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Editorial

Ioan Slavici the Contemporary or the Integrity of Historical Restitution

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Certainly, every historical endeavour is born out of three fundamental answers to the why, the how and the when? Therefore the assertions of certain historians (such as Dale H. Porter, *History and Theory* 4; 297-313, 1975) that *„historical proof exist not to discover its own significance but to allow interrogation"*, are only useful in orienting, in ordering the perspective of each act of recuperation. The act of restitution, which is a compulsory step of each historical endeavour – and by which the life and the work are viewed through a complex relationship with its social and historical background – started in the museum from Şiria (Arad county) that bears his name. Upon seeing ,,Educaţiunea Fizică" (ed. Minerva, Bucharest, 1909) I was smitten – Slavici being a well known author, less so as a pedagogue and totally unknown in the field of P.E- which, I must admit, represents a type of distraction; it ultimately means to be incredibly unmindful to the world as it is, fact that turns every honest *interpres*` work into a very difficult one. The term *in-*

terpres designates the one who is necessary to afford the integral passing of historical proof from one age to another. Ioan Slavici (1848-1925) is our contemporary not so much by cancelling out the effect of chronological distance but because the book`s message is adequate to the requirements of a very different present. In other words *then* and *now* are the same. For Slavici, the definition of physical education – the main theme of this text! – („physical education is the guidance towards maintaining one`s own health and the proper development of one`s body") incorporates, aside the language used, the two major objectives of the contemporary definition: health and physical harmony (see, Dictionary of Sport Science, Schorndorf, Germany, 1987). Therefore, the issue of appropriating the meaning contained in the two sources must be seen as an undertaking in overcoming temporal distance and, at the same time, in integrating tradition in the present dynamic of understanding physical education.

Otherwise, not only the definition provided but the entire book, which represents the starting and end point of the restitution, must be considered within a specific context, one that is a century away. The distance itself is not insurmountable because an informed reader should be able to perceive, through a careful reading process, a certain number of very actual things and significances.

It is well known that the 19th century was a battleground for systems derived from *gymnastics* (see Nicu Alexe, *Istoria exerciţiilor fizice,* Ed. Fundaţiei Romania de Mâine, Bucharest, 2006) the main players being F. Ludwig Jahn (German), Ling (Swedish), Amoros (France), Clias (Swiss), Arnold (English) or Tyrs (Czech); in Walachia the main contributions were brought forth by Gheorghe Moceanu, Stephan Ludwig Roth and Spiru Haret. It must be underlined that physical education (as a concept) gains institutional consistency only in 1920 (France) and nationally in 1928 (The Law of secondary education), therefore when Slavici`s book was published in 1909, his usage of the notion (physical education in schools) was ahead of its time. Slavici feels the need for a drastic educational reform and purposely writes his book from a physiological perspective, so that physical education`s major objective comes to ad-

dress health, growth and harmonious development. Allow me two support examples: „the wise man`s chief concern is to maintain his vigour by fortifying the weak bodily parts and overcoming his overwhelming urges „(pg. 7) and „every movement contains four elements: the intention, the plan, the dexterity and the power of execution" or „dexterity and power pertain to physical education and are together developed through persistent and rational preparation" (pg. 95).

My interpretation is based on the methodological premise that historic investigation and structural description are interdependent. For, the path from the work itself to its background (*i.e*. its historic context) would be nothing but a senseless drift if not regulated by knowledge referring to the work`s internal structures. Therefore, the internal analysis of the ideas the book relies on is meaningless if the origins of the ideas themselves are ignored.

Basing his book on at least two identifiable sources - *Consideraţii asupra importanţei şi necesităţii gimnasticii din punct de vedere higienic şi social* (C.I. Istrati, 1880) and *L'alimentation et les Regimes chez l'homme et chez les maladies* (Armand Gautier, 1904) – the author converses not only with the socio-historic reality of his time but also with an entire assimilated, interrogated or rejected library, resulting in a surprisingly contemporary message: „without physical education, intellectual and especially moral education become impossible and, more so, it is clear that times of cultural and moral decay were caused by physical degeneration"(pg. 103) .

The significance of the text, which I consider to be innovative for the period, is also a consequence of Slavici`s pedagogical work., for this work is part of an (sadly) unfinished didactic project (The Rational Education) which should have contained the following parts: Moral Education, Intellectual Education, Professional Education and Physical Education.

