba-divers in 20001 (Schipke & Pelzer, 2001). The restoration of cardiac frequency 5 minutes after the cessation of effort, pre- and post-exposure, is seen in 80% of the subjects, meaning a good cardiovascular adaptation of the tested divers.

Maximal oxygen consumption will decrease after exposure to 5.2 ATA Nitrox and will rise after exposure to 2.8 ATA - significant changes versus pre- and post-exposure values. Maximal oxygen consumption as a parameter for maximal aerobic power indicates disturbances in normal effort capacity after hyperbaric exposure. Intermittent exposures do not show significant changes compared to continuous exposures, even if intermittent exposure programs (studied especially in animals) are recommended

for increasing hyperbaric hyperoxia tolerance (Harabi, 1988; Bove, 2003). A group of researchers conducted by Mahon (Mahon et al., 2009) demonstrated that short oxygen prebreathing periods reduce or prevent severe decompression sickness in a 70-kg swine saturation model.

Urine amine elimination increases significantly after effort in pre-exposure, after hyperbarism exposure and after the post-exposure effort test. Physical effort determines in well-trained hyperbaric divers, the activation of the sympathoadrenal system, with amine urine elimination. Moderate hyperbarism exposure to 5.2 ATA Nitrox or 2.8 ATA  $O_2$  is considered an additional effort for the body, with elevated values of amines before and after exposure and with decreasing values one hour post-exposure. The data regarding increased amine elimination after effort and after hyperbaric exposure are in accordance with the literature observations regarding urinary catecholamine, vanyl-mandelic acid or serotonin excretion (Davis 1977; Therminaris 1979). A group of Scandinavian researchers demonstrated that hyperbaric oxygen increases parasympathetic activity in professional divers (Lund et al., 2000).

Ventilated air volumes and vital capacity increase after submaximal effort, after hyperbaric hyperoxia exposure; continuous exposure to 2.8 ATA  $O_2$  determines an increase of maximum volume exhaled per second, maximum ventilation per minute and Tiffneau index, but intermittent exposure to the same conditions does not. The respiratory response of the human body, studied after submaximal effort on an ergobike at 1 ATA air, is very little influenced by pre-exposure to hyperbaric continuous or intermittent oxygen. Intermittent exposure to 2.8 ATA  $O_2$  in on/off system does not influence the oxygen tolerance test.

### **Pulmonary histological changes in laboratory animals after exposure to hyperbaric oxygen**

Pulmonary changes after hyperbaric hyperoxia are the result of the toxicity of free  $O_2$  radicals, because they are produced in excess and exceed the antioxidant capacity of the body. The authors continued the previous researches of the members of the Physiology Unit of the Cluj Medicine University and observed the pulmonary histological disturbances correlated with biochemical and clinical signs of toxicity in mice. They also studied the dose-effect relationship between the hyperbaric oxygen-toxic effect (convulsions, coma, death) in mice exposed to pressures over 3 ATA  $O_2$  and the advantages of intermittent exposures with an on/off ratio smaller than 2/1 for pressures over 3 ATA  $O_2$  (Gocan et al., 1993; Tache et al., 1994).

The research was carried out in young white male NMRI mice, with a weight of 20-30 grams, which were normally fed. The experiments progressed on 180 mice grouped in 11 cohorts, exposed to hyperoxic hyperbarism in an Engelke Konrad chamber, in clusters of 5 animals and a control group, permanently observed through the window in order to detect the beginning of seizures, coma progression and death. During the experiment, the  $O_2$  concentration was constantly between 97-99%. In continuous exposures (groups 1-6), the animals were observed until the death of most of the mice, and in intermittent exposures (groups



7-11), until the death of 50% of the mice, value marked as lethal dose 50 (LD 50). Lung fragments were analyzed using the Scherle method; results (Gocan et al., 1993; Tache et al., 1994):

- Beyond 3 ATA O<sub>2</sub>, massive pulmonary histological changes will occur such as intra-alveolar hemorrhage and toxic acute pulmonary edema, responsible for the death of the animals exposed to continuous and intermittent pressure. The animal that survived to intermittent exposures had moderate lesions, such as interstitial capillary stasis and thickening of the interalveolar septum.

- Pulmonary histological signs that caused death were similar and did not depend on the lethal moment or on the pressure value 3 ATA O<sub>2</sub>.

- The value of 3 ATA O<sub>2</sub> can be considered as a level-limit beyond which pulmonary structural and functional irreversible disturbances will develop.

#### **Studies on animals regarding the improvement of hyperbaric hyperoxia resistance – peer review**

Increasing tolerance to hyperbaric oxygen has been a goal aimed by many researches during the course of time. In 1980, Lambertsen succeeded in raising animal tolerance to hyperbaric oxygen from 4 hours to 14 hours, by repetitive exposures to hyperbarism, followed in 1989 by White & co, who found similar results after the pre-exposure of mice to normobaric hyperoxia 85% O<sub>2</sub>, or an air-ozone mixture or after injection with endotoxins. In 1986, Jamieson tried injections with superoxide-dismutase, catalase and glutathione-peroxidase, but did not succeed in increasing hyperbaric resistance because the injected enzymes are not able to penetrate the cell membrane. In 1989, White successfully increased hyperbaric oxygen tolerance by the pre-exposure of the animals to hypoxia 10-12% O<sub>2</sub> for 4-7 days (Wattel, 2006).

The results of the studies performed by the members of the Physiology Unit of "Iuliu Hațieganu" University of Medicine in Cluj (Tache & Manea, 1996) demonstrated a significant improvement of effort capacity in mice after previous exposure to hypobaric hypoxia corresponding to an altitude of 2000 meters, for 48 hours. Even such moderate hypobaric hypoxia is capable to modify the blood concentration of liver and muscle (lactic dehydrogenase, succinate dehydrogenase, glutathione dehydrogenase, cytochrome oxidase, ATP-ase). Based on the fact that the increase of hyperbaric oxygen tolerance needs changes in specific intracellular enzymes, the authors studied the effect of normobaric hypoxia exposure on mice.

The study was carried out on 30 healthy male Wistar Bratislava rats, divided into three groups of 10 animals each. The first group was the control group, exposed to hyperbaric oxygen 95-97% O<sub>2</sub> for 59-75 minutes. The second group was exposed for 48 hours to normobaric hypoxia 10% O<sub>2</sub> corresponding to 5500 m altitude. The third group was exposed for 48 hours to normobaric moderate hypoxia 16.5% O<sub>2</sub> corresponding to 2000 m altitude. Normobaric hypoxia conditions were possible by using an Engelke Konrad chamber in the Naval Medical Center in Constanta, then the animals were maintained in normobaric conditions for 48 hours and after that, returned to the chamber and exposed to hyperbaric hyperoxia at 4.5 ATA, similar to a depth of 35 m underwater. Before

exposing the animals to hyperbaric hyperoxia and at the time of restoration of normobarism, blood samples from the retro-orbital sinus were analyzed for dosing glucose, lipids, proteins, ceruloplasmin. The rats were permanently observed through a window and at the first signs of oxygen toxicity (convulsions noticed at least in one animal from a group of five), hyperoxia was stopped. A number of animals died when returning to normobaric conditions, because of seizures followed by coma or because of acute pulmonary edema. Results discussion:

Confirmation of Torbati's theory since 1987 that oxygen intoxication induces hyperglycemia before convulsions - clinically and on EEG (Newton, 2001). Both in the control group and in animals pre-exposed to hypoxia, a direct relationship between reduced oxygen tolerance (clinical signs) and hyperglycemia ( $p < 0.02$ ) was observed, so blood glucose analysis during the oxygen tolerance test is a convenient and cheap indicator for oxygen sensitivity.

Rat exposure to moderate normobaric hypoxia (O<sub>2</sub> 16.5%) will increase resistance to hyperbaric oxygen toxicity, and this protective effect of hypoxia lasts for 48 hours after returning to normobarism.

The significant decrease in blood lipids can be explained by lipid peroxidation and accelerated metabolism. Ceruloplasmin, one of the important plasma antioxidants, decreased in the control group and in the moderate hypoxia exposure group, meaning that it was consumed during reactions against free radicals. The phenomenon by which hypoxia increases oxygen tolerance can be a change in the concentration of some intracellular enzymes, used in the fight against reactive oxygen species.

Hyperoxia determines disturbances of alveolar cells, disruptions of pulmonary endothelial cells and alters the capacity of serotonin capture and angiotensin I hydrolization by the pulmonary endothelium. Pre-exposure to hypoxia at 10-12% O<sub>2</sub> has no direct effect on the concentration of the conversion enzyme, but partially prevents the decrease of the enzyme through consumption due to hyperoxia. A previous exposure of animals to hypoxia 10% O<sub>2</sub> was associated with a significant increase of pulmonary glutathione-peroxidase, G-6-DG, superoxide dismutase and catalase, suggesting that increased hyperoxia tolerance may be partially based on the glutathione redox system.

#### **Conclusions**

1. The changes of oxygen-diffusion capacity at pulmonary level represent a more sensitive toxicity index compared to vital capacity, considered as an essential index for oxygen tolerance.

2. The determination of submaximal effort capacity on an ergobike at 1 ATA is only in a small percentage influenced by the oxygen tolerance test at 2.8 ATA, for 30 minutes, continuous or intermittent exposure.

3. Studies on mice demonstrated that the oxygen tolerance test can be extended from 2.8 ATA to 3 ATA without major consequences.

4. For preventing the harmful effects of hyperbaric hyperoxia, the pre-exposure of animals to moderate hypoxia of 16.5% O<sub>2</sub>, corresponding to 2000 m altitude, can be used, and this protective effect lasts for 48 hours.

5. Blood glucose analysis in dynamics during the



oxygen tolerance test can be a good predictor for oxygen sensitivity.

6. Pulmonary histological investigations in mice exposed to pressures over 3 ATA O<sub>2</sub> indicate inflammatory lesions.

7. The pressure of 3 ATA O<sub>2</sub> can be considered as a level-value beyond which irreversible pulmonary lesions will appear.

### Conflicts of interests

Nothing to declare.

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Some of the theoretical concepts, results of the studies and general conclusions were integrated in the PhD thesis of Dr. Mircea Manea, coordinated by Prof. Dr. Mircea Dorofteiu from the Physiology Unit of "Iuliu Hatieganu" University of Medicine in Cluj.

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## **Weight bearing protocol for surgical and non-surgical musculoskeletal disorders of the lower limbs**

### **Protocol de încărcare pentru afecțiunile musculoscheletale chirurgicale și non-chirurgicale ale membrelor inferioare**

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#### **Abstract**

Admission of patients from the Orthopedic Surgery Department into the Physical Medicine and Rehabilitation departments is very frequent. Depending on the case, immobilization is followed by a gradual increase in the weight placed on the lower limbs. The weight bearing rhythm and the recommended walking aids must be selected on an individualized basis, depending on the primary orthopedic problem as well as a number of other factors: the patient's muscle strength in the upper and lower limbs, their ability to maintain their static and dynamic balance, the integrity of their auditory, visual and proprioception systems and any associated cardiovascular, metabolic and respiratory disorders.

The protocol below helps the Physical Medicine and Rehabilitation physician to establish the weight bearing rhythm for the lower limbs. It must be noted that the weight bearing program is selected on a strictly individualized basis and that there is no universally applicable protocol.

**Key words:** gait, gait rehabilitation, lower limbs, orthopedic surgery.

#### **Rezumat**

În serviciile de Reabilitare Medicală sunt frecvente situațiile în care ajung pacienți după intervenții chirurgicale ortopedice. În funcție de caz, după o imobilizare eventuală se începe treptat încărcarea membrelor inferioare. Ritmul de încărcare, dispozitivele de mers recomandate, trebuie individualizate în funcție de afecțiunea ortopedică primordială, dar și în funcție de alte situații: forța musculară în membrele inferioare, dar și superioare, capacitatea de a menține echilibrul static și dinamic, integritatea organelor pentru auz, văz, propriocepție, boli asociate cardio-vasculare, metabolice sau respiratorii.

Protocolul de mai jos vine în ajutorul medicului de reabilitare în alegerea ritmului de încărcare a membrelor inferioare, cu precizarea că încărcarea membrelor inferioare se face strict individualizat și că nu există o schemă valabilă pentru toate situațiile.

**Cuvinte cheie:** mers, reabilitarea mersului, intervenții ortopedice, membre inferioare.

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### **Cemented total hip endoprosthesis**

- immediate resumption of full support gait
- days 3-4 – resumption of orthostatism and gait
- 6 weeks – a walking frame may be recommended
- 4-6 months – a cane to be held in the hand opposite the prosthetic side may be recommended (Popescu & Trăistaru, 2007; Antonescu, 2008; Mont & Takersely, 1997; Sbenghe, 1981).

### **Cementless total hip endoprosthesis**

- slow gradual increase in weight by approximately 5-10 kg/week
- partial resumption of gait after 4 weeks with bilateral walking aids
- patient resumes full support gait within approximately 2-3 months (Popescu & Trăistaru, 2007; Sbenghe, 1981).

### **Partial hip prosthesis**

- day 3 - patient sits at the edge of the bed
- day 7 - crutch gait without support
- days 14-60 - partial weight bearing gait (crutches/frame)
- 2 months - cane gait (Sbenghe, 1981).

### **McMurray (intertrochanteric) osteotomy**

- 8-10 days of immobilization in bed
- mobilization without support for a period of 3-4 months
- an additional period of 2-3 months in crutches without loading the operated lower limb
- partial support period extended to 6-7 months after the surgery (Sbenghe, 1981; Popescu & Trăistaru, 2007).

### **Hip osteotomy**

- 6-8 weeks of immobilization
- 3 months without support on the lower limb
- gradual increase of the weight (Sbenghe, 1981; Popescu & Trăistaru, 2007).

### **Femoral neck fracture**

#### *Treatment by metallic osteosynthesis*

- 3 months without support
- gradual increase of the weight placed on the operated lower limb, subsequent to the consolidation of the fracture with a load angulation of 30 degrees
- increase in the weight by 25% of body weight in bipodal position
- gradual increase of the angulation of the support plane

#### *Smith-Petersen nail osteosynthesis*

- support gait after a period of 4-5 months (Popescu & Trăistaru, 2007; Antonescu, 2008).

### **Acetabular fractures**

- 2 months – non-weight bearing gait
- 4 months - gradual introduction of support

### **Acetabular fracture with posterior dislocation - surgical treatment**

- pelvi-pedios plaster or continuous traction
- 45 days - crutch gait without support
- 3 months - gradual gait resumption (Sbenghe, 1981).

### **Femoral head fractures**

#### *Non-displaced fracture*

- orthopedic reduction
- continuous transbone extension - 6-8 weeks
- resumption of support gait - 3-4 months after the accident

#### *Fracture-dislocation with internal fixation*

- extension - 6 weeks - no weight bearing on the operated lower limb is allowed for a period of 3 months
- postoperatively - resumption of support gait after a period of 6 weeks (Antonescu, 2008).

### **Trochanteric fractures**

- surgical treatment (Ender's nails)
- mobilization as timely as possible
- support allowed starting 6 weeks after the surgery

#### *Fractures of the greater trochanter*

- non-displaced
- immobilization for a period of 21 days
- gait after an additional period of 21-28 days
- displaced
- osteosynthesis
- immobilization for a period of 14-21 days
- full weight bearing is allowed after fracture consolidation – after approximately 6-8 weeks

#### *Fractures of the lesser trochanter*

- immobilization in bed for a period of 21-28 days
- no physical effort for a period of 5-6 weeks (Antonescu, 2008; Skinner, 2003).

### **Diaphyseal femoral fractures**

- surgical treatment
- interlocking nails
- support on the operated limb after a period of 1-2 months
- Ender's elastic nails
- support after a period of 2-3 months (Antonescu, 2008).

### **Distal femoral fractures**

#### *Non-displaced fracture*

- plaster cast - 6-8 weeks
- support within 3 months of the injury

#### *Displaced fracture*

- surgical treatment
- support within 3-4 months (Antonescu, 2008).

### **Condylar fractures**

- isolated fractures of the medial or lateral condyle are rare
- treatment is surgical
- postoperatively - immobilization
- weight bearing is usually allowed within 3 months of the surgery (upon the radiographic consolidation of the fracture) (Skinner, 2003).

### **Hip dislocations**

- 14 days - plaster cast
- 14 days - no mobilization
- 28 days later - gait with a 10% load (Sbenghe, 1981).

### **Quadriceps tendon rupture**

- surgical treatment – suture
- knee pad for a period of 28 days
- patient resumes gait starting day 12 (Antonescu, 2008).

### **Anterior cruciate ligament (ACL) reconstruction**

#### *Slow protocol* (ischiotibial graft)

- postoperative week 1 - gait with 2 axillary crutches with a load equivalent to 25% of the body weight (15 kg force)
- postoperative week 2 - gait with a gradual increase of the weight bearing (within the limits of pain)
- full weight bearing should be reached by post-operative week 4

#### *Fast protocol* (patellar tendon graft)

- postoperative week 1 - gait with a gradual increase of the weight bearing (within the limits of pain) until complete (van Grinsven et al., 2010; Maxey & Magnusson, 2007; Canale & Beaty, 2008; Manske, 2006).

### **Arthroscopic partial meniscectomy**

- postoperative day 2 – full weight bearing gait with 2 crutches (Maxey & Magnusson, 2007; Canale & Beaty, 2008; Manske, 2006; Lucaciu et al., 2001)
- to be avoided: anterior slippage (in the event of tears of the posterior horn), external rotation (tears of the posterior horn of the internal meniscus)
- non-weight bearing proprioceptive workout (until day 30)
- resumption of physical activity after a period of 30 days (no jumps within a period shorter than 2 months) (Chanussot & Danowski, 2005).

### **Meniscal suture or open meniscectomy**

- non-weight bearing flexion between 0-90° for a period of 6 weeks, no squatting for a period of 3 months
- *Slow protocol* (horizontal or radial lesions)
- postoperative week 1 – non-weight bearing gait with axillary crutches
- days 14-28 - partial weight bearing gait with axillary crutches (within the limits of pain)
- >day 28 – full weight bearing gait
- *Fast protocol* (vertical lesions)
- until weeks 4-6 – full weight bearing gait with the orthosis locked in extension
- >week 6 – full weight bearing, no orthosis (Maxey & Magnusson, 2007; Canale & Beaty, 2008; Manske, 2006; Lucaciu et al., 2001)
- in the event of meniscal suture, without flexion or extension forcing
- resumption of physical activity after a period of 30 days, no jumps within a period shorter than 6 months (Chanussot & Danowski, 2005).