Therefore, in a novel and visionary manner, Slavici becomes also relevant as one of those who have laid the foundations of national physical education.

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BMI Effects on Childhood Motor Skills

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Abstract
Introduction: The development of Motor Skills (Fine and Gross) during childhood is considered essential and very important considering them as „building blocks" of their motor development. Educating early motor skill competences are mediatory for children helping them to easily perform different daily movements and more complex influencing on providing an active lifestyle. But unfortunately, the motor skills in obese children seem to be limited as a result of having difficulties controlling their posture during different daily movements. Postural control plays an important role almost at every type of movements, especially over those which are directly influenced by this capacity in the biomechanical aspect. **Aim:** The goal of this review paper was to investigate the relationship between BMI and Motor Skills in children. Through this study, we wanted to provide other important scientific reasons about the necessity of obesity prevention since childhood period as mediatory of a better lifestyle. **Methodology:** To successfully realize this review paper we studied and analyzed the contemporary scientific literature provided by various Internet-based research sectors such as „Jab Ref" „Pub Med" „Google Scholar" „Medline" „Sports Discuss" and „Research Gate". **Results:** The results have shown that obese children manifested limited „Gross" Motor Skills, which are identified mostly in those motions that BMI negatively impacted on their execution affecting especially their dexterity. This limited situation regarding gross motor skills at obese children result because of difficulties that they have to manage their heavyweight and to keep balance during performing. Unfortunately, the relationship between *fine motor skills and BMI* continues to be unclear because there are few studies

analyzing this relationship and different testing protocols used by them to identify it. **Conclusion:** At the end of our study, we can say that despite the diverse evidences, BMI may negatively affect especially those Motor Skills (fine & gross) when body weight makes it difficult to maintain balance during motion execution reducing postural control. One of the most important conclusion after all of this review we can strongly emphasize that Physical Activity must be part of everyone daily life for a healthy lifespan. In addition, for obese children, physical activities are mediatory in order to lose weight influencing postural control improvement and better motor skills.

Keywords: obese and overweight children, motor skills development, fine & gross motor skills.

Introduction

To provide a normal motor development for young generation means a lot for them, facilitating the execution of daily life activities and integration in different experiences. Therefore, it is important to motivate more and more our children towards the development of motor competencies focusing on the diversity and accuracy of these abilities. The sedentary lifestyle, as the latest trend of modern life, has negatively affected the normal motor development reducing also the possibility to provide diverse motor abilities among children. Unfortunately, these limited motor competences among young generation are consequences of obesity caused by the lack of physical activities *(Castetbon K and Andreyeva T., 2012)* There are many studies that recently are focused on analyzing the correlation between BMI and Motor skill based on the essential importance of motor skills among children and the increased prevalence of childhood obesity. *(Gortmarker et al., 1993; Lopes et al, 2012; Kumanyika, S, 2001)*

The aim of our study was the identification of scientific data about the impact of BMI on Motor Skill development on children because of the prevalence of obesity detected even at Albanian children. Detecting this correlation will be another negative health issue caused by obesity, which means that the prevention of it is immediately necessary in order to promote the wellbeing among children.

Motor skills are considered essential for better children development because of the positive influence on self-confidence and social relationships. Unfortunately, these motor competences appear limited among children because of inactivity created by the time spent with electronic games keeping them away from many active funny games (outdoor or indoor games). *(Markola et al., 2016)* Gross motor skills, including movements that are productions of big muscles contraction such as walking, running, standing, are the first motor skills that develop among childhood. Furthermore, the sequence of motor skills development continues with fine motor skills such as catching and keeping, keeping and throwing and many other motor abilities that are products of small muscles contraction. Fine motor skills are the ones that give a child the ability to handle or manipulate small objects while Gross Motor Skills are important for more complex tasks where coordinating and maintaining balance during their performance is important. *(Adolph & Berger., 2006)* It is important to emphasize the necessity of developing Gross Motor Skills because of its effects on the physical development of our child. *(Price & Greeen, 2016)*

Unlike the „Gross" Motor Skills which are the first who develop, Fine Motor Skills appears later and more exactly when children are able to use their smaller muscles, such as hand and feet muscles. *(Greutman H., 2017)* Fine Motor Skills are identified as one of the most important motor abilities for a better daily life because they help children to perform different actions like writing, holding small objects, wearing clothes, eating, using scissors, using computer keyboards, manipulate different objects etc. These fine motor competences except coordination ability, as a mandatory requirement, requires even precision which is another very important component that determines the success of such fine movements. *(Amundsen & Weil, 2001)*