### **Patella fracture**

- non-weight bearing flexion<90° provided osteosynthesis stability is high enough
- weight bearing crutch gait within the limits of pain with the knee in full extension and locked/plaster orthosis for a period of 6 weeks
- full weight bearing gait with the knee in flexion

6-8 weeks after the surgery, depending on fracture consolidation (Maxey & Magnusson, 2007; Canale & Beaty, 2008; Lucaciu et al., 2001).

### **Patella dislocations**

- *In the event the surgical procedure is unknown:*
- full weight bearing gait with the knee locked in extension is allowed
- flexion of the knee is increased gradually
- flexion associated with full weight bearing is to be avoided over a period of 6-12 weeks (Canale & Beaty, 2008; Kisner & Colby, 2002; Lucaciu et al., 2001).
- *Depending on the surgical procedure:*
- cartilage shaving – immediate weight bearing, +/- 2 crutches for a period of 48 hours, immediate flexion, prudence, extension workout, no genuflexing or lunging, exercise only after a period of 21 days
- Pridie's cartilage perforation – immediate weight bearing, +/- 2 crutches for a period of 48 hours, immediate but gradual flexion (for a period of 21 days), extension workout, no genuflexing or lunging earlier than day 45, exercise after a period of 6 months
- "spongification" of the subchondral bone – immediate weight bearing, +/- 2 crutches for a period of 7 days, immediate but gradual flexion (for a period of 21 days), extension workout, no genuflexing or lunging earlier than day 45, exercise after a period of 6 months
- sectioning of the collateral ligament – immediate weight bearing, +/- 2 crutches for a period of 48 hours, immediate flexion, exercise after day 21
- suture of the medial collateral ligament – immediate weight bearing, +/- 2 crutches for a period of 48 hours, prudent flexion, exercise after a period of 2 months
- medial collateral ligament ligamentoplasty – immediate weight bearing with 2 crutches for a period of 30 days, with splint until day 21, flexion<90° until day 21, flexion>90° after day 21, exercise after day 75
- Mansat technique 1, 2 – immediate weight bearing with 2 crutches for a period of 30 days, with splint until day 21, flexion<60° between day 1 and day 21, flexion<90° between day 21 and day 45, flexion>90° after day 45
- Mansat technique 3 – partial weight bearing until day 21, with splint until day 30 and 2 crutches until day 45, exercise after a period of 3 months
- Osteotomy of the anterior tibial tuberosity – partial weight bearing with splint until day 21 and 2 crutches until day 30, exercise after a period of 3 months (Chanussot & Danowski, 2005).

### **Total knee arthroplasty**

- postoperative day 2 or 3 - patient resumes partial weight bearing frame or crutch gait (within the limits of pain)
- postoperative weeks 1-2 - patient can resume partial weight bearing gait with 2 crutches or 1 crutch within the limits of pain
- postoperative week 3 - patient resumes full weight bearing gait
- in the event of structural grafts, weight bearing will be partial until 3 months after the surgery, depending on graft incorporation



- in the event of extensive soft tissue release for severe valgus/varus deformities - partial weight bearing for a period of 6 weeks using a stabilizing orthosis (Maxey & Magnusson, 2007; Canale & Beaty, 2008).

### **Medial collateral ligament (MCL) injuries - grades 1 and 2 - conservative treatment**

- knee orthosis (4-6 weeks)
- knee mobilization:  
day 1-15: 0-60°  
day 15-30: 0-90°  
>day 30: no restrictions (Chanussot & Danowski, 2005)
- days 1-7 - weight bearing crutch gait within the limits of pain
- days 1-14 - full weight bearing gait without crutches (Canale & Beaty, 2008; Manske, 2006; Skinner, 2003)
- resumption of physical activity after a period of 3 months, contention in the first month (Chanussot & Danowski, 2005).

### **Medial collateral ligament (MCL) injuries – grade 3 - conservative or surgical treatment**

- injury is isolated only rarely
- orthosis allows flexion between 30 and 120°
- partial weight bearing gait with crutches for a period of 6 weeks (Canale & Beaty, 2008; Manske, 2006; Skinner, 2003).

### **Lateral collateral ligament (LCL) injury – grade 3 - early conservative treatment**

- orthosis locked depending on the stability of the ligament repair
- minimum load for a period of 6 weeks
- 6-8 weeks - full weight bearing gait with a stabilizing orthosis without flexion/extension limitations (Canale & Beaty, 2008; Manske, 2006; Skinner, 2003)
- athletes: resumption of practice after a period of 3 months and resumption of competitive activity after a period of 6, 8 or 12 months (depending on the sport – pivot sport or contact sport) (Chanussot & Danowski, 2005).

### **Quadriceps tendon rupture – surgical treatment**

- days 1-14 - gait with axillary crutches and minimum load (only to feel the ground) with the orthosis locked at 0°
- the following 21 days - partial weight bearing gait with the orthosis locked in extension
- postoperative weeks 6-8 – full weight bearing gait with the orthosis locked in extension, non-weight bearing flexion<90°
- >3 months - full weight bearing with flexion (Canale & Beaty, 2008; Manske, 2006).

### **Patellar tendon rupture – surgical treatment**

- postoperative weeks 1-2 - gait with axillary crutches and minimum load (only to feel the ground) with the orthosis locked at 0°
- postoperative weeks 3-5 - partial weight bearing gait with the orthosis locked in extension
- postoperative weeks 6-8 - full weight bearing gait with the orthosis locked in extension, non weight bearing flexion<90°

- >3 months - full weight bearing with flexion
- in the event of using solid wire or fiber wire cerclage to protect the suture, the rehabilitation periods are to be reduced by half (Canale & Beaty, 2008; Manske, 2006).

### **Achilles tendon rupture – surgical treatment**

#### *Slow protocol:*

- weeks 1-2 – non-weight bearing gait (the ankle is immobilized in a plaster splint in plantar flexion)
- weeks 3-4 – non-weight bearing gait (the plaster splint is replaced and the ankle is immobilized in slight plantar flexion)
- weeks 5-6 - gait with a gradual increase of the weight bearing (the plaster splint is replaced and the ankle is immobilized in neutral position)
- week 7 - the plaster splint is removed

#### *Fast protocol:*

- weeks 1-2 - gait with weight bearing on the tiptoes within the limits of pain (the ankle is immobilized in a plaster splint in plantar flexion)
- weeks 3-4 - gait with a gradual increase of the weight bearing (the ankle is immobilized in neutral position)
- week 6 - the plaster splint is removed

*Important:* The progressive correction of the equinus increases the quality of the postoperative scar and reduces the risk of relapse (Van Dijk et al., 2008; Maxey & Magnusson, 2007; Canale & Beaty, 2008; DeLee & Drez, 2003).

#### *Phase 1 (postoperative phase, days 1-45)*

- 6 weeks - immobilization in plaster cast with a fenestrated patch, no weight bearing (3 weeks with the leg immobilized in gravity equinus, 3 weeks with the leg immobilized at a 90-degree angle)
- knee flexion in parallel with leg positioning (week 1 - flexion>90°, week 2 - flexion between 60 and 90°, week 3 - flexion between 30 and 60°, week 4 - flexion>90°, week 5 - flexion between 60 and 90°, week 6 - flexion between 30 and 60°)

#### *Phase 2 (post-immobilization phase, days 45-74)*

- progressive resumption of weight bearing over a period of 15 days
- plantar orthosis with an initial heel lift of 40 mm; restoration by 10 mm/week
- monopodal weight bearing is prohibited at this stage
- progressive rehabilitation of the knee extension associated with dorsal flexion

#### *Phase 3 (functional re-education phase, >day 75)*

- gait with plantar flexors for support (jogging wear) and tiptoe gait after a period of 3 months
- maximal voluntary contraction during extension is to be avoided within the first 3 months
- resumption of physical activity after a period of 6 months (Chanussot & Danowski, 2005).

### **Medial gastrocnemius rupture (“tennis leg”)**

#### *Partial disinsertion*

- partial weight bearing gait with 2 crutches, rigid fixation in gravity equinus
- no total immobilization in repose position

#### *Total disinsertion*

- competitive athletes: surgical treatment, immobili-

zation of the leg in plaster cast in equinus for a period of 30 days followed by immobilization of the leg at a 90-degree angle for a period of 15 days

- leisure athletes: orthopedic treatment – immobilization of the leg in plaster cast in equinus for a period of 30 days followed by immobilization of the leg at a 90-degree angle for a period of 15 days (Chanussot & Danowski, 2005).

### **Tibial plateau fractures**

Rapid consolidation (within 6 weeks) with the slow recovery of structural integrity (within 3 months) is characteristic.

#### *First 6 weeks*

- non-weight bearing crutch gait or “touch down” weight bearing gait. Joint mobility will be restored during this period provided osteosynthesis allows it.

#### *After 6 weeks*

- Crutch gait with a gradual increase of the weight bearing, full support being allowed after a period of 3 months according to the radiographic evolution of the consolidation process (Canale & Beaty, 2008; Lucaciu et al., 2001; Skinner, 2003).

### **Calf fractures (tibial and peroneal fractures)**

Minimum load (10-15 kg) crutch gait is allowed after **osteosynthesis with statically locked nails**. In the case of interfragmentary contact between intrinsically stable proximal and distal bone fragments, a gradual increase of the weight bearing is allowed over a period of 3 months after the surgery. In the case of an unstable fracture and intrinsically unstable proximal and distal bone fragments, minimum support is maintained until consolidation is complete or until the dynamization of the nails.

The dynamization of the nails: the advantage and disadvantage of osteosynthesis with statically locked nails consists in the blocked translation of the proximal and distal fragments. In the case of unstable fractures, it prevents the loss of the reduction obtained. In the case of stable fractures, it prevents the dynamic interfragmentary compression during gait, thus affecting bone consolidation. In this situation, interfragmentary compression can be obtained either through the subsequent dynamization of the nail or through second-generation locking nail osteosynthesis. The former involves the suppression of the locking screws at one of the ends of the nail following partial consolidation, which leads to an acceleration of the consolidation process. In the latter situation, interfragmentary compression is obtained, but the rotation of the bone fragments is blocked.

After *osteosynthesis with classic plates* - no or minimum weight bearing crutch gait is allowed until fracture consolidation.

After *LCP (“locking compression plates”)* *osteosynthesis* - the weight bearing progression is similar to that encountered in the case of locking nail osteosynthesis (Canale & Beaty, 2008; Lucaciu et al., 2001).

### **Corrective osteotomies**

- minimum or progressive weight bearing may be allowed until fracture consolidation, depending on the stability of the osteotomy and the type of fixation (Canale & Beaty, 2008; Lucaciu et al., 2001).

### **Juvenile osteochondritis dissecans (Osgood Schlatter disease)**

- spontaneous recovery can be achieved by reducing the weight bearing load; therefore, minimum weight bearing crutch gait may be recommended for a period of 3-6 months, depending on the evolution of the healing process. In the majority of cases, a reduced amount of physical effort or a change in the exercise routine is sufficient (Canale & Beaty, 2008; Lucaciu et al., 2001)

- **the acute phase:** rigid posterior orthosis in extension (3-5 weeks), total flexion of the knee must be avoided, rest for a period of 3-6 months (interruption of sporting activities in the event of pain) (Chanussot & Danowski, 2005).

### **Osteochondritis dissecans**

- spontaneous recovery cannot be achieved
- following the reconstruction procedures (osteosynthesis, mosaicplasty) – depending on the defect and the mechanical load of the nails, full progressive weight bearing may be recommended until 6 weeks after the surgery or non-weight bearing crutch gait may be recommended until 3 months after the surgery (Canale & Beaty, 2008; Lucaciu et al., 2001).

### **Osteonecrosis**

- the weight bearing progression does not influence the evolution of the condition for spontaneous recovery cannot be achieved (Canale & Beaty, 2008; Lucaciu et al., 2001).

### **Tibio-peroneal diastasis**

- surgical treatment
- weight bearing is allowed after a period of 10-12 weeks
- fixation is removed after a period of 3 months from the operation, prior to the resumption of sporting activities.

### **Ankle dislocation**

- associated with minor or major bone injury
- ankle dislocation without fracture is rare
- immobilization in plaster cast and no weight bearing for a period of 21 days
- walking cast for an additional period of 3-6 weeks
- semirigid orthosis until 6 months after the occurrence of the injury (DeLee & Drez, 2003).

### **The Tillaux fracture**

- fracture of tibial epiphysis in teenagers
- immobilization in plaster cast for a period of 21 days – no weight bearing
- walking cast for a period of 21 days (DeLee & Drez, 2003).

### **Talocalcaneal sprain**

- 3<sup>rd</sup> degree sprain
- immobilization in plaster cast without weight bearing for a period of 14-21 days
- semirigid orthosis with weight bearing for the following 3 weeks (DeLee & Drez, 2003).

### **Mid-tarsal sprain**

- 3<sup>rd</sup> degree Lisfranc sprain
- percutaneous wire fixation

- no weight bearing for a period of 8-12 weeks (DeLee & Drez, 2003; DeLisa et al., 2005).

### **Charcot neuroarthropathy**

- immobilization in plaster cast/orthosis and no weight bearing for a period of 3 months (DeLisa et al., 2005; Fryksberg, 1991).

### **Metatarsal fractures**

- conservative treatment
- immobilization in plaster cast and no weight bearing for a period of 6 weeks
- Consolidation can last for a period of at least 3 months (DeLisa et al., 2005)
- *non-displaced fracture*
- treatment by functional strapping
- relative unloading for a period of 14-21 days
- *displaced fracture*
- surgical treatment and immobilization in a walking cast for a period of 6 weeks
- *recovery principles*
- prior to consolidation (6 weeks) - plantar support for unloading the forefoot, intrinsic muscle tonicization and short sessions of metatarsal mobilization
- after consolidation - retrocapital plantar support, forefoot joint mobilization and work on the propulsion phase of gait (Chanussot & Danowski, 2005).

### **Base of the 5<sup>th</sup> metatarsal fracture**

#### *Conservative treatment*

- immobilization in plaster cast and no weight bearing for a period of 6-8 weeks
- surgical treatment is recommended in the event that there are no signs of bone healing within a period of 12 weeks

#### *Surgical treatment*

- no weight bearing for a period of 7 days
- progressive weight bearing starting day 15-21
- patient resumes physical activity 6-10 weeks after the surgery (Skinner, 2003).

### **Navicular fracture**

- immobilization in plaster cast/orthosis and no weight bearing for a minimum period of 6 weeks
- comminuted fractures cannot be reduced anatomically (Skinner, 2003).

### **Navicular bone stress fractures**

#### *conservative treatment for type I and type II*

- no weight bearing for a period of 6 weeks
- patient resumes physical activity after a period of 3 months

#### *surgical treatment for type III*

- patient resumes physical activity after a period of 6-8 months (Skinner, 2003).

### **Fractures of the talar neck**

#### *Type I fractures (non-displaced)*

- immobilization in plaster cast
- no weight bearing for a period of 2-3 months (until radiographic healing signs are present) (Skinner, 2003)

- verticalization, starting day 10-45, no weight bearing
- the following gait recovery methods are to be used starting with the second month, depending on the loading:
  - water immersion (e.g. water at the level of the knees
  - 90% load, water at the level of the umbilicus - 50% load, water at the level of the sternal fork - 10% load)
  - angulation of the verticalizer (e.g. 10% load at 6°, 30% load at 30°, 90% load at 65°)
  - the use of technical aids - 2 or 3-point crutch gait with 2 Canadian crutches, 2-point alternate gait, alternate gait with 1 crutch, unassisted gait (Chanussot & Danowski, 2005).

### **Fracture of the lateral talar process**

- conservative treatment
- immobilization in plaster cast and no weight bearing for a period of 4-6 weeks
- walking cast for an additional period of 6 weeks (Skinner, 2003).

### **Calcaneal fractures**

#### *Conservative treatment (non-displaced fractures)*

- no weight bearing for a period of 4-8 weeks (until radiographic healing signs are present)
- Gaffin plaster (walking) cast for a period of 6 weeks (Chanussot & Danowski, 2005)

#### *Surgical treatment*

- postoperative immobilization in plaster cast and no weight bearing for a minimum period of 8 weeks
- walking cast for an additional period of at least 1 month (Skinner, 2003; DeLee & Drez, 2003).

### **Flexor hallucis longus tendon injury**

- surgical treatment is required in all young athletes: in the event the tendon ends are easy to identify, the tendon requires meticulous repair. Tendon repair is recommended because the adherence syndrome is a problem, especially when injury occurs at the head of the 1st metatarsal
- patients subjected to this type of treatment are immobilized in plaster cast with no weight bearing for a period of 5-6 weeks (DeLee & Drez, 2003; Frenette & Jackson, 1977).

### **Subluxation of peroneal tendons**

- rare
- conservative treatment is required in all acute cases – immobilization in plaster cast and no weight bearing for a period of 5-6 weeks (DeLee & Drez, 2003; Stover & Bryan, 1962; Escales et al., 1980; McLennan, 1980; Scheller et al., 1980).

### **Plantar fasciitis**

Treatment can consist in cortisone infiltrations or physiotherapy. In the event of immobilization, the following protocol is recommended:

- immobilization in plaster cast and no weight bearing for a period of 4-7 days
- progressive weight bearing over the next 14 days
- weight bearing is allowed after a period of 21 days
- jogging is allowed after a period of 6-12 weeks (DeLee & Drez, 2003).

### **Plantar fascia rupture**

- immobilization in plaster cast and no weight bearing for a period of 21 days
- progressive weight bearing over the next 7-21 days using 2 crutches and an 8 contention
- the plaster cast can be removed when the patient no longer presents pain
- resumption of sporting activity after a period of 9+/- 6 weeks and resumption of competitive sporting activity after a period of 7-40 weeks (DeLee & Drez, 2003).

### **Tarsal tunnel syndrome – surgical treatment**

- no weight bearing for a period of 21 days
- then, progressive weight bearing is allowed within the limits of pain
- activities requiring physical effort should be avoided for a minimum period of 2 months (DeLee & Drez, 2003).

### **Hallux valgus – surgical treatment through osteotomy**

- corrective bandage is applied after the surgery
- immobilization in plaster cast and no weight bearing for a period of 28 days
- osteotomy heals within 6-8 weeks (DeLee & Drez, 2003).

### **Osteochondritis dissecans of the talus**

- surgical treatment
- immobilization in plaster cast and no weight bearing for a period of 14 days
- replacement of the plaster cast with an orthosis for an additional period of 10 days
- resumption of normal activity is allowed after a period of
- in the event the surgical treatment consists in mosaicplasty (graft at the level of the ipsilateral knee)
- no weight bearing for a period of 4-6 weeks
- in the event of arthroscopic excision of the osteochondral lesion
- crutch gait within the limits of pain for a period of 7-10 days
- then, the support is removed (DeLee & Drez, 2003).

### **Fracture of the posterior process of the talus**

- the majority of fractures are without or with minimal dislocation and can be treated conservatively
- immobilization in plaster cast and no weight bearing for a period of 4-6 weeks
- displaced fractures are treated surgically
- fractures of the lateral talar process are treated orthopedically if non-displaced and do not affect a large portion of the posterior talocalcaneal joint
- In situations where the CT scan indicates a dislocation below 3-4 mm and less than 10% of the articular surface is affected, the patient is immobilized in plaster cast for a period of 6 weeks and wears a walking cast for an additional 6 weeks.
- In situations where the CT scan indicates a dislocation over 3-4 mm, the patient is subjected to surgical treatment, which consists in the excision or fixation of the fragment (DeLee & Drez, 2003).

### **External malleolus and bimalleolar fractures**

#### *Non-displaced*

- orthopedic treatment consisting of immobilization in a walking cast for a period of 21 days

#### *Displaced and involving the internal lateral ligament*

- surgical treatment, osteosynthesis of the malleolus and LLI suture

- walking cast for a period of 5 weeks

#### *Recovery principles:*

- prior to consolidation, passive mobilization of dorsal flexion >90° is to be avoided and the ankle must not be in valgus or varus
- the load is increased progressively after consolidation and the removal of the walking cast; tiptoe gait is resumed (Chanussot & Danowski, 2005).

### **Fracture of the astragalus**

#### *Fractures of the neck (forced dorsal flexion)*

- orthopedic treatment consisting in immobilization in a walking cast for a period of 3 months

#### *Fractures of the dome (grade III sprain)*

- surgical treatment and immobilization in a walking cast for a period of 3 months

#### *Recovery principles:*

- very slow progressive weight bearing with leg joint mobility restoration and tonicization of the triceps surae
- particular attention is required because of the risk of bone necrosis and secondary arthrosis (Chanussot & Danowski, 2005).

### **Scaphoid fractures**

#### *Non-displaced avulsion fracture of the tubercle*

- treatment by functional strapping
- relative unloading from day 8 to day 15 or orthopedic treatment consisting of immobilization in a walking cast for a period of 4 weeks

#### *Displaced avulsion fracture of the tubercle*

- surgical treatment and immobilization in a walking cast for a period of 1 month

#### *Recovery principles:*

- prior to consolidation (4 weeks), early sudden loading of the tibialis posterior muscle is to be avoided
- consolidation is followed by the passive mobilization of the astragaloscaphoid, astragalocuneiform and ankle joints; tiptoe gait and jumps are to be avoided if pain occurs upon the contraction of the tibialis posterior muscle (Chanussot & Danowski, 2005).

### **Freiberg's disease**

- except for complicated cases, no immobilization is recommended
- surgical treatment is recommended if conservative treatment fails; the surgical procedure depends on the patient's symptoms and age and on the presence or absence of free bodies (DeLee & Drez, 2003).

### **Excision of the tibial sesamoid bone**

- a plaster splint is maintained for a period of 5-7 days after the excision of the sesamoid bone; after that, mobility exercises follow
- toe rising, flexion and passive extension follow after



a period of 10-14 days

- physical activity can be resumed after a period of 6 weeks
- the Kirschner wire is removed 3 weeks after the excision of both sesamoid bones and no weight bearing is allowed for an additional period of 3 weeks
- athletic activity is not allowed for a period of 12 weeks (DeLee & Drez, 2003).

#### **Leg ulcer**

- gradual and progressive weight bearing is allowed in patients subjected to surgical treatment
- protocol starts with 15 min weight bearing sessions after which the tegmen is checked for erythema
- sessions are extended progressively depending on the patient's tolerance
- if the local postoperative evolution is slow or complications occur, weight bearing gait is allowed after a period of 6 weeks instead of 4 (Lee et al., 2001).

#### **Articular cartilage lesions treated using the microfracture technique**

- postoperative recovery can include continuous passive movements (CPM) for an improvement of the quality of the healing process
- no support gait is allowed for 6-8 weeks after the surgery (O'Connor et al., 2005).

#### **Articular cartilage lesions treated by autologous chondrocyte transplantation**

- postoperative recovery consists in the aggressive use of CPM
- no weight bearing is allowed for 6-8 weeks after the surgery
- the load is increased gradually until full weight bearing is reached between operative weeks 6 and 12 (O'Connor et al., 2005).

#### **Cartilage lesion treatment by mosaicplasty**

- early mobilization without weight bearing is allowed for a period of 2 weeks after the surgery, with a gradual increase of the weight bearing until full weight bearing is reached between weeks 2 and 6
- in the case of lesions larger than 2 cm<sup>2</sup>, weight bearing is only allowed after a period of 6-12 weeks (O'Connor et al., 2005).

#### **Stress fractures**

- particular attention is required because of the slower healing process and a higher pseudarthrosis rate
- **navicular stress fractures**
- no weight bearing for a period of 6-8 weeks
- progressive weight bearing for an additional period of 6 weeks
- **5<sup>th</sup> metatarsal stress fracture**
- plaster mobilization without weight bearing for a period of 6-10 weeks
- **sesamoid bone stress fracture**
- no weight bearing for a period of 6 weeks (O'Connor et al., 2005).

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## Motivation and its implications in sports performance (Note I) Motivația și implicațiile acesteia în sportul de performanță (Nota I)

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### Abstract

In addressing this theme, I started from the premise that motivation is a prerequisite to practicing sport and especially, for obtaining sport performance, driven by both internal motivational factors and external ones. These factors depend on the basic needs of human beings, but also external, social and educational factors.

In professional sports, motivation is a key factor in achieving athletic performance, without which athletes are unable to support the training effort to perfect their psychomotor abilities. Stimulating motivation remains an art that only the coach has the skill and ability to achieve.

**Key words:** motivation, training, performance.

### Rezumat

În abordarea problematicii circumscrisei temei am plecat de la premisa că motivația reprezintă o condiție de bază a practicării sportului și mai ales, a obținerii de performanțe sportive, determinată atât de factorii motivaționali interni, cât și de cei externi. Acești factori depind de modul în care sunt trăite trebuințele de bază ale ființei umane, dar și de modul în care au acționat factorii externi, sociali și pedagogici.

În sportul de performanță motivația reprezintă un factor determinant în realizarea performanțelor sportive, fără de care sportivii nu ar reuși să facă față efortului din antrenamentul sportiv, în vederea perfecționării capacităților psihomotrice. Stimularea motivației rămâne o artă care ține de măiestria și harul antrenorului.

**Cuvinte cheie:** motivație, antrenament, performanță.

### Introduction

The problem of the psychological preparation of athletes as part of training is of great interest, especially now when sports results are extremely high. Psychological preparation can acquire new meanings and perspectives and can be a challenge for the optimization of athletic performance. According to Epuran (2008), the psychological preparation of the athlete involves „all the strategies and techniques used in training and education to increase the mental ability and personality development of athletes, corresponding to the requirements of an event/sport, in order to achieve superior effects and results in training and competition” (Epuran 2008 cited by Mihăilescu & Cucui 2013).

In addressing this theme, we started from the premise that motivation is the process that governs the choices made by each individual athlete to achieve sports performance.

Motivation is expressed by a particular state of psychic tension based on the correlation between perception and thought. The foundation of motivation is represented by all needs and interests of athletic performance. Motivation determines focus and will, and energetically supports the efforts of training and participation in competitions (Mihăilescu et al., 2011).

Some authors say that motivation should be seen

as a „function of the relationship between effort and the perceived level of performance - on the one hand - and the expectation of reward (its size ) - on the other hand” (Hellriegel et al., 1992).

Athletic performance is „motor performance achieved in an institutionalized social comparison context, which implies inequality in the distribution of rewards” (Teodorescu, 2006).

The studied literature considers that „human performance can be explained as a multiplicative factor of motivation and abilities/skills,  $P = f(MXA)$ ” (Bologa & Gherghișan, 1994 cited by Haralambie & Mihăilescu, 2010).

Coaches and sports performance specialists seek various ways and means to increase the efficiency of athletes in competitions. Most of them have turned their attention to the development of exercise capacity. However, in the context of the current performance level, of the altitude and instability of performance, it is imperative to find other solutions. In this respect, we consider beneficial the intervention of specialists on the psyche of the athlete, who must be optimally motivated to cope with sports training and high level competitions.

Following documentation, we found that the

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studied issues are still little addressed, although mental preparation in general and motivation in particular is a lever for achieving athletic performance. Studies have been developed regarding the screening of motivation of young athletes participating in competitions in relation to sex, age or the type of sport, the identification of the main reasons for sports practice depending on the athletes' performance level, the detection of the motivational task and its intensity, as well as negativity and self-confidence during the pre-competition period, the identification of the reason why some sports are practiced in universities, the motivation of physical exercise among the adolescent and elderly population (Amici et al., 2009; Campbell & Lioyd, 2006; Nepopalooov & Aleksandridi 2004; Coelho & Vasconcelos-Raposo, 2006; Rose et al., 2006; Pihu et al., 2006; Liang MY & Chun MC, 2004; Welde & Svebak, 2008 cited by Haralambie & Mihailescu, 2010).

### The concept of motivation

The concept of motivation emerged only in the 20th century. The complexity of the concept of motivation as a psychological phenomenon prompted the interest of researchers in psychology (Mitchell, 1982; Hellriegel et al., 1992; Amici et al., 2009; Maslow, 2007).

According to Mitchell (1982), motivation is „all psychological processes that generate the initiation, direction and persistence of voluntary actions aiming to achieve objectives” (Mitchell, 1982 cited by Frățilă, 2004).

Motivation is defined in scientific psychology as „an internally exposed external causality” (Golu, 2005), „a system of impulses, incentives, internal pulsions, activations, tensions or motives of actions and behavior” (Popescu-Neveanu, 1978). Popescu (2009) considers that motivation is the subjective premise for the formation of an attitude, which is based on the needs that cause the individual to exhibit a certain behavior.

Motivation „is a state that energizes behavior and gives it direction” (Atkinson & Hilgard, 2005). Motivation „is self-directed; motivation actions have a purpose; motivated behavior is variable; there is an expectation of success in terms of motivated behaviors; there is a positive or negative incentive, a ”consuming” value of action” (Dempsey & Zimbardo cited by Pânișoară & Pânișoară, 2005).

### Theories of motivation

Motivation should not be considered and interpreted only as an end in itself, but as a means for obtaining high performance. Performance is a higher level of goal achievement. In this context, the relationship between motivation and performance has not only a theoretical but also a practical importance.

The athlete conduct is explained based on psychological factors by means of motivation theories.

*Motivation theories* are advanced in scientific psychology in different forms, influenced by human behavior: *the theory of instinct, impulse, theories focused on physiological needs with a new socio-biological dimension, the theory focused on psychological needs, purpose focused theories, or process theories that explain rather the process following which motivation appears; theories that support the role of social factors in influencing*

*behavior.*

One of the most popular theories is *Maslow's theory* (1943), which is based on the idea that human needs act at multiple different levels, from lower levels to higher levels.

This model theory states that people tend to progressively meet their needs, first on a lower level, and subsequently on a higher level. There are authors (Guest, 1984, cited by Bogathy, 2004) who argue that Maslow's theory is not fully justified to be supported and that it would be disadvantaged by the rigidity of its conception.

Another theory is *Herzberg's bifactorial theory*, which is based on the premise that human life is conducted on two different levels: *physical and psychological*. According to this theory, motivation occurs under the influence of motivating factors and hygiene factors. The factors that determine satisfaction are *motivators* (motivating factors), while factors that cause dissatisfaction are called *hygiene factors*. Motivating factors refer to the essence of activity, and hygiene factors relate to the environment in which an individual performs (Duică, 2008).

During the course of time, a number of specialists have exposed their opinions on motivation theories, opinions that supported existing ones and were in turn completed. Of these, we mention the expectancy theory and the goal theory.

The *expectancy theory* developed by Vroom (1964) assumes that motivation is the process that governs individual choices among various possibilities. The main idea of the theory is that people's choices are influenced by the expected results of their choice.

The relevance of this theory in high performance sport comes from the fact that effort during sports training is rarely an end in itself; beyond the objectives of a training session, the effort is aimed at reaching other goals. The training of athletes would be a first level goal allowing to reach the second level goals that depend on the athlete's needs, for the achievement of the proposed objectives in the competitions to come.

The theory is based on three variables: *valence, expectancy and instrumentality*, considered to form the „infrastructural level of motivation” (Mamali, 1981). *Valence* is the strength of an individual's desire to achieve second level goals, and *expectancy* is defined as the perceived likelihood of what can be achieved in the future in terms of satisfaction of needs and desires. Choosing a first level goal depends on the supposed relationship with the results expected from the second level.

Instrumentality is the association of first level and second level goals and expresses the extent to which that need is really met (second level goal). Valence is a predominantly affective dimension, expectancy is predominantly cognitive, and instrumentality is predominantly actional; these dimensions may include these features themselves. According to them, it can be said that athletes adjust their own behavior depending on their expectations and to the probable link perceived between the goals.

The relevance of this theory at an organizational level is illustrated by House's theory (1971), according to which in order to induce a particular behavior, the manager/coach must act on one of the three variables (House, 1971, cited by Ciucurel, 2008).



Therefore, according to this theory adapted to sport, it can be said that the coach is the one who must come up with a strategy to support the athlete to correct his deficiencies in terms of valence, expectancy and instrumentality, as follows:

- if expectancy is deficient, the coach must encourage the athlete and help him think positively, stimulating him with material or spiritual rewards, even when the athlete's results are disappointing or less than expected. Of course, the approach of this strategy largely depends on the coach's view;

- if instrumentality is reduced, the coach needs to establish links between second level and first level goals. This type of strategy has an equal chance of being adopted by the majority of the coaches.

- in the case of a weak valence, the coach proposes second level goals that are desirable for the individual and acceptable for the sports club or FRA.

Locke's goal theory (1990) shows that goals also guide behavior and influence performance. People who set themselves a specific goal have better performance than those without a fixed goal or with a vague goal. Managerial implications show that this theory is seen more as a motivation strategy than as a formal theory of motivation. This strategy involves the identification of goals that ensure a high level of performance; the setting of goals at a competitive but realistic level; the need for feed-back, etc.

The relevance of this theory in sport performance is reflected by the development of the annual training plan; the coach together with the athlete plan the training and performance objectives, establishing the training strategy to obtain maximum performance in the major goal competition.

In terms of explaining the behavior of individuals on the basis of psychological factors, psychology proposes the *achievement motivation theory* developed by Murray (1938), which expresses a secondary psychogenic need that makes an individual execute something difficult, dominate, manipulate things, people, overcome obstacles, achieve a high level and excel (Murray, 1938 cited by Teodorescu, 2006).

According to theorists, achievement motivation is based on three theories (Weinberg & Gould, 1995):

- a) *the need for achievement theory*, which considers that achievement motivation is influenced by personality factors, situational factors, trends, emotional reactions, and achievement behavior as a result of the interaction of the four mentioned factors.

- b) *the attribution theory* refers to the cognitive process by which individuals perceive and explain their own behavior (self-attribution) or the behavior of others (hetero-attribution) in everyday life.

The relevance of this theory in high performance sport highlights the possibility of explaining success and the factors contributing to performance. The following may contribute to a certain performance of an athlete: internal factors (the athlete's talent or skills), external factors (chance, the coach's skill), internal causes (special effort or injury sequelae), external causes (convenient opponents or poor organizational conditions), factors that can be controlled (tactical plan or the athlete's disinterest), and

factors that cannot be controlled (training of opponents or absence of the need for optimal training).

#### c) *the goal attainment theory*

The prerequisite of this theory is the need to understand the meaning that success or failure has for an individual. The optimal way to find the answer to this question is to examine how the athlete achieves the proposed goal and how he is influenced by the perception of his own abilities or skills (Teodorescu, 2006).

### Structure of motivation

The *structure of motivation* is composed of all the motives that stimulate human behavior. It is necessary to know that a person's motivation for an action does not lie in the presence of a certain motive, but in the hierarchization of all the motives, which results in the actual form and structure of motivation. The motivation area includes phenomena such as: needs, impulses, intentions, tendencies, interests, ideals, expectations, aspirations, values. These phenomena lead to the emergence of reason.

*Motive* "is the cause, the reason of an action, an impulse that drives action; it is mobile, a momentum, an impulse, a goal, an objective" (\*\*\*, 2005). Actions are always based on a motive, it is the motive that launches action and triggers the performance of actions in direct relation to the motivated program. Motive "is force, a need, a specific desire that energizes and directs behavior towards a purpose" (Morris, 1990, quoted by Pânișoară & Pânișoară, 2005).

The motives of sports activity are extremely *varied*, being sometimes found in one and the same person, who has in this way a richer motivation for sports activity. Motives are *dynamic*, they change, so that the same activity acquires very different motivations over time.

Motive is an internal factor that triggers, supports and directs an activity and has two functions: activation or energy mobilization, and behavior channeling.

Motivation (an internal factor) is conditioned by its object; the external factor has a triggering effect only in relation to specific needs, desires, aspirations. It is considered that external factors are interwoven with internal factors causing the self-regulation, adaptation of individuals, so that they act spontaneously and on their own based on their motives (Mihăilescu et al., 2012).

High performance sport requires effort and sacrifices which often seem incomprehensible (activities at the limit of biological and psychological tolerance, repeated stressful situations, temporary deprivation of natural needs, etc.). All this leads to a simple question: What does high performance sport offer to compensate for so many shortcomings?

The motives underlying the determination of an athlete's activity are different (Bouet, 1969, cited by Epuran et al., 2000) (Table I).

Motivation for high performance sport can be triggered by various motives depending on the individual, on his/her aspirations, personality, level of development, training, and there can be various motives, but they cannot be reduced to any of the factors that determine and influence them.