However, it is important to note that in order to ensure a smooth development of Fine Motor Skills, the Gross Motor Skills should be developed too as these skills affect one another demonstrate with ease, and above all with precision. *(Gesell & Amatruda, 1947)*

There are many researches about the consequences of obesi-

ty showing the negative impact of it on health, psychosocial and physical aspects limiting also motor abilities reducing quality of daily life activities. Excessive body weight complicates the ability to move easily affecting negatively the balance control ability which is important and essential for the development of motor skills. *(Teasdale et.al, 2013; Daniels S.R, 2006)*

Since the „balance" is the basic requirement for almost all the daily life motions and the difficulties that obese children have to control balance, becomes the cause of the accuracy and dexterity reduction. This is the reason why an increased BMI, by causing problems with the ability to control balance during performing, may negatively affect also the accuracy and dexterity of different motor patterns. *(Browning, R.C, 2012)*

There is a study about the correlation between BMI and Motor Skills realized in 2004 that identified that obese children could perform every action according to the test protocol but their performance resulted slower than their peer group with normal weight. *(Graf C, et al., 2004)*

This result has been shown even in 2009 from the study of *Deforche* who determined that obese children because of their difficulties to perform fast are less likely to be part of such sports or physical activities where jumps are the most frequent actions. *(Deforche et al., 2009)* Unfortunately, avoiding obese children from various physical activities can further contribute to maintaining excess body weight and even further accumulation of body fat. *(Parsons et al., 1999)*

For our study, it is interesting to analyze the study of *Hills and Parker* who studied the influence of BMI on the model of walking over 20 children (10 with normal weight and 10 obese) aged 8.5-10.9 years old. They registered the model of walking for about 10 meters in three ways 1) in a normal, slower way (10% slower than normal walking) and walking fast (30% faster than normal walking). From this study it turned out that obese children were significantly slower where the relative speed of walking was low and they spent more time during a supportive phase and two supporters. It was also noted the difficulty of walking where dexterity and

rhythm of steps were reduced to obese children compared to normal weighted peers. *(Hills & Parker, 1991)* These data resulted even by *McGraw and his colleagues* in the 2000. *(McGraw et al., 2000)*

This negative correlation between BMI and postural control limiting Motor Skills development (Gross and Fine) is detected even by *Teasdale in 2007*, who determined the necessity of reducing body weight on obese children in order to affect their motor abilities by improving both, fine and gross motor skill development. *(Teasdale et al., 2007)*

The delay of motor skills development at obese and overweight children is also detected even from the study concluded during 2017 from two authors *Abdelgawad and Moustafa*. They, after analyzed 75 children age with mean age 15 ± 2.1 months, determined not only the impact of BMI on motor skills development emphasizing that motor developmental appears delayed among overweight and obese children. They also declare the importance of obesity prevention during infancy as necessity to reduce the motor developmental delays in obese and overweight young children. *(Abdelgawad H.A and Moustafa M.M. 2017)*

The same results were detected even by *Berrigan* and his colleagues in 2008 about obesity and its negative influence on motor skill. Part of their study was also the identification of Physical Activity impact on improving reduced motor skills in obese children. They showed great efficacy of losing weight because it was associated with postural control improvement affecting speed and precision of motor skill performance. *(Berrigan et al., 2008)*

This positive effect of losing weight on motor skill improvement is clearly identified even by D'hondt and his colleges in 2011. They detected that the reduction of BMI as result of physical activities was associated by motor coordination and postural control improvements. *(D'hondt et al, 2011)*

There are data indicating that the relationship between BMI and Motor Skill varies from the type of actions selected to the test. Based on these, researches have shown that the relationship was detected more significant especially at those movements that body

weight plays a key role in their performance such as hopping and jumping. *(Castetbon K and Andreyeva T., 2012)*

According to D'hont, because of the lack of studies about fine motor skills and BMI impact, the relationship between BMI and Gross Motor skill is clearer than with fine motor skills.