**Table I**  
Various motives for sports activity

Motor needs	Need to spend energy Need to exercise
Self-assertion	Aspects of self-assertion Favorable conditions for self-assertion
Seeking compensation	Complementary and balancing For overcoming For substitutions
Social trends	Need for affiliation Desire for integration
Interest in competition	Need for success Need to compare with others Need to oppose another Desire for the unexpected Pleasure of feeling the tension of competition
Desire to win	Desire of possession Desire for self-assertion Patriotism
Aspiration to become a champion	Exigency Self-assertion Material interests Influence of others
Aggression and combativeness	Adversity Combativeness
Taste of risk	Game of life Need to experience dangerous situations Desire to show courage
Attraction to adventure	Desire for the unexpected Desire to solve crisis situations
Love for nature	Fight against nature Contemplation of nature

## Motivation and its importance in achieving athletic performance

Motivation for sport takes different aspects because sport itself is differentiated by levels of performance, but also because sport is practiced by people of different ages. The importance of motivation in obtaining athletic performance is largely determined by the stage of training of the athlete, the athlete's involvement in the activity, the importance of the competition, and the athlete's physical, technical and mental abilities.

Performance motivation underlies any effective activity and is the most important factor for the mobilization of human capacity, which is why it can be considered the most required adjustment factor in sport.

So, performance motivation and necessity are an effective component of praxis, of behavior directed towards performance. Achievement motivation is involved. Thus, performance motivation is recognized as a process, as a dynamic function regulating both sports activity and human behavior, plus environmental factors perceived as stimuli. To highlight the important role of performance motivation in relation to performance conduct, a correlation with positive attitudes towards work and effort, including the effort of sports training and competitions, should be established.

Any behavior is inextricably linked to motivation and any attitude expressed by a particular behavior has motivational support. Motivated behavior has a great power of expression, so that any obstacle or difficult problems arising in the way of sports performance are removed and resolved.

Sports performance can be influenced by the intensity of motivation, as it is known that optimally motivated athletes generally tend to achieve better performance. So,

motivation is one of the factors that contribute to individual athletic performance; along with motivation, performance is heavily influenced by the level of skills, abilities, biomotor qualities, by the understanding of objectives and the opportunity to achieve remarkable results.

Motivation determines focus and will, and energetically supports the efforts of training and participation in competitions. Motivation is based on the beliefs, ideals and pursuit of high performance.

As part of motivation, *beliefs* determine the steady and firm adherence to the requirements and sacrifices of high performance sport, they generate rational self-discipline and contribute to the *ideal of sporting excellence*. The sporting ideal determines the understanding of sports performance in relation to its social values. The performance ideal influences lifestyle based on increasingly higher internalized values. The performance ideal and the pursuit of maximum performance are cultivated in preadolescence and adolescence, and will dominate the personality of the mature athlete, thus ensuring a continuous and strong motivational source.

Motivation is the result, the consequence of the interaction between the individual, the task to be fulfilled, and the organizational environment. It is "the extent to which persistent effort is directed towards the achievement of a goal" (Johns, 1996, cited by Preda, 2006).

In high performance sport, motivation plays a decisive role because it underlies the continuity of sports training and its performance at a close to optimal level. This must be seen from the point of view of athletes, of their professional entourage (trainers, physician, psychologist, manager, etc.), as well as of their social entourage (family, friends, etc.).

The approach from the perspective of the individual claims that the motivating force is inherent to the individual and depends on personal characteristics such as needs, impulses, instincts, personality traits. In the situational perspective (individual + environment), behavior depends on factors exterior to the individual, i.e. the work environment, nature of work, leadership of superiors, etc.

Motivation refers to the fact that behavioral acts do not occur without a cause, at their origin there is always a number of internal causes that drive action and support it energetically; motivation explains why a behavioral act can have different meanings for different subjects.

## Conclusions

1. Motivation is "what drives action" and behavior reflects the actions taken to achieve goals, so, motivations determine individual behavior.

2. Motivation is a prerequisite of sports practice and especially, of sports performance, determined both by internal and external motivational factors. These factors depend on how the basic needs of human beings are experienced, but also on the action of external, social and educational factors.

3. In high performance sport, motivation is a key factor for achieving athletic performance, without which athletes would not be determined to cope with the sports training effort in order to improve their psychomotor abilities. Stimulating motivation remains an art that depends on the

skill and gift of the coach.

4. Sports performance can be influenced by the intensity of motivation, as it is known that optimally motivated athletes generally tend to achieve better performance. So, motivation is one of the factors that contribute to individual athletic performance; along with motivation, performance is strongly influenced by the athlete's skills, abilities, biomotor qualities, by the understanding of objectives and the opportunity to achieve remarkable results.

### Conflicts of interests

There is no conflict of interest.

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## Tomatoes and lycopene in the athletes' diet Roșiile și licopenul în dieta sportivilor

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### **Abstract**

Unlike other groups of food, tomatoes have not only a nutritional value, but they also contain a large group of secondary components (such as lycopene), non-nutritive, which give them the extraordinary organoleptic diversity and benefic pharmacological qualities.

While eating fruits and vegetables raw is more nutritional, cooking sweet tomatoes increases the amount of lycopene that our body can absorb.

Because of the antioxidant activity, consuming tomatoes may help to prevent or treat certain health conditions, including high cholesterol, heart disease and certain types of cancer.

Moreover, in sportsmen, a diet rich in tomatoes juice has a potential antioxidant effect and may significantly reduce the serum concentration of 8-oxo-dG (8-Oxo-2'-deoxyguanosine), a sensitive marker of oxidative stress. Also, tomatoes can help ease fatigue from exercise, by lowering TGF-ss, a well-known indicator of exercise-related fatigue, a type of cytokine, a protein molecule used specifically for intercellular communication.

**Key words:** tomato, lycopene, effects, health, athletes.

### **Rezumat**

Spre deosebire de alte grupe de alimente, roșiile nu au doar o valoare nutritivă, dar conțin și o serie de componente secundare (cum este licopenul), non-nutritive, care le dau o extraordinară diversitate organoleptică și calități farmacologice benefice.

În timp ce consumul celor mai multe fructe și legume se recomandă a se face în stare crudă, pentru a le păstra cea mai mare valoare nutritivă, prepararea termică a roșiilor duce la creșterea cantității de licopen utilizat digestiv.

Datorită activității antioxidante, consumul de roșii poate preveni sau trata unele afecțiuni, cum ar fi hipercolesterolemia, bolile de inimă sau unele tipuri de cancer.

În plus, la sportivi, o dietă bogată în suc de roșii are un potențial efect antioxidant și poate reduce semnificativ concentrația serică de 8-oxo-dG (8-Oxo-2'-deoxyguanosine), un marker sensibil al stresului oxidativ. De asemenea, roșiile ar putea să reducă oboseala consecutivă exercițiului fizic, prin scăderea concentrației de TGF (transforming growing factor), un cunoscut indicator al oboselii de după exercițiu, un tip de citokină proteică folosită în comunicarea intercelulară.

**Cuvinte cheie:** roșii, licopen, efecte, sănătate, sportivi.

### **General considerations**

People know a lot about food and nutrition, since Hippocrates, but they still do not know enough. Nowadays, in the most developed world, the increase of non-communicable chronic diseases associated with dietary and lifestyle changes, reduced physical activity and increased urbanization still remains a major challenge for society. For some chronic diseases, such as type 2 diabetes, cardiovascular disease, some cancers, and a range of inflammation-associated conditions, certain phytochemicals and plant-based foods could reduce the incidence and progression (Diamond, 2011). Moreover, athletes might benefit from the antioxidant effects of plants such as tomatoes (Martin et al., 2011; Martin et al., 2013).

Unlike other groups of food, fruits and vegetables have not only a nutritional value, but they also contain a large group of secondary non-nutritive components, which give

them the extraordinary organoleptic diversity and beneficial pharmacological qualities. One of the most amazing plants is tomato, also called over the years “love apple”, “golden apple,” “apple of paradise” or even “devil apple”.

Tomatoes are members of the nightshade family (plants which have developed a means of defending themselves against predators). The family is also known as the potato family or *Solanaceae*. This flowering family contains many plants used by humans as food, spice and medicine, and many poisonous plants.

The plants from this family produce a toxic substance (alkaloidal glycosides, or simply alkaloids) to protect themselves from being eaten. The toxin produced is in small amounts, so usually extremely harmful only to small creatures, such as bugs and insects. As far as humans are concerned, these alkaloids can be desirable, toxic, or both, though they have presumably evolved because they have

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reduced the tendency of animals to eat the plants.

The family includes *Datura* or Jimson weed, *Mandragora* (mandrake), *Atropa belladonna* (deadly nightshade), *Lycium barbarum* (wolfberry), *Physalis philadelphica* (tomatillo), *Physalis peruviana* (Cape gooseberry flower), *Capsicum* (chili pepper, bell pepper, paprika), *Solanum* (potato, tomato, eggplant), *Nicotiana* (tobacco), and *Petunia*. With the exception of tobacco (*Nicotianoideae*) and *petunia* (*Petunioideae*), most of the economically important genera are contained in the subfamily *Solanoideae*.

The leaves, stems, and green unripe fruit of the tomato plant contain small amounts of the toxic alkaloid tomatine (a glycoalkaloid with antifungal properties and a higher toxic impact on dogs than on humans) (McGee, 2009; Brevitz, 2004).

They also contain solanine, a toxic alkaloid found in potato leaves and other plants of the nightshade family (Barceloux, 2009; Stimekova, 2006). The use of tomato leaves for tea (tisane) has been responsible for at least one death (McGee, 2009; Barceloux, 2009). However, tomatine levels in foliage and green fruit are generally too low to be dangerous unless large amounts are consumed, for example, as greens. Small amounts of tomato foliage are sometimes used for flavoring without ill effect, and the green fruit is sometimes used for cooking, particularly as fried green tomatoes, a delicacy in restaurants (McGee, 2009). Compared to potatoes, the amount of solanine in green or ripe tomatoes is low (1).

The toxicity of these alkaloids for humans and animals ranges from mildly irritating (allergic reaction, or food sensitivity) to fatal in small quantities, so it is wise for some individuals to avoid them (8).

In 1753, Linnaeus placed the tomato in the genus *Solanum* (alongside the potato) as *Solanum lycopersicum*. In 1768, Philip Miller moved it to its own genus, naming it *Lycopersicon esculentum* (6).

This name came into wide use, but was in breach of the plant naming rules. Technically, the combination *Lycopersicon lycopersicum* (L.) H. Karst. would be more correct, but this name (published in 1881) has hardly ever been used, except in seed catalogs, which frequently used it and still do (7).

The scientific epithet *lycopersicum* means “wolf peach”, and comes from German werewolf myths. These legends said that deadly nightshade was used by witches and sorcerers in potions to transform themselves into werewolves, so the tomato’s similar, but much larger fruit was called the “wolf peach” when it arrived in Europe (Hammerschmidt & Franklin, 2005).

The Aztecs called the fruit *xitomatl*, meaning “something round and plump”. Other Mesoamerican peoples, including the Nahuas (Aztec language), took the name as *tomatl*, from which most western European languages derived their names for “tomato”. However, the Italian word, *pomodoro* (from *pomo d’oro* “apple of gold”) was borrowed into Polish, and via Russian, into several other languages. Similarly, the now rare German term *Paradeisapfel* (for “apple of paradise”) is still heard in the form *paradeiser* in Bavarian and Austrian dialects, and was borrowed into modern Hungarian, Slovenian and

Serbian.

Botanically, a tomato is a fruit: the ovary, together with its seeds, of a flowering plant. However, the tomato has a much lower sugar content than other edible fruits, and is therefore not as sweet, although some tomato varieties do taste sweet.

Typically served as part of a salad or main course of a meal, rather than as a dessert, it is considered a vegetable for most culinary uses. One exception is that tomatoes are treated as a fruit in home canning practices: they are acidic enough to process in a water bath rather than a pressure cooker as vegetables require. Tomatoes are not the only food source with this ambiguity: green beans, eggplants, cucumbers, and squashes of all kinds (such as zucchini and pumpkins) are all botanically fruits, yet cooked as vegetables.

The first tomatoes can be traced back to the Andes in Peru, where they grew wild as cherry-sized berries. Aztecs and other peoples in Mesoamerica used the fruit in their cooking. The exact date of domestication is unknown: by 500 BC, it was already cultivated in southern Mexico and probably other areas.

During a long period, the tomato was considered poisonous, and it took nearly 200 years for the tomato to be one of the largest commercial crops in North America, then in Europe.

By the end of the 19th century, in the 1893 U.S. Supreme Court case of “*Nix v. Hedden*,” the tomato was declared a vegetable, along with cucumbers, squashes, beans and peas. In the 20th century, tomatoes were believed to have “medicinal virtues”.

The fact that tomatoes were once considered poisonous is a particularly ironic fact in light of recent scientific research supporting their many health benefits.

Freshly picked tomatoes are one of the great fruits of summer, and now they are recognized for their nutritional and health benefits, due to their phytochemicals (chemicals produced by plants that may affect health, but are not essential nutrients). They occur naturally in plants (phyto = “plant” in Greek), and are responsible for color and organoleptic properties, such as the deep purple of blueberries and smell of garlic (Liu, 2004).

Phytochemicals help plants defend themselves against environmental challenges, such as damage from pests or ultraviolet light, and appear to provide humans with protection as well.

Some scientists estimate that there may be as many as 10,000 different phytochemicals having health effects, while others estimate that up to 40,000 phytochemicals will someday be fully catalogued and understood. Over just the last 30 years, many hundreds of these compounds have been identified and are currently being investigated for their health-promoting qualities (Park et al., 2009).

The many phytochemicals work differently. Most of them have *antioxidant* activity and protect our cells against oxidative damage and reduce the risk of developing certain types of cancer (e.g. allyl sulfides from onions, leeks, garlic; carotenoids; flavonoids from fruits and vegetables; polyphenols from tea and grapes).

Others have a *hormonal action* (isoflavones, found in soy, imitate human estrogens and help to reduce



menopausal symptoms and osteoporosis).

Another possible action is *stimulation of enzymes* (indoles, from cabbages, stimulate enzymes that make the estrogen less effective and could reduce the risk for breast cancer; other phytochemicals, which interfere with enzymes, are protease inhibitors from soy and beans, and terpenes from citrus fruits and cherries).

Saponins from beans *interfere with the replication of cell DNA*, thereby preventing the multiplication of cancer cells. Capsaicin, found in hot peppers, protects DNA from carcinogens.

The phytochemical allicin from garlic has *antibacterial properties*.

Some phytochemicals bind physically to cell walls, thereby *preventing the adhesion of pathogens to human cell walls*. Proanthocyanidins from cranberry will reduce the risk of urinary tract infections and will improve dental health.

Phytochemicals are classified by their chemical structure and categorized into families based on similarities in their structures: *phenols*, or polyphenols (*anthocyanidins* and *catechins*); *flavonoids* (isoflavones); *organosulfur compounds* (glucosinolates and indoles from brassica vegetables like broccoli, and allylic sulfides from garlic and onions); *organic acids* (some powerful antioxidants, like ferulic acid, which is found in whole grains), and *carotenoids*.

*Carotenoids* are a class of more than 600 naturally occurring pigments synthesized by plants, algae, and photosynthetic bacteria. These richly colored molecules are the sources of the yellow, orange, and red colors of many plants (Yeum & Russell, 2002).

Fruits and vegetables provide most of the carotenoids in the human diet. Carotenoids can be broadly classified into two classes, *carotenes* (alpha-carotene, beta-carotene, and lycopene) and *xanthophylls* (beta-cryptoxanthin, lutein, and zeaxanthin). Alpha-carotene, beta-carotene, and beta-cryptoxanthin are provitamin A carotenoids, meaning they can be converted by the body to retinol (vitamin A). Lutein, zeaxanthin, and lycopene have no vitamin A activity.

Lutein and zeaxanthin are the only carotenoids found in the retina and lens of the eye. The results of epidemiological studies suggest that diets rich in lutein and zeaxanthin may help slow the development of age-related macular degeneration and cataracts, but it is not known whether lutein and zeaxanthin supplements will slow the development of these age-related eye diseases (Krinsky et al., 2003).

### Metabolism and bioavailability of carotenoids

Carotenoids in foods are mainly in the *all-trans* form, although cooking may result in the formation of other isomers. The relatively low bioavailability of carotenoids from most foods compared to supplements is partly due to the fact that they are associated with proteins in the plant matrix (Yeum & Russell, 2002). Chopping, homogenizing (puréeing), and cooking carotenoid-containing vegetables in oil generally disrupt the plant matrix, increasing the bioavailability of carotenoids they contain (Dewanto et al., 2002; Van Het Hof et al., 2000). The bioavailability of lycopene from tomatoes is substantially improved by

heating tomatoes in oil (Gartner et al., 1997; Stahl et al., 1997).

For dietary carotenoids to be absorbed intestinally, they must be released from the food matrix and incorporated into mixed micelles (mixtures of bile salts and several types of lipids) (Yeum & Russell, 2002). Therefore, carotenoid absorption requires the presence of fat in a meal. As little as 3-5 g of fat in a meal appears sufficient to ensure carotenoid absorption (Van Het Hof et al., 2000).

Because they do not need to be released from the plant matrix, carotenoid supplements (in oil) are more efficiently absorbed than carotenoids in foods (Van Het Hof et al., 2000). Within the cells that line the intestine (enterocytes), carotenoids are incorporated into triglyceride-rich lipoproteins called chylomicrons and released into the circulation (Yeum & Russell, 2002). Triglycerides are depleted from circulating chylomicrons through the activity of an enzyme called lipoprotein lipase, resulting in the formation of chylomicron remnants. Chylomicron remnants are taken up by the liver, where carotenoids are incorporated into lipoproteins and secreted back into the circulation. In the intestine and the liver, provitamin A carotenoids may be cleaved to produce retinol, a form of vitamin A. The conversion of provitamin A carotenoids to vitamin A is influenced by the vitamin A status of the individual (During & Harrison, 2004). Although the regulatory mechanism is not yet clear in humans, cleavage of provitamin A carotenoids appears to be inhibited when vitamin A stores are high.

Carotenoids have many biological *activities*:

- *vitamin A activity*: orange and yellow vegetables like carrots and winter squash are rich sources of alpha- and beta-carotene. Spinach is also a rich source of beta-carotene, although the chlorophyll in spinach leaves hides the yellow-orange pigment (\*\*\*, 2000).

- *antioxidant activity*: in plants, carotenoids have the important antioxidant function of quenching (deactivating) singlet oxygen, an oxidant formed during photosynthesis (Halliwell & Gutteridge, 1999). Test tube studies indicate that carotenoids can also inhibit the oxidation of fats (i.e., lipid peroxidation) under certain conditions, but their actions in humans appear to be more complex (Young & Lowe, 2001). At present, it is unclear whether the biological effects of carotenoids in humans are a result of their antioxidant activity or other non-antioxidant mechanisms.

- *light filtering*: the long system of alternating double and single bonds common to all carotenoids allows them to absorb light in the visible range of the spectrum (Halliwell & Gutteridge, 1999). Reducing the amount of blue light that reaches the critical visual structures of the eye, where lutein and zeaxanthin are abundant, may protect them from light-induced oxidative damage (Krinsky et al., 2003).

- *intercellular communication*: carotenoids can facilitate communication between neighboring cells grown in culture by increasing the expression of the gene encoding a connexin protein (Bertram, 1999). Connexins form pores (gap junctions) in cell membranes, allowing cells to communicate through the exchange of small molecules. This type of intercellular communication is important for maintaining cells in a differentiated state and is often lost in cancer cells (Stahl et al., 1997).

- *immune system activity*: because vitamin A is essential for normal immune system function, it is difficult to determine whether the effects of provitamin A carotenoids are related to their vitamin A activity or other activities of carotenoids. Although some clinical trials have found that beta-carotene supplementation improves several biomarkers of immune function, increasing intakes of lycopene and lutein - carotenoids without vitamin A activity - have not resulted in similar improvements in biomarkers of immune function (Corridan et al., 2001).

## Lycopene

Lycopene, an acyclic isomer of  $\beta$ -carotene, without provitamin-A activity, is a red natural pigment that is synthesized by plants and microorganisms but not by animals. In its natural state, lycopene is a highly unsaturated, long straight chain hydrocarbon containing 11 conjugated and two non-conjugated double bonds. The conjugated bonds allow it to absorb light and "quench" free radicals. A study published in "Archives of Biochemistry and Biophysics" demonstrated that lycopene was the most efficient biological scavenger of singlet oxygen free radicals, which are commonly produced during cellular metabolism. In fact, lycopene may be the most powerful carotenoid quencher of singlet oxygen (Di Mascio et al., 1989), being 100 times more efficient in test tube studies of singlet-oxygen quenching action than vitamin E, which in turn has 125 times the quenching action of (water soluble) glutathione. Singlet oxygen produced during exposure to ultraviolet light is a primary cause of skin aging (Berneburg et al., 1999).

Ingested lycopene travels in the blood and accumulates in the liver, skin, blood serum, adrenal glands, prostate gland and colon.

Lycopene gives tomatoes, apricots, pink grapefruit, rose hips, watermelon, and guava their red color. Lycopene is the most represented carotenoid in tomato, accounting for above 90% of all carotenoids and it is one of the major carotenoids in the Western diet. Tomatoes are considered the richest food sources of lycopene (it has been estimated that 80% of lycopene in the diet comes from tomatoes and tomato products such as tomato sauce, tomato paste, and ketchup). Lycopene can also be taken in supplemental form (Agarwal, 2001).

Some foods that are good sources of lycopene are listed in Table I (4).

**Table I**  
Lycopene content of selected foods

Food	Serving	Lycopene (mg)
Tomato paste, canned	1 cup	75.4
Tomato purée, canned	1 cup	54.4
Tomato soup, canned, condensed	1 cup	26.4
Vegetable juice cocktail, canned	1 cup	23.3
Tomato juice, canned	1 cup	22.0
Watermelon, raw	1 wedge (1/16 of a melon that is 38 cm long x 19 cm in diameter)	13.0
Tomatoes, raw	1 cup	4.6
Ketchup	1 tablespoon	2.5
Pink grapefruit, raw	½ grapefruit	1.7
Baked beans, canned	1 cup	1.3

Like in the other carotenoids, naturally occurring geometrical isomers of lycopene are primarily (95%) in a linear configuration (all-*trans* configuration) with few exceptions. However, *cis*-isomers (a bent shape) of lycopene represent approximately 50% of total lycopene in blood and up to 80% in prostate tissues (Norris, 2000). The all-*trans* configuration is a structure that hinders the molecule's absorption through the intestinal walls and into the blood stream, so all-*trans*-lycopene is isomerized in the body or is less bioavailable.

So, *cis*-isomers are more bioavailable than all-*trans*-lycopene, most likely because of the greater solubility of *cis*-isomers in the bile acid micelles, a shorter chain length to fit into micelles, and the lower tendency to aggregate (Rao & Rao, 2007). Even an "in cell" isomerization has also been hypothesized (Yeum & Russell, 2002). The mechanisms explaining the isomerization of all-*trans* to *cis*-lycopene isomers *in vivo*, and the physiological importance of *cis*-lycopene are not fully understood. During food processing, lycopene may isomerize to *cis*-isoforms with the presence of heat and/or oil, or during dehydration. Moreover, during storage and/or processing, lycopene undergoes further geometrical isomerization, mainly *cis*- to *trans* retro-isomerization. With long heating times or temperatures above 50 °C, degradation proceeds faster than isomerization, the stability of lycopene isomers decreases in the order: 5-*cis* > all-*trans* > 9-*cis* > 13-*cis* > 15-*cis* > 7-*cis* > 11-*cis*. Starting from all-*trans*-lycopene, isomerization is characterized first by the formation and then by the disappearance of the unstable 13-*cis*-isomer. It is clear that isomerization and degradation are competitive and contemporaneous processes.

Lycopene in tomato paste is four times more bioavailable than in fresh tomatoes. For this reason, tomato sauce is a preferable source as opposed to raw tomatoes (Gartner et al., 1997; Kirsh et al., 2006) (2).

In order to gain the benefits of lycopene, the body somehow transforms lycopene molecules through reactions that have yet to be identified, so that lycopenes are able to be absorbed into the blood and transported to tissue, or they must be bent prior to ingestion. Heating red tomatoes and adding oils during processing has the potential of creating a sauce that contains the bent molecular forms of lycopene.

While eating fruits and vegetables raw is the best way to extract the most nutritional content (cooking most fruits and vegetables typically removes a significant amount of the vitamin and mineral content), sweet tomatoes are unique because, unlike most fruits and vegetables, cooking sweet tomatoes actually increases the amount of lycopene that our body can absorb. The amount of lycopene available to the body is increased when tomatoes are processed. Up to 15 minutes of cooking will continue to increase the absorption of lycopene, but there is no increased benefit for longer cooking times (Giovannucci, 2002; Giovannucci et al., 2002).

### Heart benefits

Lycopene is a powerful antioxidant that helps protect against heart disease: it reduces health risks associated with high cholesterol - atherosclerosis (lycopene stops LDL cholesterol from being oxidized by free radicals and cannot be deposited in the plaques that narrow and harden

the arteries). When taken in doses of 25 mg or more daily, lycopene reduced LDL cholesterol by 10 percent, which was comparable to the effect of low doses of statins in patients with slightly elevated cholesterol levels (Ried & Fakler, 2011). The results concluded that when taken in doses of 25 mg or more daily, lycopene reduced total cholesterol by 7.55mg/dl and LDL cholesterol by 10.35mg/dl. Lycopene helps treat and prevent heart disease also by reducing inflammation and reducing the risk of blood clots, even in low doses.

According to Reid and Fakler, 25 mg of daily lycopene helped reduce blood pressure in research studies, while lower amounts of this nutrient did not improve this condition. More research is needed to confirm the suggested beneficial effects on total serum cholesterol and systolic blood pressure.

#### *Bone benefits*

The National Institute of Health reports that, although osteoporosis is most common in post-menopausal women, men experience it as well. Osteoporosis is a bone disease that leads to deterioration of bone tissue and breakdown of bone mass, increasing the chance of hip, wrist and spine fractures. Researchers from Canada investigated the effects of lycopene on osteoporosis and found that subjects with higher levels of lycopene in their systems had lower levels of oxidative stress and bone turnover rate, so lycopene is beneficial for the prevention of osteoporosis (Rao, 2007).

Some studies have demonstrated that oxidative stress is a key modulator of bone cell function and that oxidative status influences the pathophysiology of bone. Endurance exercise is effective for antioxidant enzyme activity enhancement and bone formation enhancement. On the other hand, lycopene is a carotenoid that has a higher antioxidant capability to reduce oxidative stress caused by exercise. In addition, several studies have reported that lycopene is effective for suppressing bone resorption. The results suggest that lycopene intake exhibited a positive effect on bone strength but not on bone mineral density (Kakutani et al., 2011).

#### *Common cold benefits*

Lycopene in watermelon may also ease common cold symptoms, as well as asthma and upper and lower respiratory infections caused by rhinovirus. One of the most common symptoms of rhinovirus infection is inflammation of the airways. Researchers at the University of Newcastle in Australia tested the effects of lycopene on cells inflamed and infected by rhinovirus and the results of the study showed that lycopene was able to reduce airway inflammation (Saedisomeolia et al., 2009).

#### *Anticancer benefits*

Lycopene has potent anticancer benefits, it stops the growth and development of cancer cells in prostate, breast and endometrial cancer, with the strongest effect on prostate cancer (Peters et al., 2007). Lycopene's anticancer actions stem from its strong antioxidant content. It is not clear whether lycopene itself is protective. Studies suggest that lycopene is one factor involved in reducing the risk of prostate cancer (Haseen et al., 2009; Zuniga et al., 2013). Since tomatoes also contain vitamins, potassium, and other carotenoids and antioxidants, other compounds in tomatoes may account for some of the protective effects first thought

to be due to lycopene. These compounds may act alone or in conjunction with lycopene. When researchers look at large population groups with different lifestyles and habits, it is also possible that their findings can be explained by other factors that were not examined (Campbell et al., 2004).

To test whether lycopene is the main cancer-fighting substance in tomatoes, one animal study compared lycopene supplements to powdered tomatoes. The groups of rats that were fed tomato powder were compared to rats receiving lycopene. The rats that received tomato powder had a much lower cancer risk, whereas the rats receiving lycopene supplements did not differ significantly from the group that received no special supplements (3).

The results of several prospective cohort studies suggest that lycopene-rich diets are associated with significant reductions in the risk of prostate cancer, particularly more aggressive forms (lycopene improved symptoms and halted the progression of prostate enlargement), and cervical cancer (Giovannucci, 2005). However, dietary lycopene intake was not related to prostate cancer risk in a prospective study on more than 58,000 Dutch men (Schuurman et al., 2002). A meta-analysis that combined the results of 11 case-control and ten prospective studies found that men with the highest intakes of dietary lycopene or tomatoes had modest, 11-19% reductions in prostate cancer risk (Etminan et al., 2004). Another study in a cohort of 29,361 men monitored for 4.2 years found no association between dietary lycopene intake and prostate cancer risk (Kirsh et al., 2006). Additionally, a large prospective study found no association between plasma concentrations of lycopene, or plasma concentrations of total carotenoids, and the overall risk of prostate cancer (Key et al., 2007). While there is considerable scientific interest in the potential for lycopene to help prevent prostate cancer, it is not yet clear whether the prostate cancer risk reduction observed in some epidemiological studies is related to lycopene itself, other compounds in tomatoes or other factors associated with lycopene-rich diets. To date, results of short-term dietary intervention studies using lycopene in prostate cancer patients have been promising (Dahan et al., 2008). Yet, the safety and efficacy of the long-term use of lycopene supplements for prostate cancer prevention or treatment are not known (Dahan et al., 2008). Large-scale, controlled clinical trials would be needed to address these issues.

In a clinical study published in 2008 in "Journal of Nutrition," the authors found that men with benign prostate hyperplasia who took lycopene supplements for six months experienced decreased levels of prostate-specific antigen, a marker of the disease (Schwarz, 2008).

#### *Lycopene and lung function*

It has been suggested that exercise-induced bronchoconstriction may involve oxidative stress. Strenuous exercise promotes free radical production, which can lead to many of the pathophysiological changes associated with asthma, including bronchoconstriction, mucus secretion, and microvascular leakage (Mannisto et al., 2004). Lycopene has been shown to have high antioxidative activity. Lycopene supplementation has no effect on airway hyperreactivity and inflammation in young athletes who complain of difficulty in breathing related to physical exertion (Falk et al., 2005; Gallicchio



et al., 2008).

#### *Macular degeneration*

Although evidence is limited, consumption of lycopene may protect against macular degeneration by antioxidant and light-screening mechanisms. Lycopene and other carotenoids might also be useful in the treatment of glaucoma (Khachik et al., 2002).

### **Tomatoes, lycopene and physical activity**

Reactive oxygen species (ROS) that include oxygen ions, hydroxyl ions and peroxides play an important role in the development of cancer and aging. They react with cell components such as proteins, lipids, and DNA and bring about chemical modifications in the cells, causing what is known as oxidative stress.

Oxidative stress induced DNA damage is measured by the concentration of 8-Oxo-2'-deoxyguanosine (8-oxodG) present within the cell.

Many scientific data strongly suggest that tomato juice has a potential antioxidant effect and may significantly protect the nucleotide pool of the DNA from ROS produced in response to extensive physical activity, reducing the elevated level of ROS induced by oxidative stress. The results indicated that a daily intake of tomato juice (150 ml), equal to 15 mg lycopene per day, reduced the serum level of 8-oxodG (a sensitive marker of oxidative stress) after extensive physical exercise (Harms-Ringdahl et al., 2012; Wagner et al., 2010; Rolland Y et al., 2010).

Recently, it has been found that tomatoes can also help ease fatigue from exercise. The key to maximizing the effects of tomato juice is drinking it at the right time. According to a study, drinking tomato juice before or during exercise can help ease fatigue caused by these activities. The key factor in the experiment was TGF- $\beta$ 1 (Transforming Growth Factor), a protein produced by the body. This substance is a well-known indicator of exercise-related fatigue. Researchers are aware that the amount of this protein increases remarkably after physical activity. Scientists had mice exercise for one hour and measured the amount of TGF- $\beta$ 1 in their blood plasma six hours later. Some mice were given tomato juice an hour before or during the physical activity (0.3 milliliters to 1 milliliter of tomato juice was given to each mouse), while others were given water (8).

The researchers found that post-exercise blood TGF- $\beta$ 1 levels increased less in mice that received tomato juice than in those that received water. TGF- $\beta$ 1, which is secreted from immune cells, is a type of cytokine or protein molecule used specifically for intercellular communication. It is believed that the substance is associated with transmitting signals of physical fatigue caused by exercise within the body. The level of TGF- $\beta$ 1 is reported to increase in the bloodstream of patients suffering from chronic fatigue syndrome. The results of another animal study showed that mice whose brain was injected with TGF- $\beta$ 1 began to move more slowly.

Tomato juice is believed to help ease fatigue not only in runners, but also in people who practice moderate forms of exercise such as walking. It is widely known that active people are less prone to lifestyle-related disease than those who are inactive. It is also widely known that walking for

exercise provides many health benefits, such as obesity prevention (Doyle, 2006; Kushi et al., 2006).

Scientists also found that tomatoes contain a substance that is said to be able to activate DNA associated with the burning of fat in our body, namely (13-oxo-ODA), a special type of unsaturated fatty acid. This substance is said to help decrease the amount of neutral fat in the body and prevent metabolic syndrome from setting in (Young-il et al., 2012).

However, tomato juice is not a panacea, it is not a nutritional drink; some tomato juice brands may contain salt.

#### *Dietary supplement and side effects*

Lycopene is available as a dietary supplement in mixed formulations or by itself. It is typically available in soft-gel form and is oil based. There are currently no reported side effects from eating foods that are rich in lycopene or taking lycopene dietary supplements (in the standard dosage prescribed). Tomato extract is another form of lycopene supplement that is becoming popular and wide-selling.

#### *Adverse effects of lycopene in humans*

There is a dearth of information on the adverse effects of lycopene in humans. High intakes of lycopene-rich foods or supplements may result in a deep orange discoloration of the skin known as lycopenoderma. Because lycopene is more intensely colored than carotenes, lycopenoderma may occur at lower doses than carotenoderma (\*\*\*, 2000). Lycopenoderma has been observed with high intakes of lycopene-containing foods (i.e. 2 liters of tomato juice daily for several years). Although there was evidence of lycopene and fatty deposits in the liver, there was an absence of measurable hepatic dysfunction. After 3 weeks of consuming a diet free of tomato juice, the orange discoloration faded. Because of the lack of data on the adverse effects or toxicities of lycopene in animals or apparently healthy humans, there is no set tolerable upper intake level for lycopene (McClain et al., 2003).

### **Conclusions**

1. We live in a time where people know that eating better and exercising on a regular basis are important. Healthy eating is not about strict nutrition philosophies, staying unrealistically thin, or depriving ourselves of the foods we love. Rather, it is about feeling great, having more energy, stabilizing our mood, and keeping ourselves as healthy as possible.

2. A healthy nutrition is about eating daily half a plate of vegetables and fruits. They are low in calories and nutrient dense, which means they are packed with vitamins, minerals, and fiber. In fruits like tomatoes, beyond their nutritional components, the presence of other non-nutritional factors (i.e. carotenoids such as lycopene) has an important antioxidant function. The amount of lycopene available to the body is increased when tomatoes are combined with fat and heated during processing (tomato juice).

3. Due to its antioxidant activity, lycopene found in tomatoes may help prevent or treat certain health conditions, such as: heart diseases, infertility, diabetes, age-related macular degeneration and cataracts, skin aging, osteoporosis, and many types of cancer. Besides, tomatoes can help ease fatigue from exercise in athletes.



4. However, tomato juice is not a panacea, it is not a nutritional drink, some tomato juice brands may contain salt; lycopene does not replace conventional treatment for cancer or other medical conditions.

5. Overall, it is not possible to say conclusively that tomatoes or lycopene have any definite effect on the above medical conditions, or whether this is clinically significant. Complex interactions between multiple nutrients may contribute to the properties of tomatoes. Large randomized controlled trials will be needed to further investigate these issues. In the interim, tomatoes and other lycopene-containing fruits can still contribute to our recommended five daily portions of fruit and vegetables.

### Conflicts of interest

Nothing to declare.

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## **RECENT PUBLICATIONS** **ACTUALITĂȚI EDITORIALE**

### **New Romanian publications in the field of sports** **Publicații românești recente în domeniul sportului**

#### **Bazele jocului de fotbal**

*Andrade I. Bichescu*

Editura Eftimie Murgu, Reșița, 2013  
305 pagini

Răspândirea și popularitatea fotbalului, nemaîntâlnite la nici un alt sport cunoscut astăzi pe mapamond, rezidă în irezistibila atractivitate a acestui joc sportiv, fiindcă tocmai această atractivitate i-a conferit forța necesară pentru a rezista eroziunii vremii, propulsându-l din generație în generație, dintr-o țară în alta, dintr-un continent în alt continent, astfel încât, în zilele noastre, nu există loc pe mapamond în care fotbalul să nu fie cunoscut, învățat și practicat cu pasiune.