Despite that, this lack of data showed the absence of these relationships because the selected actions of tests to evaluate fine motor skill development at obese children exclude the impact of BMI on their execution. *(D'hont et al 2008)*

The variety of data that resulted from our review about the relationship between Motor Skills and BMI is the result of various protocol of tests used to assess the Motor Skills, the small number of actions used to analyze „fine and gross" motor skill at obese children and various age groups where studies are based.

Methodology

To successfully realize this review paper we studied and analyzed that contemporary scientific literature that deals more closely with *the effect of overweight or obesity (BMI) on the performance of motor skills in children* and *the importance of physical activity to improve impaired motor skills in children with high body weight (overweight or obese)*. This literature was provided by various Internet-based research sectors such as „Jab Ref" „Pub Med" „Google Scholar" „Medline" „Sports Discuss" and „Research Gate".

Conclusions

After a detailed analysis of refereed researches, we noticed a variety of data related to the correlation between BMI and Motor Skills, where most of the studies are focused more on the examination of BMI impact on Gross Motor Skill than on Fine Motor Skills. At the end of the study, we noticed that most of the studies determine the negative impact of BMI at motor proficiency. Fur-

thermore, excessive body weight seems to have a greater impact on gross motor skills particularly on those gross movements that BMI affects negatively by reducing the dexterity to perform such gross movements as *running, jumping, walking*.

Based on these results we can conclude that the negative impact of BMI on some of the „Gross" motor skills may be the consequence of the biomechanical changes that the obesity causes, making difficult its execution and the ability to perform such movements with agility. In addition, obese children compared to those with normal weight show limited performance of gross motor skill because of less postural control and the difficulties to maintain their balance during a performance which unfortunately is negatively compromised by excessive body weight.

The data about the impact on fine motor skills aren't as clear as the evidence is about gross motor skills and the cause of it is the lack of researches made due to these skills.

In conclusion we noticed that there are two different results of fine motor skills and BMI such as:

- There are studies that have identified and support that BMI can reduce the development of fine motor skill at children. These studies are focused on the examination of those fine movements where the postural control component is essential for their performance and as it is known obese children have difficulties to perform movements where keeping balance is necessary for the execution of fine motor skills.
- But there are also studies that exclude the negative impact of BMI on the development of fine motor skills. These studies determine that obese children can perform fine motor skills as easily as a normal weight child can because during tests are such fine moves where maintaining the equilibrium is not necessary for a good performance.

In conclusion, we emphasize that the variety of data is the consequence of different actions used testing fine and gross motor skills and the different age group where each of the refereed studies is focused.

Despite the diversity noticed in our study, we came to the conclusion that:

- BMI may adversely and negatively affect Motor Skills development, emphasizing that the negative effect of BMI occurs particularly at those movements (*fine or gross*) that overweight hamper the performance of any movements, because of its biomechanical consequences.

It is very important to present that there are many studies proving the necessity of physical activities among obese children emphasizing its impact on losing weight influencing positively motor skills development improving the ability to maintain equilibrium. These studies that prove this positive impact of physical activities on obese children with reduced motor skills, unfortunately, have no practical recommendations of training programs used by them.

Based on the results of our paper, we recommend that:

- Obesity should be one of the most important and immediate health issues for the new generation in order to minimize the reduced mobility that an obese child can manifest in his daily life activities and in different physical activities.
- We should pay more attention to the normal development of Fine and Gross Motor Skills as they are essential for later development of more complex and specialized movements that children need to competently participate in different games, sports or creative activities.
- Further studies are needed to be carried out regarding intervention programs recommendations to improve Motor Skills in Obese children, in order to minimize the reduced mobility of obese children.

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The Role of Didactic Strategies in Optimizing the Training of Handball Players at the Wing Post – the Analysis of the Somatic Indicators