Deși literatura de specialitate este foarte bogată în domeniul fotbalului, apariția acestei lucrări este mai mult decât binevenită, autorul tratând, într-o succesiune logică, aspecte legate de: Istoria jocului de fotbal, Organizarea fotbalului la nivel mondial, continental și național, Tehnica și tactica jocului, Mecanismele de execuție a elementelor și procedeele tehnice cu mingea, precum și un portofoliu al antrenorului de fotbal.

#### **Câștigă urât. Războiul mental în tenis**

*Brad Gilbert, Steve Jamison*

Editura Publica, București, 2013  
332 pagini

Spre deosebire de alte sporturi, meciul de tenis începe în afara terenului de joc, continuă în momentele de dinaintea meciului și din timpul meciului; continuă și după ce ai câștigat sau pierdut punctul final.

Jucătorii inteligenți știu cum să se pregătească în mod corect pentru un meci și, odată început turneul, cum să își controleze emoțiile. Știu cum să gândească în timpul meciului, evitând lovitură cu procentaj scăzut, care prezintă riscuri inutile în momente neesențiale. Jucătorii inteligenți observă ce se întâmplă într-un meci și analizează informațiile. Știu cum să fructifice ceea ce știu.

Pe parcursul acestei cărți, vei găsi oportunitățile de care trebuie să fii conștient, opțiunile pe care le ai și modul în care le poți fructifica de dinaintea meciului până după

meci. Cum să te pregătești mental și fizic pentru bătălia de pe teren. Cum să joci împotriva oricărui stil de tenis. Cum să recunoști dinamica importantă într-un meci. Cum să faci față presiunii și stresului.

”În *Câștigă urât*, Brad Gilbert ne explică cum se câștigă un meci de tenis. Nu cred să existe cineva mai priceput la a înțelege războiul mental din jocul de tenis. Brad m-a ajutat să-mi îmbunătățesc jocul și sunt sigur că vă va ajuta și pe dumneavoastră” (Andre Agassi).

#### **Messi. Povestea băiatului devenit legendă**

*Luca Caioli*

Editura Preda Publishing, București, 2014  
287 pagini

Ce poți să mai spui despre Leo Messi, după ce îl vezi jucând? Singurul lucru rămas de spus este că Messi e pur și simplu cel mai bun. Și aceasta este o concluzie unanimă. Atât de mult, încât, pentru prima dată, mass-media engleză și cea argentiniană sunt de acord, ambele folosind cuvântul “rege” pentru a-l descrie. “Trăiască regele”, titrează *Olé*, aluzie la dragostea pe care o au britanicii pentru familia regală, în timp ce *Sunday Times* titrează “Domnia Regelui Messi”.

În vârstă de 26 de ani, Lionel Messi este considerat, de numeroși analiști, cel mai bun fotbalist al tuturor timpurilor. În perioada 2003-2005, a fost desemnat de FIF Pro și World Soccer Magazine, “tânărul jucător al anului”. În 2009, 2010 și 2011 a primit Balonul de Aur, egalând performanța lui Michel Platini, singurul jucător din istorie care reușise să câștige, până în acel moment, trei baloane de aur consecutive. În 2012 depășește acest record, fiind singurul jucător din istorie care câștigă al patrulea Balon de Aur consecutiv.

Messi este un portret revelator al unui fotbalist rapid, ingenios și uluitor. Caioli dezvăluie, prin declarațiile în exclusivitate ale părinților, familiei, antrenorilor, colegilor, dar și ale lui Messi însuși, un personaj complex, extrem de talentat dar și modest, jucător genial, dar și om remarcabil.

**Leon Gombos**

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## Book reviews

### Recenzii cărți

**The Encyclopaedia of Sports Medicine: An IOC Medical Commission Publication, Volume XIX, Sports Nutrition**

(Enciclopedia medicinei sportive: o publicație a Comisiei Medicale a CIO, volumul XIX, Nutriția sportivă)

Editor: Ronald J. Maughan

Editura: Wiley-Blackwell, 2013

680 pagini; Preț: € 156,40



Un număr record de 65 contributori, toți nume de renume în domeniile lor, coordonați de Ronald J. Maughan – nimeni altul decât, începând din 2002, președintele Grupului „Nutriție Sportivă”, din cadrul Comisiei Medicale a CIO - ne oferă un volum absolut impresionant, dedicat alimentației sportivilor. Subiect foarte important nu doar pentru lumea sportului, ci și pentru cei ce studiază și/sau sunt interesați de alimentația omului în general, dat fiind faptul că solicitările și condițiile cărora ființa umană trebuie să le facă față în contextul antrenamentelor și competiției, sunt extrem de variate, dar totodată clar delimitate în timp, încât să permită identificarea precisă a efectelor și consecințelor diferitelor strategii dietetice adoptate.

Așadar, editura Wiley-Blackwell ne dă posibilitatea ca, parcurgând cele aproape 700 de pagini ale respectivei cărți, să ne facem o imagine maximum de completă, asupra a tot ce se cunoaște despre alimentația și hidratarea sportivilor, acum la începutul celui de-al III-lea mileniu. Ceea ce este în măsură să justifice nu numai opțiunea subsemnatului de a o recenza, ci și, sperăm, decizia specialiștilor noștri de a și-o procura sau, măcar, de a stimula bibliotecile să o includă neapărat pe lista lor de achiziții.

Este deja de multă vreme unanim acceptat că alimentația adecvată are un impact semnificativ asupra performanțelor sportive, și în general asupra realizărilor indivizilor, indiferent de activitatea – profesională sau nu – în care aceștia sunt implicați. Prin alimentație adecvată înțelegând, în cazul sportivilor, că toate substanțele nutritive esențiale trebuie ingerate în cantitățile corecte și la momentele cele mai indicate, numai în acest mod asigurându-li-se accesul la așa-numita sănătate optimă și la obținerea de rezultate deosebite, în competiții. Totul, desigur, în condițiile în care, măcar într-o anumită măsură, trebuie să se țină cont și de preferințele alimentare ale sportivilor, precum și de tradițiile și cultura culinară în care ei au fost crescuți. Aspect nu rareori

ignorat în unele țări - printre care se numără și a noastră - în care „tradiția” spune că „sportivii trebuie doar să asculte, să execute ce li se cere, și să înghită tot ce li se dă; pentru că știu ei, antrenorii și/sau doctorii, ce este bine și ce nu”.

După cum se va vedea în continuare, volumul de care ne ocupăm abordează domeniul foarte dinamic al nutriției sportive, de o manieră greu de egalat în ce privește cuprinderea și profunzimea; dezvoltând temele până la cele mai mici și mai recente detalii. Pe de altă parte, ca orice publicație din științele sportului care se respectă, pentru fiecare dintre teme ne sunt prezentate mai întâi bazele științifice, după care urmează soluții și programe nutriționale practice, specifice unei game largi de sporturi, individuale și de echipă. Referindu-se la toți macro și micronutrienții, și la atât de la modă suplimente alimentare, autorii nu uită ca, pe lângă utilitatea și beneficiile cu care ele sunt creditate, să menționeze și eventualele lor efecte nedorite, sau riscurile la care se expun consumatorii, mai ales atunci când fac exces de ele. Găsim de asemenea în paginile cărții, adevărate ghiduri privind nevoile alimentare particulare ale unor grupuri speciale de sportivi – vegetarienii, copii și adolescenții, vârstnicii –, dar și capitole dedicate unor categorii clinice de practicanți ai activităților fizice, cum este cazul cu cei care suferă de diabet, obezitate sau boli de inimă.

Chiar dacă acest lucru nu este menționat în mod expres, volumul reprezintă o nouă ediție a unei lucrări publicate cu 3 cicluri olimpice în urmă. Iar faptul că board-ul CIO și comisia sa medicală au decis în acest sens, se datorează constatării că, de la precedentă sinteză, s-au acumulat foarte multe noutăți și clarificări. Care, înțelese și interpretate dintr-o perspectivă mai largă, au condus la conturarea clară a ideii că alimentația îl ajută pe sportiv nu doar – cum până nu de mult se credea – să se refacă mai bine și mai complet, până la proxima solicitare; rolul său primordial fiind acela de a favoriza și susține adaptările pe care ședințele de pregătire le generează la nivelul fiecărui țesut și organ. Răsturnarea de optică menționată s-a impus în urma cercetărilor de la nivel molecular. Ele au permis să se înțeleagă corect căile intracelulare de semnalizare care modulează expresia genetică, ca răspuns la stimulul reprezentat de antrenament și la dietă. O astfel de perspectivă nu a fost posibilă până de curând, iar noile abordări aduc cu ele speranța că vor putea fi concepute programe de pregătire și alimentație cu adevărat individualizate, care se vor concretiza în îmbunătățiri notabile ale performanțelor sportive.

Consistentul material este distribuit în 6 părți și 53 de capitole. După cele 3 capitole – *Nutriția omului*, *Fiziologia efortului fizic* și *Biochimia efortului* – ale primei părți (*Bazele științifice*), vine partea secundă (*Energia și macronutrienții*) care, în cele aproape 150 de pagini ale sale, conține nu mai puțin de 14 capitole. Primele două dintre acestea sunt dedicate aspectelor energetice; fie că este vorba de evaluarea costurilor energetice ale eforturilor sportive (cap. 4), sau de echilibrul energetic al organismului (cap. 5), deloc ușor de asigurat în cazul sporturilor extrem de solicitante în planul intensității și/sau duratei. Evaluarea compoziției corporale (cap. 6) ca modalitate indirectă de estimare și ținere sub control a echilibrului energetic, face trecerea către secțiunile



dedicate celor patru categorii de nutrienți principali: glucidele (3 capitole), proteinele și lipidele câte 2 capitole și apa și electroliții (3 capitole); ultimul capitol, al 17-lea, ocupându-se de efectele nutriției asupra oboselii centrale.

Alte 10 capitole alcătuiesc partea a 3-a: *Micronutrienții și suplimentele alimentare*. Deși oricare dintre aceste substanțe își are importanța sa în sport, iar pe de altă parte despre fiecare apar în permanență noutăți, ne permitem să atragem în primul rând atenția asupra capitolului care se ocupă de produse în cazul cărora riscul de abuz este mai mare, atunci când sportivii nu au acces la sfatul unui specialist, sau, și mai grav, resping consilierea științifică din partea acestuia, abandonându-se integral manipulărilor generate de înșelătoarele reclame comerciale. Este vorba de capitolul 22, alocat substanțelor generice intitulate „fitochimicale” (cea mai cunoscută dintre ele fiind lycopene), ale căror atât de supralicite efecte benefice sunt departe de a fi fost suficient probate științific, de cap 24 (creatina), și de cap 26; așa-numitele substanțe-tampon; care ar contracara aciditatea internă generată de efortul fizic. Netrebuind a fi trecut cu vederea desigur cap 23, redactat de însuși editorul lucrării R.J Maughan, și intitulat: *Riscuri și beneficii aduse sportivilor de către suplimentele alimentare*. Principiile nutriționale ce trebuie avute în vedere în cazul deplasării la mari distanțe (cap. 34), sau al eforturilor fizice prestate în condiții ambientale care prin ele însele generează un evident stres asupra organismului (cap. 35), nu au fost nici ele uitate, iar subiectul atât de incitant al alimentației celor angrenați în competiții sportive de mare anvergură, constituie substanța cap. 36.

*Aspecte practice* este titlul părții a 4-a, care se deschide cu cap. 28: *Alimentația femeii sportive*. Urmează *alimentația sportivilor tineri* (cap. 29), a celor *în vârstă* (cap. 30), a *vegetarienilor* (cap. 31) și a *celor cu nevoi speciale* (cap. 32). Deși acoperă sub 10 pagini, capitolul 33 (*Intervenția nutrițională în „sindromul subperformanțelor neexplicate” și în supraantrenament*) își are locul și importanța sa, deoarece este probat că alimentația are și ea un rol în prevenirea acestor situații nedorite și periculoase, și în „tratarea” lor, practic în grăbirea revenirii la situația de dinainte, și la reluarea cursului ascendent al realizărilor în planul potențialului fizic și al performanțelor. Bazați pe teoria care implică citokinele în explicarea acestor fenomene, cei doi autori ai capitolului se concentrează pe rolul nutriției în revenirea din condiția cunoscută sub numele de supraîncărcare (overreaching), oferind strategii dietetice punctuale pentru simptomele cheie ale acestei stări care, dacă nu este tratată/abordată corect, conduce la supraantrenament.

Partea a 5-a are 8 capitole; în ele sunt prezentate strategii și recomandări nutriționale specifice, valabile pentru cei care prestează exercițiul fizic în scopul promovării și întăririi sănătății, sau cei care, deja bolnavi fiind, încearcă să profite de beneficiile și ușurările pe care activitatea fizică regulată și adaptată lor, li le poate aduce. Astfel, după ce, în primul capitol al acestei secțiuni, lecturăm informațiile bine fundamentate și verificate, dar și noutățile de ultimă oră, referitoare la legătura strânsă dintre alimentație, activitatea fizică și sănătate, ne putem edifica în continuare asupra unor aspecte pe cât de interesante, pe atât de utile, aplicabile în cazul practicanților de exerciții fizice și sport care suferă de sindroame inflamatorii (cap. 38), boli imune (cap. 39), diabet (cap. 40), obezitate (cap. 41) și afecțiuni gastrointestinale (cap. 42). Importanța și implicarea funcției gastrointestinale pentru sănătate și performanța sportivă, fac obiectul cap. 43.

Aici fiind dezvoltate inclusiv atât de recent clarificatele (dar și deosebit de relevantele din perspectivă practică) chestiuni legate de calitățile și caracteristicile pe care trebuie să le respecte alimentele și soluțiile administrate în efort, și între eforturi, pentru a putea trece din stomac în intestin și, mai departe, pentru a fi absorbite prompt. Dacă deshidratarea și pericolele pe care ea le incumbă, împreună cu strategiile de rehidratare, au ajuns să fie destul de mult dezbătute și relativ bine cunoscute (vezi cap. 16), nu același lucru se poate spune despre excesul de hidratare; așa-numita „intoxicație cu apă”. Este vorba de un sindrom în care esența o constituie hiponatremia severă, iar despre cauzele, mecanismele și efectele sale în sport, ne vorbește, în cap. 44, Noakes, fost maratonist și unul dintre cei mai mari fiziologi ai efortului fizic din zilele noastre.

Conținutul părții finale – într-o traducere liberă intitulată *Aspecte practice ale nutriției specifice diverselor categorii de discipline sportive* – îi va interesa în mod deosebit pe practicienii de toate calificările și nivelele profesionale (antrenori, medici etc.), dar cu siguranță și pe sportivi sau aparținătorii lor. Și asta deoarece în cele aproape 100 de pagini, pe care se întind ultimele 9 capitole, au fost colectate principii nutriționale, dar și „rețete” (adică recomandări specifice și punctuale), care răspund și corespund întregii game de situații în care se pot afla practicanții numeroaselor sporturi inventate până acum. Gruparea disciplinelor în cadrul capitolului este logică și deja clasică; sporturi de forță și putere, sprinturi, alergările de distanță, ciclismul, gimnastica, înotul, sporturile de iarnă, sporturile de echipă și sporturile pe categorii de greutate. Discutabil - deși cumva explicabil, în virtutea viziunii și filozofiei celor ce conduc mișcarea olimpică - ni se pare totuși modul de alocare a spațiului tipografic, care a condus la situația că, în absolut, sporturilor de echipă le revine numărul cel mai mic de pagini. Deși, nu încapă nici un fel de discuție, acest grup de sporturi reprezintă el însuși o lume, foarte diversă din perspectiva solicitărilor fizice, a regulamentelor și a condițiilor ambientale în care se desfășoară antrenamentele și competițiile. Nemaivorbind de răspândirea cu adevărat globală și de numărul evident cel mai mare de practicanți.

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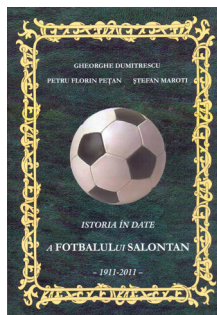
**Istoria în date a fotbalului salontan - 1911-2011**

(The History of the Romanian Football Salontan Data)

Autori: Gheorghe Dumitrescu, Petru Florin Pețan, Ștefan Maroti

Editura: Universității din Oradea, 2012

267 pagini



Ceea ce au făcut Gheorghe Dumitrescu, Petru Florin Pețan și Ștefan Maroti ține, fără exagerare, de domeniul fantasticului. Fantasticului deoarece "Istoria în date a fotbalului salontan" a fost o întreprindere grea și migăloasă, documentare laborioasă, în condițiile în care materialele "legate de fotbalul salontan sunt puține". Puțin care s-ar traduce prin articole în publicațiile timpului (Șzalontai Lapok', „Az Ujsag", „Arena Sporturilor", „Crișana", „Sportul popular", „Sportul românesc", „Gazeta de Vest", „Bihari Naplo'",...), de o primă lucrare rămasă în manuscris, semnată de Gheorghe Cotrău și Mados Mihaly („Fotbalul salontan la a 70-a aniversare. 1911-1981"). Plusul de informație este legat de perioada ultimilor treizeci de ani, cu alte surse de documentare, majoritatea "elaborate de structurile sportive. De asemenea, am putut consulta un bogat material iconografic, documente din albumele și arhivele unor persoane", am citat din „Cuvântul înainte" al autorilor.

Este istoria fotbalului salontan, o istorie vie prin oameni, date și fapte sportive și nu numai. Este cartea document istoric, cartea document științific, care din care sunt multe de învățat. "O altă lecție desprinsă din această carte, citez din cele scrise de Torok Laszlo, primarul municipiului Salonta, este aceea că în fotbal este foarte important spiritul de echipă. Precum am învățat în copilărie din romanele lui Dumas, „Toți pentru unul și unul pentru toți ! Acest lucru nu diferă cu nimic în fotbal, deoarece un singur jucător nu este suficient să ducă la bun sfârșit un meci, este nevoie de o echipă. Solidaritatea este lecția pe care societatea ar trebui să o învețe din fotbal (...)" Pentru motivele arătate mai sus am convingerea că această carte are un rol educativ și nu numai de prezentare, arătând că sportul este o piatră de rezistență în societatea noastră. Într-adevăr, conform datelor, Salonta a devenit mai prosper în urma dezvoltării sportului și a fotbalului. Prin fotbal se leagă de Salonta clipe de neuitat, personalități ilustre și numeroase succese. Mulțumim tuturor celor care ne-au servit un bun exemplu, de muncă și solidaritate...". Admirabile cuvinte, ilustrative și reprezentative pentru o mișcare sportivă cu un trecut demn de o carte.