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Abstract
Scope. Designing a didactic strategy means predictability, experience and adaptation of methods and means to the structure of human material, which highlights and differentiates it from the algorithm : the strategy offers alternatives, the option of manifesting intelligent behavior, while the algorithm involves a mechanical state of an action sequence. **Methodology**. The experiment took place between December 2017 - June 2018, in the city of Suceava, with the 18 team of Suceava Sports High School specialized on the wing post. During this period, the team maintained its regular training program, the wings following our proposed program to analyze its effect on improving the tracking parameters. We estimate that the scientific approach to training, from the perspective of the physical, technical and psychological components of sports training, will increase the competitive yield. **Results.** After we aplly our program we see the changes: - at the body fat of the extreme players decreasing significantly from 15.72 ± 3.42% to 13.57 ± 2.52%; - the level of active mass of our subjects recorded a statistically significant increase from 42.73 ± 1.97% to 45.97 ± 2.16%; - the basal energy needs of our athletes suffer a significant increase, from 1697 ± 127.6 kcal to 1818 ± 124.1 kcal. **Conclusion.** The training program has show us good results, but any planning can not achieve perfection, requiring continuous improvements, gait adjustments and additions in line with the requirements of modern handball. The proposed program can be continuously implemented in the research team, by adapting to the conditions of the moment and the proposed objectives.

Keywords: handball, wing , training, strategies

Introduction

Teaching strategies have the role of prefiguring the most appropriate, logical and effective methodological approach to addressing a concrete teaching and learning situation, thus preventing mistakes, risks and undesirable events in teaching. In this context, we talk about the whole of the objectives, content, means and methods of education, the algorithm of the activity of the subjects of the educational process, subject to evolution.

The didactic strategies support the development of mental processes and can be diversified in providing the necessary conditions for the processing of information: some address general learning, the others activate the distinct processes, specifically (Joita, E., 2002, p. 101).

Designing a didactic strategy means predictability, experience and adaptation of methods and means to the structure of human material, which highlights and differentiates it from the algorithm: the strategy offers alternatives, the option of manifesting intelligent behavior, while the algorithm involves a mechanical state of an action sequence. From this perspective, the strategy can be viewed as a global picture originally planned but permanently perfect during its course. The strategy summarizes a twofold pedagogical option: an assumed option, for a certain way of combining methods, processes, means of learning, forms of learning organization, and an option for a certain approach to heuristic learning, heuristic , algorithmization, experimental research"(Cerghit, I., coord., 1980, p. 59).

The activity of physical education, sports activity is an activity with multiple practical valences, and the teacher / coach should not neglect the transmission of useful theoretical information that underlies the formation of attitudes and beliefs and feed-back.

Feedback reflects „retrospection in order to maintain balance" in relation to or influence of external variables (Pop, C.L., 2008, p. 22). In physical education and sport, feed-back has constructive value, considered to be the link between teachers and students. It shows how the message was understood, assimilated and accepted.

Feedback, as information sent back to the source, has a motivating role, or has a corrective, immediate or delayed role.

Strategies in performance sports focus on sports training and athletes' ability to respond to the challenges of competition to maximize their potential. The modes of action, goal programming, application and assessment will be tailored to the age and level of training, while maintaining optimal health status, ensuring a harmonious physical development and showing a driving capacity that is favorable to professional and social insertion.

Previous assertions support the judicious planning of training that is based on teaching strategies, accompanied by objectives. Gloria Raţă (2008a, pp. 212-213) proposes the following steps useful in the design of motoring: setting general or final goals, frame and reference objectives or intermediate objectives for all performance cycles for each lesson. It is the coach who sets the basic and operational objectives for each lesson. Each goal has a time to be reached.

In the area of sport, extending the paradigm, we work with assigning numbers to facts and phenomena, so the evaluation is subordinated to a previously established standard or scale, which leads to a hierarchy of subjects and implicitly to a value appreciation (Nicola I. , 1996, p. 400). We have to do with measuring and evaluating what are complementary operations and even giving us quantitative data, they give us a global picture of the performance of athletes. Their functions are control, system regulation, prediction, classification and selection, educational and social. The coach's diagnosis will help him adapt his teaching strategies to the particular situation of the group he is instructing and each individual athlete, the latter benefiting from a strengthening of efforts according to the performance goals.

Material method

The experiment took place between December 11, 2017 - June 3, 2018, in the city of Suceava, with the -18 team of Suceava Sports High School specialized on the wing post.

The above mentioned period covered the preparatory period (December 4, 2017 - January 26, 2018), return (January 27, 2018 - March 10, 2018) and final tournaments (semifinal: 18-22 April 2018 and final: 2-3 June 2018) 2017/2018, organized by the Romanian Handball Federation.

During this period, the team maintained its regular training program, the wings following our proposed program to analyze its effect on improving the tracking parameters.

The subjects of the research went through two evaluation sessions:

- initially between 14 and 16 December 2017;
- final in the period 24-26 May 2018.

We estimate that the scientific approach to training, from the perspective of the physical, technical and psychological components of sports training, will increase the competitive yield.

Results and discussions

Following the implementation of the training program, the careful follow-up of the athletes' evolution and the evaluations carried out, we created a database that was processed and interpreted statistically. This is necessary to draw conclusions on a quantitative basis and to check whether our assumptions are valid or not.

On December 16 and May 26, the subjects of our research supported physical assessments in the Areni Hall. Thus, the effort capacity through the test battery was evaluated. The results of the evaluation are presented in Table 1.

Table no. 1. Performance parameters (mean ± standard deviation)

Parameter	Initial	Final	p
Height (cm)	174,8 ± 4,27	175,1 ± 4,24	0,101
Body mass	69,23 ± 7,26	68,65 ± 6,45	0,520
Body mass index (kg/m^2)	22,65 ± 1,93	22,39 ± 1,85	0,364
Body fat (%)	15,72 ± 3,42	13,57 ± 2,52	0,016*

Parameter	Initial	Final	p
Muscle mass (%)	42,73 ± 1,97	45,97 ± 2,16	0,006*
Basal metabolic rate (kcal)	1697 ± 127,6	1818 ± 124,1	0,0008*
Visceral fat (1 – 30)	4 ± 0,81	2,75 ± 0,96	0,015*

* statistically significant difference between groups

In the handball and basketball game, body mass is the limiting factor that determines the posture that the athlete plays (Drinkwater et al., 2007; Hoare, 2000).

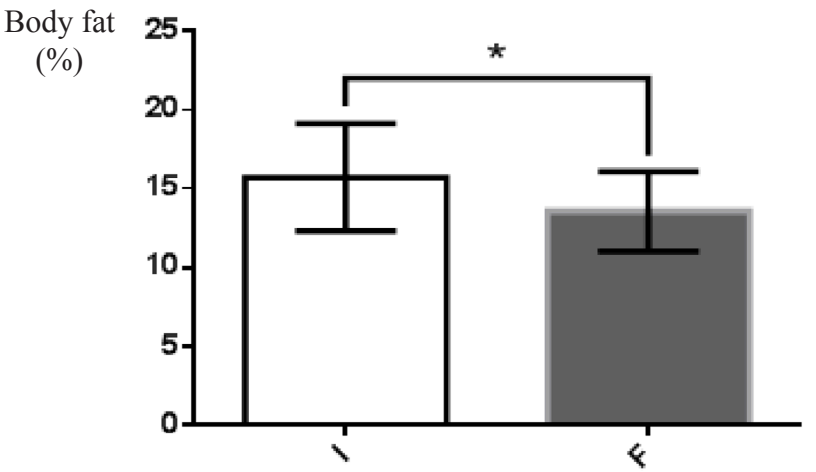

Fig. 1. Change in body fat values in research

Figure 1 shows the differences that occur at the level of body fat in the athletes studied.

The training program influences the body fat of the extreme players in a positive sense, decreasing statistically significantly from 15.72 ± 3.42% to 13.57 ± 2.52%. This difference of about 2% can weigh heavily in influencing the other physical components by eliminating inactive tissue from the body.

Our request had two totally different moments, one during the championship, before a training period (winter) and the other at the

end of the summer season. We must also take into account the diet specific to our population, which is richer in December and based on fats of animal origin.

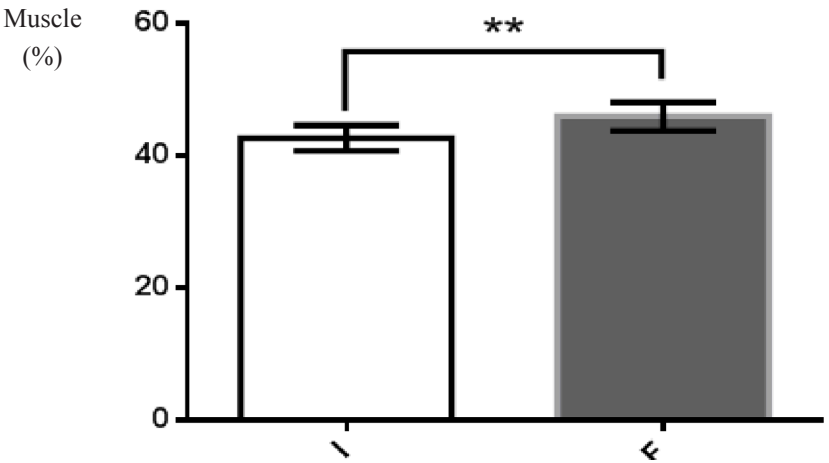

Fig. 2. Modification of muscle mass values in subjects of research (** - p <0.005)

Muscle mass is an important parameter of the body composition of the handball player. The level of active mass of our group of subjects recorded a statistically significant increase from 42.73 ± 1.97% to 45.97 ± 2.16% (Figure 2).