Autorii nu au avut deloc o muncă ușoară, meritul lor este cu atât mai mare. Ei refac pas cu pas, istoria mișcării sportive din Salonta, cu început în 1895, constituirea Cercului Patinatorilor din Salonta Mare, apoi constituirea Asociației Sportive Salonta Mare (în 1900, noiembrie), primul meci de fotbal, la Oradea (1902), concursul de gimnastică (tot în

1902), festivalul sportiv al elevilor (1906), recensământul asociațiilor sportive din comitatul Bihor (1907; în Salonta funcționau Asociația Sportivă Salonta, respectiv Cercul Patinatorilor), inaugurarea terenului de sport/fotbal la 27 mai, 1911, pentru ca, o zi mai târziu, 28 mai, să se dispute și primul meci de fotbal, componenții celor două echipe evoluând "în haine de stradă". Începuturile au fost făcute... Continuările se regăsesc în capitolele cărții – „Înființarea și activitatea echipei Clubului Athletic Salonta", „Clubul Sportiv Salonta în primii săi ani de activitate", „Fotbalul salontan în perioada reorganizării activității fotbalistice din Regatul României Mari", Echipele de fotbal din Salonta în perioada desfășurării campionatului României pe regiuni geografice", „Echipele din Salonta în campionatul Districtului Oradea", „Anul celei de a XXV-a aniversări", „Perioada premergătoare și anii din timpul celui de al Doilea Război Mondial", „Reluarea activității fotbalistice în orașul Salonta 1945-1950", „Încercări repetate de promovare în eșalonul superior", „În campionatul Republican, divizia C", „Din nou în campionatul Regional", „O lungă perioadă cu o echipă în divizia C", „Anii premergători Revoluției 1982-1989", „Din campionatul județean în divizia B 1990-1996", „Fotbalul salontan între anii 1996-2004", „Anii cu cele mai bune rezultate în fotbalul salontan", „Perioada 2006-2011" - capitole bine scrise, în care fiecare afirmație este susținută de documentele timpului.

Nu voi insista asupra numelor de antrenori, jucători, conducători de cluburi sportive/fotbalistice din Salonta, dintr-un singur motiv, sînt mulți și nu doresc să omit pe nimeni. Pot însă scrie despre fotbalul salontan ca unul cu o tradiție bună în relație cu cluburile de fotbal clujene - "U" Cluj, CFR, Dermata Cluj, Electrometal Cluj, Viitorul IRA Cluj, Thenofrig Cluj, Medicina Cluj, Energia Flacăra Cluj, Flamura Roșie Herbak Janos Cluj, Rapid Cluj, CMC Cluj, Unirea Dej, Minerul ocna Dej, ISCT, Arieșul Turda, Progresul Turda, CIL Gherla, Cimentul Turda, Arieșul Cîmpia Turzii, Sticla Turda -, un material foarte bun pentru cei care vor dori să se aplece asupra echipelor amintite, din dorința de a le scrie istoria.

În plus, cartea oferă date relevante despre alte echipe de top ale României și ajunge să amintesc team-uri precum UTA, Jiul, Corvinul Hunedoara, Politehnica Timișoara, Olimpia Satu Mare, FC Bihor, FC Argeș, Gaz Metan Mediaș, Unirea Alba Iulia,..., echipe cu un istoric al lor bine definit în fotbalul românesc.

Se pot scrie multe despre fotbalul salontan juvenil, despre partidele internaționale ale echipelor din Salonta, multe, foarte multe, nu aș vrea să ne îndreptătesc vreuna neamintind-o, apoi despre jucătorii salontani ajunși la echipe din țară sau de peste hotare, cupe amicale, partide oficiale, o istorie fascinantă, care trebuie cunoscută.

*Istoria în date a fotbalului salontan 1911-2011* se citește cu plăcere, reținând mai multe paliere de abordare, viață socială, economică, politică, sportivă nu în ultimul rând, pentru fiecare palier având parte de nume datorite sportului și nu numai.

Prin informațiile oferite, multe și relevante, *Istoria în date a fotbalului salontan* egalează celebra istorie a fotbalului "U" Cluj, a regretatului prof. dr. Gheorghe Bodea. Sunt cărți din care avem numai și numai de învățat.

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## **PORTRETE - PERSONALITĂȚI ALE SPORTULUI ROMÂNESC** **PORTRAITS - PERSONALITIES OF THE ROMANIAN SPORTS**

### **Ioan Sabău - Cadrul didactic și personalitate remarcabilă a atletismului românesc**

### **Ioan Sabău - The teacher and outstanding personality of Romanian athletics**



Rectorul Ioan Sabău -  
Ziua francofoniei, ANEFS, 1999

Ioan Sabău s-a născut la 15 mai 1937 în comuna Opișani, județul Cluj. În anul 1961 a devenit licențiat în Educație fizică și sport al Institutului de Cultură Fizică din București, și tot în același an și-a început și cariera universitară, titular al aceleiași instituții care l-a format și care mai târziu și-a schimbat denumirea în Institutul de Educație Fizică și Sport, apoi în Academia Națională de Educație Fizică și Sport și în ultimii ani în Universitatea Națională de Educație Fizică și Sport. Din anul 1961 a fost promovat cu toate titlurile ierarhice academice. Ajuns profesor universitar, la scurt timp a devenit conducător de doctorat la aceeași instituție, unde a activat până în anul 2004. În acești ani, în activitatea didactică și de antrenorat a deținut funcții de conducere și îndrumare:

- Rector al ANEFS - 1996-2000;
- Șeful Catedrei de atletism, Natație-sporturi nautice, Sporturi de iarnă-turism și Orientare turistică - 1992-1996, 2001-2004;
- Antrenor de atletism la Cluburile Știința, ICF, Clubul Athletic Universitar București - 1961-1991;
- Lector în stagii de perfecționare ale antrenorilor de atletism, organizate în cadrul Solidarității Olimpice sub patronajul Președintelui CIO, Juan Antonio Samaranch - 1987-1991;
- Antrenor al lotului național de atletism timp de peste 20 de ani, pentru competițiile Balcanice și Europene.

În calitatea de cadru didactic a condus ca președinte de comisie zeci de examene de admitere, de doctorat, licență, disertație, absolvire, atestare a titlurilor științifice de doctor, conducător de doctorat, conferențiar și profesor universitar.

Ioan Sabău a contribuit la elaborarea Legii Educației Fizice și Sportului, fiind colaborator în cadrul Comisiei pentru Învățământ, Știință, Tineret și Sport din Camera Deputaților - Parlamentul României - atestat nr. 357/10.08.1999. A fost membru al COR, 1996-2004, președinte al Comisiei Naționale Consultative pentru Educație Fizică și Sport din Învățământul Superior 1996-2002, evaluator al Consiliului Național al Cercetării Științifice din Învățământul Superior, 2001-2007, membru al Colegiului Central de Antrenori al Federației Române de Atletism ș.a.

Datorită rezultatelor pe linia didactică și de antrenorat, Ioan Sabău a primit în cariera sa numeroase distincții și titluri (peste 35), dintre care enumerăm pe cele mai semnificative:

- Ordinul Meritul Sportiv acordat de Președintele României - în semn de apreciere deosebită pentru întreaga activitate și pentru contribuția la promovarea imaginii țării noastre, Decret nr.1071/10.12.2004;
- Diplome de Excelență acordate de ministerul Tineretului și Sportului, pentru merite excepționale, 1997 și 2002;
- Distincția „Merite deosebite în activitatea sportivă”, acordată de Consiliul național, pentru Educație Fizică și Sport, 1972;
- Placheta de Aur - Federația Română de Atletism, 2004;
- Diploma de onoare și distincția de „Antrenor Emerit” conferite de FRA, 1990;



Rectorul Ioan Sabău înmânează „Diploma de onoare” președintelui Federației Internaționale de Body Building, Ben Weider.



- Diplome de Onoare conferite de MTS și COR, pentru merite deosebite în dezvoltarea olimpismului și a sportului românesc, 1998;

- Diploma de Excelență acordată de Ministerul Educației Cercetării și Tineretului și de către ANEFS, pentru rezultatele de excepție în întreaga activitate, 2007;

- Diploma de Excelență acordată cu prilejul aniversării a 90 de ani de la înființarea Federației Române de Atletism, pentru merite deosebite, 2002;

- Diploma de Onoare conferită d-lui rector Ioan Sabău cu ocazia Aniversării a 75 de ani de la înființarea ANEFS, pentru rezultate excepționale obținute în Domeniul Educației fizice și Sportului, 1997;



Trofeu oferit de președintele FRA Victor Firea, Prof. Dr. Ioan Sabău, Rectorul ANEFS, cu ocazia ședinței festive „ANEFS 75”.

- Diploma de Onoare acordată d-lui Ioan Sabău de către Clubul Sportiv al Armatei „Steaua”, cu ocazia aniversării a 50 de ani de la înființarea acestuia, pentru contribuția adusă la afirmarea sportului pe plan național și internațional, 1997;

- Expert Evaluator, titlu din partea consiliului Național al Cercetării Științifice din Învățământul Superior, pentru „competența și ținuta științifică în activitatea de evaluare a cercetării din Învățământul Superior” - certificat nr. 497/11/05.2001;

- Diplomă de Excelență pentru Merite Excepționale obținute în sportul de înaltă performanță, în calitate de absolvent al ICF, conferită de ANEFS cu ocazia „ANEFS 75”, 1997.

În paralel cu activitatea didactică, domnul Sabău a fost un antrenor de excepție, cu numeroase cunoștințe în domeniul atletismului pe care a reușit să le transmită mai departe și să le perfecționeze prin studiu continuu și prin activitate științifică și publicistică care să-i facă cinste. Preocuparea firească a domnului profesor în cercetările din domeniul antrenamentului sportiv de mare performanță în atletism, (probele de aruncări) a dus în cariera dânsului la rezultate concretizate, prin performanțele de excepție pe care atleții pregătiți de domnia sa le-au obținut: atleta Mihaela Loghin - maestră emerită a sportului, vicecampionă olimpică la aruncarea greutății 20,47, Los Angeles, 1984; medalie de argint la Jocurile Mondiale

Universitare, Paris, 1975; medalie de bronz și record al României în Mexic la Jocurile Mondiale Universitare, 1979; medalie de bronz la Campionatele Europene de la Madrid, 1986. Este atleta care a depășit granițele celor 19 m, 20 m, și 21 m în proba de aruncare a greutății, realizând zeci de recorduri și titluri consecutive de Campioană a României.

A urmat atletul Nicu Roată - maestru al sportului, Campion Balcanic, Izmir, 1986; Campion Internațional al României cu record al României 79,32 m, București, 1985, Record al României 81,16 m, Concurs de Grand Prix, Praga, 1987; 2 titluri de Campion Național al României și 10 recorduri consecutive ale României la aruncarea suliței.



Nicu Roată, Corina Ivan, Ioan Sabău, Constantin Miclea la antrenament. Stadionul Tineretului, București, 1988.



Antrenorul Ioan Sabău și atleții Stela Neamțu - aruncarea discului, Nicu Roată - suliță, Constantin Miclea - suliță, în perioada de pregătire Predeal, 1987.

Atleta Corina Gârbea Ivan - Maestră a sportului, Campioană Națională a României, numeroase medalii la Jocurile Balcanice și la Campionatele Naționale Universitare, realizând cu 67 m, a doua performanță a sezonului în meciul Ungaria - România, Debrecen, 1982, medalie de aur la aruncarea suliței 66,58 m la concursul de Grand Prix, Budapesta; 1982, medalie de aur cu 61,40 m, la Cupa Europei, Bodo, Norvegia, 1987.



Atletul Constantin Miclea - maestru al sportului, al doilea atlet (după Nicu Roată) care a depășit granița celor 80 m cu noul tip de suliță, medalie de aur și campion balcanic la aruncarea suliței 80,70 m, Sofia, 1988; Campion Național al României, medalie de argint la concursul „Ziua Olimpică”, Berlin, 1989.



Antrenorul Ioan Sabău și atleții Stela Neamțu, Nicu Roată și Constantin Miclea, în sala de forță - Predeal, 1987.

Atleta Elisabeta Neamțu - Maestră a sportului, medalie de aur la aruncarea discului 62,82 m, Cupa Europei, Edinburgh, 1986, medalie de aur la concursul de Grand Prix la aruncarea discului 63,40 m, Belgrad, 1987;

medalie de aur și prima Campioană Națională la aruncarea ciocanului, realizând și două recorduri ale României în cadrul concursului, București, 1988.

În 1995, ca antrenor de lot național, l-a pregătit și pe atletul Dumitru Negoită, care în acel sezon a obținut medalie de aur și titlul de Campion Balcanic la aruncarea suliței 92,42 m (cu vechiul tip de suliță), Stara Zagora – Bulgaria; medalie de aur și Campion Mondial Universitar cu aruncarea de 84,70 m la Kobe - Japonia.

Cu ocazia decernării titlului „Doctor Honoris Causa”, rectorul Universității „Valahia” din Târgoviște, dl. prof. univ. dr. Ion Cucui spune despre profesorul Sabău: „Sărbătorim astfel un om care a știut să-și îndeplinească cariera de dascăl și de cercetător cu cea de practician, înnobilându-le și ducându-le pe cele mai înalte culmi. Profesorul Ioan Sabău demonstrează prin fapte că și-a însușit dictonul lui Brâncuși potrivit căruia „*Lucrurile nu sunt greu de făcut. Greu este să te pui în starea de a le face*”, și în plus a găsit secretul manierei de realizare a tot ceea ce și-a propus. Credem că, în spatele a toate acestea, stau voința dublată de o muncă neobosită și mai credem că domnia sa este un exemplu demn de urmat de toți cei care îl cunosc, dar mai ales de tânăra generație, care are privilegiul de a se împărtăși la un izvor nesecat de conștiinciozitate și determinare”.

În încheiere doresc să subliniez faptul că domnul profesor Ioan Sabău este singura persoană din România care posedă cumulativ titlurile de Profesor universitar doctor, Doctor Honoris Causa și Antrenor emerit, toate acestea în domeniul Educație Fizică și Sport.

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## IN MEMORIAM

### Iustin Lupu (1946-2013)



Revista *Palestrica Mileniului III* (redactorii, colaboratorii, autorii articolelor și cititorii) au suferit recent – Noiembrie 2013 o grea pierdere: dispariția în urma unei boli necruțătoare a Conf. Dr. Iustin Lupu, fost coordonator al Departamentului Științe Sociale și Activități Fizice al revistei noastre.

Această pierdere dureroasă a fost cu atât mai neașteptată, cu cât Iustin Lupu, cu stoicism și discreție, a activat depășind suferințele provocate de boală. El a mascat suferințele prin comportamentul său optimist și activ, încât boala sa a rămas practic necunoscută prietenilor săi de la redacție (Prof. S. Tache, Prof. T. Bocu, Dr. P. Derevenco).

Natura și caracterul l-au înzestrat pe Iustin cu calități deosebite, cizelate prin educație și cultură. Astfel, Iustin însuma numeroase calități și abilități intelectuale: avea o deschidere largă spre utilizarea computerizării pusă în folosul unei temeinice documentări, ușurată de buna

cunoaștere a limbii engleze, a statisticii și informaticii și de un spirit critic acut.

Activitatea sa bogată este reflectată parțial în articolele semnate ca prim autor sau coautor.

Dintre cărțile publicate semnalăm „Manualul de Bioetică Medicală” - principii, dileme, soluții - a apărut la Editura Medicală Universitară Iuliu Hațieganu; ediția 1, 2001, ediția a 2-a, 2004 completată.

Volumul reușește să prezinte doar în 178 pagini o tematică vastă, incitantă, instructivă, nu doar pentru studenții catedrelor unde preda.

Redăm cuprinsul capitolelor:

1) Etică, morală, moralitate; 2) Bioetica; 3) Principiul autonomiei; 4) Principiul nondăunării; 5) Principiul binefacerii; 6) Principiul echității sau justiției; 7) Coduri etice; 8) Sinuciderea; 9) Eutanasia; 10) Clonarea; 11) Terorism și bioterorism.

Volumul este prevăzut cu 15 anexe (scale, chestionare, indicatoare etc.).

Nu dorim să transformăm această evocare a prietenului nostru Iustin într-un savant curriculum vitae.

Recomandăm doritorilor de a se documenta asupra contribuțiilor științifice teoretice și practice aduse de Iustin Lupu și publicate în paginile revistei *Palestrica*, să consulte colecția PM III aflată la sediul redacției.

*Redacția revistei Palestrica Mileniului III*

## 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; psycho-neuroendocrinology 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 University 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. *Educație Fizică și 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 senescentei. In: Hăulică I. (sub red.) *Fiziologia umană*, Ed. Medicală, Bucureşti, 1996, 931-947.

Starting with issue 4/2010, every article should include a minimum of 15 bibliographic references and a maximum of 100, mostly journals articles published in the last 10 years. Only a limited number of references (1-3) older than 10 years will be allowed. At least 20% of the cited resources should be from recent international literature (not older than 10 years).

#### **Peer-review process**

In the final stage all materials will be closely reviewed by at least two competent referees in the field (Professors, and Docent doctors) so as to correspond in content and form with the requirements of an international journal. After this stage, the materials will be sent to the journal's referees, according to their profiles. After receiving the observations from the referees, the editorial staff shall inform the authors of necessary corrections and the publishing requirements of the journal. This process (from receiving the article to transmitting the observations) should last about 4 weeks. The author will be informed if the article was accepted for publication or not. If it is accepted, the period of correction by the author will follow in order to correspond to the publishing requirements.



### **Conflict of interest**

The authors must mention all possible conflicts of interest including financial and other types. If you are sure that there is no conflict of interest we ask you to mention this. The financing sources should be mentioned in your work too.

### **Specifications**

The specifications must be made only linked to the people outside the study but which have had a substantial contribution, such as some statistical processing or review of the text in the English language. The authors have the responsibility to obtain the written permission from the mentioned persons with the name written within the respective chapter, in case the readers refer to the interpretation of results and conclusions of these persons. Also it should be specified if the article uses some partial results from certain projects or if these are based on master or doctoral theses sustained by the author.