Percentage change in muscle mass is likely to be related to the decrease in body fat, and in this case we can talk about body remodeling during the championship. These changes are a result of the implications of the training program, but let us not forget that they are largely determined by each individual's life regime.

Fig. 3. Change in basal metabolic rate values in subjects of research (*** - p <0.0005)

The basal energy needs of our athletes suffer a significant increase, from 1697 ± 127.6 kcal to 1818 ± 124.1 kcal (Figure 3).

Each human individual has a fatty substrate in all tissues, including around internal organs. The weight in question is visceral fat, it has a protective role for internal organs, but it damages the excess.

In our case, visceral fat dropped significantly from 4 ± 0.81 to 2.75 ± 0.96 (Figure 4), which demonstrates the effect of physical handball effort on this tissue.

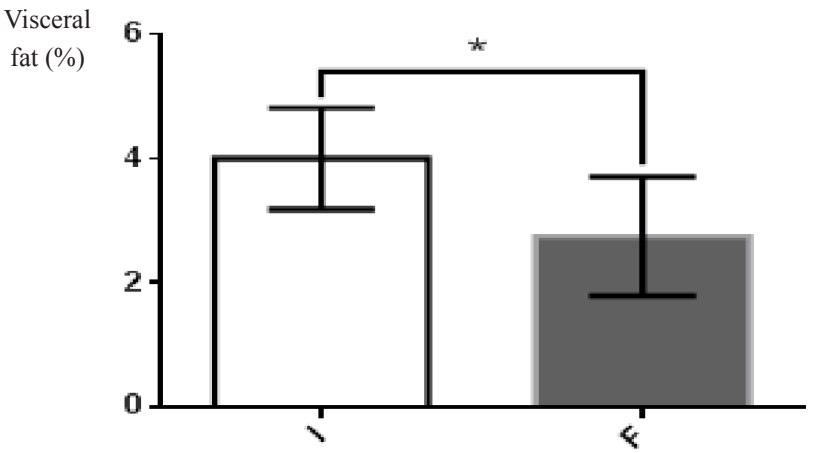

Fig. 4. Change in visceral fat values in subjects of research (* - p <0.05)

Since visceral fat is a parameter used in the assessment of obesity, there is no high level of our lot because it is subjected to a stressful exercise regimen. In the literature, we do not find similar references, which are reported for people who have problems with body mass, elderly people or various diseases.

Conclusions

The training program has resulted in good results, but any planning can not achieve perfection, requiring continuous improvements, gait adjustments and additions in line with the requirements of modern handball.

A full handball player encompasses high-level components: physical, cognitive, technical, tactical, psychological, etc.

At the physical component, some changes occurred, so:

- despite the insignificant change in body mass, the ratio of adipose tissue to muscle mass has changed in favor of the active mass of athletes involved in this research;
- as the muscle mass increases, the basal metabolic rate has increased, and the adipose layer around the internal organs has decreased its level.

The proposed program can be continuously implemented in the research team, by adapting to the conditions of the moment and the proposed objectives.

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Improvement of Speed Running Through Plyometric Exercises

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Abstract
Introduction: Sports performance and all physical exercise depend on the coordination of skeletal muscle activation by providing the strength and power that translates into the ability of the movement. Today, it is generally accepted that sprint performance, like endurance performance, can improve considerably with training. Strength training, especially, plays a key role in this process. **Aim:** The purpose of the study was to find out how the plyometric exercises influence the development of elastic force improving stages of speed running for the 30m; 30-60m and 60m. **Methodology:** This literature was selected by different research sectors that are based on the internet like „Jab Ref" „PubMed" „Google Scholar" „Medline" „Sports Discuss". Our study is focused on 39 subjects, students of the „Sports University of Tirana" Students were separated into 2 groups. The average age of the participants was 19-20 years. In our study we involve 1(one) experimental groups, respectively this group was trained with plyometric exercises and the Control group. In order to collect data for contact time, and speed running is used these measuring instruments Brower Timing Systems 2010, Leonardo Mechanograph® GRFP standard variant of STD. **Results and conclusion:** The experimental group showed improvement in running speed for the 0-30m distance with 4.7% m/sec for average group values. Compared to the Control group, the results for this distance indicated for sig≤0.05. For the 30-60m distance the speed improved by 3.96% m/sec for the average value in the group.