### **Ethical criteria**

The Editors will notify authors in due time, whether their article is accepted or not or whether there is a need to modify texts. Also the Editors reserve the right to edit articles accordingly. Papers that have been printed or sent for publication to other journals will not be accepted. All authors should send a separate letter containing a written statement proposing the article for submission, pledging to observe the ethics of citation of sources used (bibliographic references, figures, tables, questionnaires).

For original papers, according to the requirements of the Helsinki Declaration, the Amsterdam Protocol, Directive 86/609/EEC, and the regulations of the Bioethical Committees from the locations where the studies were performed, the authors must provide the following:

- the informed consent of the family, for studies in children and juniors;
- the informed consent of adult subjects, patients and athletes, for their participation;
- malpractice insurance certificate for doctors, for studies in human subjects;
- certificate from the Bioethical Committees, for human study protocols;
- certificate from the Bioethical Committees, for animal study protocols.

The data will be mentioned in the paper, in the section Materials and Methods. The documents will be obtained before the beginning of the study. Will be mentioned also the registration number of the certificate from the Bioethical Committees.

Editorial submissions will be not returned to authors, whether published or not.

### **FOR THE ATTENTION OF THE SPONSORS**

Requests for advertising space should be sent to the Editors of the "Palestrica of the Third Millennium" journal, 1, Clinicilor St., 400006, Cluj-Napoca, Romania. The price of an A4 full colour page of advertising for 2012 will be EUR 250 and EUR 800 for an advert in all 4 issues. The costs of publication of a logo on the cover will be determined according to its size. Payment should be made to the Romanian Medical Society of Physical Education and Sports, CIF 26198743. Banca Transilvania, Cluj branch, IBAN: RO32 BTRL 0130 1205 S623 12XX (RON).

### **SUBSCRIPTION COSTS**

The "Palestrica of the Third Millennium" journal is printed quarterly. The subscription price is 100 EUR for institutions abroad and 50 EUR for individual subscribers outside Romania. For Romanian institutions, the subscription price is 120 RON, and for individual subscribers the price is 100 RON. Note that distribution fees are included in the postal costs.

Payment of subscriptions should be made by bank transfer to the Romanian Medical Society of Physical Education and Sports, CIF 26198743. Banca Transilvania, Cluj branch, IBAN: RO32 BTRL 0130 1205 S623 12XX (RON), RO07 BTRL 01,304,205 S623 12XX (EUR), RO56 BTRL 01,302,205 S623 12XX (USD). SWIFT: BTRLRO 22

Please note that in 2010 a tax for each article submitted was introduced. Consequently, all authors of articles will pay the sum of 150 RON to the Romanian Medical Society of Physical Education and Sport published above. Authors who have paid the subscription fee will be exempt from this tax. Other information can be obtained online at [www.pm3.ro](http://www.pm3.ro) "Instructions for Authors", at our e-mail address [palestrica@gmail.com](mailto:palestrica@gmail.com) or at the postal address: 1, Clinicilor St., 400006, Cluj-Napoca, Romania, phone: +40264-598575.

### **INDEXING**

Title of the journal: Palestrica of the third millennium – Civilization and sport

pISSN: 1582-1943; eISSN: 2247-7322; ISSN-L: 1582-1943

Profile: a Journal of Study and interdisciplinary research

Editor: "Iuliu Hațieganu" University of Medicine and Pharmacy of Cluj-Napoca and The Romanian Medical Society of Physical Education and Sports in collaboration with the Cluj County School Inspectorate

The level and attestation of the journal: a journal rated B+ by CNCIS in the period 2007-2011 and certified by CMR since 2003

Journal indexed into International Data Bases (IDB): EBSCO, Academic Search Complete, USA and Index Copernicus, Journals Master List, Poland; DOAJ (Directory of Open Access Journals), Sweden.

Year of first publication: 2000

Issue: quarterly

The table of contents, the summaries and the instructions for authors can be found on the internet page: <http://www.pm3.ro>. Access to the table of contents and full text articles (in .pdf format) is free.

## ÎN ATENȚIA COLABORATORILOR

### Tematica revistei

Ca tematică, revista are un caracter multidisciplinar orientat pe domeniile biomedical, sănătate, efort fizic, științe sociale, aplicate la activitățile de educație fizică și sport, astfel încât subiectele tratate și autorii aparțin mai multor specialități din aceste domenii. Principalele rubrici sunt: „Articole originale” și „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 și riscuri; determinanți emoționali ai performanței; recuperarea pacienților cu suferințe ale coloanei vertebrale; sindroame de stres și psihosomatică; educația olimpică, aspecte juridice ale sportului; efortul fizic la vârstnici; tulburări ale psihomotricității; pregătirea sportivă la altitudine; fitness; biomecanica mișcărilor; testele EUROFIT și alte metode de evaluare a efortului fizic; reacții adverse ale eforturilor; endocrinologie sportivă; depresia la sportivi; dopajul clasic și genetic; Jocurile Olimpice etc.

Dintre articolele consacrate studiilor și cercetărilor experimentale notăm pe cele care vizează: metodica educației fizice și sportului; influența unor ioni asupra capacității de efort; profilul psihologic al studentului la educație fizică; metodica în gimnastica sportivă; selecția sportivilor de performanță.

Alte articole tratează teme particulare vizând diferite sporturi: înotul, gimnastica ritmică și artistică, handbalul, voleiul, baschetul, atletismul, schiul, fotbalul, tenisul de masă și câmp, luptele libere, sumo.

Autorii celor două rubrici de mai sus sunt medici, profesori și educatori din învățământul universitar și preuniversitar, antrenori, cercetători științifici etc.

Alte rubrici ale revistei sunt: editorialul, actualitățile editoriale, recenziile unor cărți - ultimele publicate în domeniu, la care se adaugă și altele prezentate mai rar (invenții și inovații, universitaria, preuniversitaria, forum, remember, calendar competițional, portrete, evenimente științifice).

Subliniem rubrica “Memoria ochiului fotografic”, unde se prezintă fotografii, unele foarte rare, ale sportivilor din trecut și prezent.

De menționat articolele semnate de autori din Republica Moldova privind organizarea învățământului sportiv, variabilitatea ritmului cardiac, etapele adaptării la efort, articole ale unor autori din Franța, Portugalia, Canada.

Scopul principal al revistei îl constituie valorificarea rezultatelor activităților de cercetare precum și informarea permanentă și actuală a specialiștilor din domeniile amintite. Revista își asumă și un rol important în îndeplinirea punctajelor necesare cadrelor didactice din învățământul universitar și preuniversitar precum și medicilor din rețeaua medicală (prin recunoașterea revistei de către Colegiul Medicilor din România), în avansarea didactică și profesională.

Un alt merit al revistei este publicarea obligatorie a cuprinsului și a câte unui rezumat în limba engleză, pentru toate articolele. Frecvent sunt publicate articole în extenso într-o limbă de circulație internațională (engleză, franceză).

Revista este publicată trimestrial iar lucrările sunt acceptate pentru publicare în limba română și 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) și listate, prin poștă pe adresa redacției. Lucrările colaboratorilor rezidenți în străinătate și ale autorilor români trebuie expediate pe adresa redacției:

#### **Revista «Palestrica Mileniului III»**

Redactor șef: Prof. dr. Traian Bocu

Adresa de contact: palestrica@gmail.com sau traian\_bocu@yahoo.com

Adresa poștală: 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 activității de cercetare a colaboratorilor săi, în special prin stimularea participării acestora la competiții de proiecte. Menționăm că articolele publicate în cadrul revistei sunt luate în considerare în procesul de promovare în cariera universitară (acreditare obținută în urma consultării Consiliului Național de Atestare a Titlurilor și Diplomelor Universitare).

Ne propunem de asemenea să încurajăm publicarea de studii și cercetări, care să cuprindă elemente originale relevante mai ales de către tineri. Toate articolele vor trebui să aducă un minimum de contribuție personală (teoretică sau practică), care să fie evidențiată în cadrul articolului.

În perspectivă ne propunem îndeplinirea criteriilor care să permită promovarea revistei la niveluri superioare cu recunoaștere internațională.

### STRUCTURA ȘI TRIMITEREA ARTICOLELOR

Manuscrisul trebuie pregătit în acord cu prevederile Comitetului Internațional 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.

**Ilustrațiile:**

**Figurile** (grafice, fotografii etc.) vor fi numerotate consecutiv în text, cu cifre arabe. Vor fi editate cu programul EXCEL sau SPSS, și vor fi trimise ca fișiere separate: „figura 1.tif”, „figura 2. jpg”, iar la solicitarea redacției și în original. Fiecare grafic va avea o legendă care se trece **sub** figura respectivă.

**Tabelele** vor fi numerotate consecutiv în text, cu cifre romane, și vor fi trimise ca fișiere separate, însoțite 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 instituției, adresa poștală și 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 consacrați). Toate articolele vor avea un rezumat în limba engleză. Nu se vor folosi prescurtări, note de subsol sau referințe.

*Premize și obiective:* descrierea importanței studiului și precizarea premizelor și obiectivelor cercetării.

*Metodele:* includ următoarele aspecte ale studiului:

Descrierea categoriei de bază a studiului: de orientare sau aplicativ.

Localizarea și perioada de desfășurare a studiului. Colaboratorii vor prezenta descrierea și mărimea loturilor, sexul (genul), vârsta și alte variabile socio-demografice.

Metodele și instrumentele de investigație folosite.

*Rezultatele* vor prezenta datele statistice descriptive și inferențiale obținute (cu precizarea testelor statistice folosite): diferențele dintre măsurătoarea inițială și cea finală, pentru parametri investigați, semnificația coeficienților de corelație. Este obligatorie precizarea nivelului de semnificație (valoarea *p* sau mărimea efectului *d*) și a testului statistic folosit etc.

*Concluziile* care au directă legătură cu studiul prezentat.

Articolele de orientare și 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 și Metode (inclusiv informațiile etice și statistice), Rezultate, Discutarea rezultatelor, Concluzii (și 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 menționa: numele tuturor autorilor și inițialele prenumelui, anul apariției, titlul articolului în limba originală, titlul revistei în prescurtare internațională (caractere italice), numărul volumului, paginile

*Articole:* Pop M, Albu VR, Vișan D et al. Probleme de pedagogie în sport. Educația Fizică și Sportul 2000; 25(4):2-8.

*Cărți:* Drăgan I (coord.). Medicina sportivă aplicată. Ed. Editis, București 1994, 372-375.

*Capitole din cărți:* Hăulică I, Bălțatu O. Fiziologia senescentei. În: Hăulică I. (sub red.) Fiziologia umană. Ed. Medicală, București 1996, 931-947.

Începând cu revista 4/2010, fiecare articol va trebui să se bazeze pe un minimum de 15 și un maximum de 100 referințe bibliografice, în majoritate articole nu mai vechi de 10 ani. Sunt admise un număr limitat de cărți și articole de referință (1-3), cu o vechime mai mare de 10 ani. Un procent de 20% din referințele bibliografice citate trebuie să menționeze literatură străină studiată, cu respectarea criteriului actualității acesteia (nu mai vechi de 10 ani).

## Procesul de recenzare (peer-review)

Într-o primă etapă toate materialele sunt revizuite riguros de cel puțin doi referenți competenți în domeniu respectiv (profesori universitari doctori și doctori docenți) pentru ca textele să corespundă ca fond și formă de prezentare cerințelor unei reviste serioase. După această etapă materialele sunt expediate referenților revistei, în funcție de profilul materialelor. În urma observațiilor primite din partea referenților, redacția comunică observațiile autorilor în vederea corectării acestora și încadrării în cerințele de publicare impuse de revistă. Acest proces (de la primirea articolului până la transmiterea observațiilor) durează aproximativ 4 săptămâni. Cu această ocazie se comunică autorului dacă articolul a fost acceptat spre publicare sau nu. În situația acceptării, urmează perioada de corectare a articolului de către autor în vederea încadrării în criteriile de publicare.

## Conflicte de interese

Se cere autorilor să menționeze toate posibilele conflicte de interese incluzând relațiile financiare și de alte tipuri. Dacă sunteți siguri că nu există nici un conflict de interese vă rugăm să menționați acest lucru. Sursele de finanțare ar trebui să

fie menționate în lucrarea dumneavoastră.

### **Precizări**

Precizările trebuie făcute doar în legătură cu persoanele din afara studiului, care au avut o contribuție substanțială la studiul respectiv, cum ar fi anumite prelucrări statistice sau revizuirea textului în limba engleză. Autorii au responsabilitatea de a obține permisiunea scrisă din partea persoanelor menționate cu numele în cadrul acestui capitol, în caz că cititorii se referă la interpretarea rezultatelor și concluziilor acestor persoane. De asemenea, la acest capitol se vor face precizări în cazul în care articolul valorifică rezultate parțiale din anumite proiecte sau dacă acesta se bazează pe teze de masterat sau doctorat susținute de autor, alte precizări.

### **Criterii deontologice**

Redacția va răspunde în timp util autorilor privind acceptarea, neacceptarea sau necesitatea modificării textului și își 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 redacției odată cu articolul propus spre publicare, într-un fișier word separat, o declarație scrisă în acest sens, cu angajamentul respectării normelor deontologice referitoare la citarea surselor pentru materialele folosite (referințe bibliografice, figuri, tabele, chestionare).

Pentru articolele originale, în conformitate cu îndeplinirea condițiilor Declarației de la Helsinki, a Protocolului de la Amsterdam, a Directivei 86/609/EEC și a reglementărilor Comisiilor de Bioetică din locațiile unde s-au efectuat studiile, autorii trebuie să prezinte:

- acordul informat din partea familiei, pentru studiile pe copii și juniori;
- acordul informat din partea subiecților adulți, pacienți și sportivi, pentru participare;
- adeverință de Malpraxis pentru medici, pentru cercetările/studiile pe subiecți umani;
- adeverință din partea Comisiilor de Etică, pentru protocolul de studiu pe subiecți umani;
- adeverință din partea Comisiilor de Bioetică, pentru protocolul de studiu pe animale.

Datele vor fi menționate în articol la secțiunea Material și metodă. Documentele vor fi obținute înainte de începerea studiului. Se va menționa și numărul de înregistrare al adeverinței din partea Comisiilor de Etică.

Materialele trimise la redacție nu se restituie autorilor, indiferent dacă sunt publicate sau nu.

### **ÎN ATENȚIA SPONSORILOR**

Solicitățile pentru spațiile de reclamă, vor fi adresate redacției revistei "Palestrica Mileniului III", Str. Clinicilor nr. 1, cod 400006 Cluj-Napoca, România. Prețul unei pagini de reclamă full color A4 pentru anul 2012 va fi de 250 EURO pentru o apariție și 800 EURO pentru 4 apariții. Costurile publicării unui Logo pe copertile revistei, vor fi stabilite în funcție de spațiul ocupat. Plata se va face în contul Societății Medicale Române de Educație Fizică și Sport, CIF 26198743. Banca Transilvania, sucursala Cluj Cod IBAN: RO32 BTRL 0130 1205 S623 12XX (LEI).

### **ÎN ATENȚIA ABONAȚILOR**

Revista "Palestrica Mileniului III" este tipărită trimestrial, prețul unui abonament fiind pentru străinătate de 100 Euro pentru instituții, și 50 Euro individual. Pentru intern, prețul unui abonament instituțional este de 120 lei, al unui abonament individual de 100 lei. Menționăm că taxele de difuzare poștală sunt incluse în costuri.

Plata abonamentelor se va face prin mandat poștal în contul Societății Medicale Române de Educație Fizică și 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, toți autorii semnatari ai unui articol vor achita împreună suma de 150 Lei, în contul Societății Medicale Române de Educație Fizică și Sport publicat mai sus.

Autorii care au abonament vor fi scutiți de această taxă de articol.

Alte informații se pot obține online de pe [www.pm3.ro](http://www.pm3.ro) „Pentru autori” sau pe adresa de mail a redacției [palestrica@gmail.com](mailto:palestrica@gmail.com) sau pe adresa poștală: Str. Clinicilor nr.1 cod 400006, Cluj-Napoca, România, Telefon:0264-598575.

### **INDEXAREA**

Titlul revistei: Palestrica Mileniului III – Civilizație și sport

pISSN: 1582-1943; eISSN: 2247-7322; ISSN-L: 1582-1943

Profil: revistă de studii și cercetări interdisciplinare

Editor: Universitatea de Medicină și Farmacie „Iuliu Hațieganu” din Cluj-Napoca și Societatea Medicală Română de Educație Fizică și Sport, în colaborare cu Inspectoratul Școlar al Județului Cluj

Nivelul de atestare al revistei: revistă acreditată în categoria B+ de CNCS în perioadele 2007-2011 și atestată CMR din anul 2003 și în prezent

Revistă indexată în Bazele de Date Internaționale (BDI): EBSCO, Academic Search Complete, USA și Index Copernicus, Journals Master List, Polonia, DOAJ (Directory of Open Access Journals), Sweden

Anul primei apariții: 2000

Periodicitate: trimestrială

Cuprinsul, rezumatele și instrucțiunile pentru autori se găsesc pe pagina de Internet: <http://www.pm3.ro> Accesul la cuprins și articole în extenso (în format .pdf) este gratuit.



**TALON DE INDIVIDUAL DE ABONAMENT 2014**

**„PALESTRICA MILENIULUI III – CIVILIZAȚIE ȘI SPORT”**

4 NUMERE / 2014 – 100 lei

NUMELE (INSTITUȚIA).....  
ADRESA: Strada..... Nr..... Bloc..... Scara..... Etaj..... Ap.....  
Sector..... Localitatea..... Județ.....  
Cod poștal..... Tel. fix..... Tel Mobil.....  
Fax..... E-mail.....

Plata se va face în contul Societății Medicale Române de Educație Fizică și Sport, CIF 26198743, Banca Transilvania, Cluj, IBAN: RO32 BTRL 0130 1205 S623 12XX (LEI), SWIFT: BTRLRO 22, cu specificația „Abonament la revista Palestrica Mileniului III”.

Vă rugăm anexați xerocopia dovezii de achitare a abonamentului, de talonul de abonament și expediați-le pe adresa redacției, în vederea difuzării revistelor cuvenite.

**„PALESTRICA MILENIULUI III – CIVILIZAȚIE ȘI SPORT”**

este o revistă recunoscută de CNCIS și este luată în considerare în vederea avansării didactice. De asemenea, revista este acreditată de către Colegiul Medicilor din România. Un abonament anual beneficiază de 5 credite.



**TALON DE ABONAMENT 2014**

**„PALESTRICA MILENIULUI III – CIVILIZAȚIE ȘI SPORT”**

4 NUMERE / 2014 – 100 lei

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