Compared to the Control group the results for this distance showed values of sig=0.11 not significant for sig≤0.05. For the 60m distance, the speed was upgraded to 3.53% m/sec for average group values. Compared to the Control group, the results for this distance showed sig=0.08 for sig≤0.05. In control group, the contact time indicator from the height 40cm showed correlation with running speed for the three (3) measured distances where for 0-30m with r = -0.605; 30-60m with values of r = -0.540 and 60m with values of r = 0.566. Based on the above results, the plyometric method applied in the experimental group showed more correlation between contact time by h=40cm and the running speed on acceleration phase 0-30m.

Keyword: training, speed of running, methods, exercise, plyometric, distance

Introduction

Sports performance and all physical exercise depend on the coordination of skeletal muscle activation by providing the strength and power that translates into the ability of the movement. (Komi, P.V., 1984). Today, it is generally accepted that sprint performance, like endurance performance, can improve considerably with training. Strength training, especially, plays a key role in this process. (Delecluse, Ch., 1997)

Improving the results in speed races is a component of the combination of speed and force. Where their combination will produce power, that as an ability is to be achieved through training by the speed racing coaches. accelerating faster after starting is one of the main technical phases in speed races and to achieve faster time in acceleration phase the coaches have to focus on contact time parameters and inter coordinations of lower limbs muscles. (Jacobs R & Van Ingen Schenau GJ.,1992)

In recent years, this distinct method of training for power or explosiveness has been termed plyometrics. Plyometrics is based on the understanding that a concentric muscular contraction is much stronger if it immediately follows an eccentric contraction of the same muscle. (Schmidtbleicher, D., 1992)

A plyometric exercise comprises of three phases during these phases, and especially in the Concentric phase, or take-off phase uses the stored energy to increase the force of the movement (Bomba, T. et al. (2005). It is commonly agreed that plyometric training develops the neural and musculotendinous systems of the SSC to generate maximal force in the shortest amount of time. Given this, plyometrics are often used as a method of training to bridge the division between strength and speed. Even despite rigorous scientific investigation, plyometric training continues to prove itself as a potent training method for enhancing athletic performance. (Markovic G. & Mikulic, P., 2010).

Plyometric training involves the usage of jumps, hops, bounds, and/or skips and should not be confused with ballistic training. Plyometric activities can be separated into two categories depending upon the duration of the ground contact time: 1) fast plyometric movements (≤250ms); and 2) slow plyometric activities (≥251ms). (Turner, A.N. & Jeffreys, I. 2010).

Aim

The purpose of the study was to find out how the plyometric exercises influence the development of elastic force improving stages of speed running for the 30m; 30-60m and 60m.

Methodology

This literature was selected by different research sectors that are based on the internet like as „Jab Ref" „PubMed" „Google Scholar" „Medline" „Sports Discuss" taking into consideration stated data on scientific research articles published in different conferences and particularly on „Journal of Strength and Conditioning Research".

Selection of the subjects: Our study is focused on 39 subjects, students of the „Sports University of Tirana" All subjects agreed

to participate by free will maintaining their name anonymous. Students were separated into 2 groups. The average age of the participants was 19-20 years. In our study we involve 1(one) experimental group, respectively this group was trained with plyometric exercises and the Control group

Training of plyometric exercises. (experimental group): The experimental group was trained twice a week, with two exercises per session. To implement this program were applied 40-60-80- cm platform. The intensity of performing this exercises was required in maximum value, which was measured by movement speed, where the 1-st exercise intensity was measured by contact time, while in the 2-nd exercise intensity was measured by distance. These exercises were:

1. Depth jumping with two legs. Training loads of exercise 3 x 10 x 60 / 80cm.

2. Repeated jumps on one leg starting over a 40cm platform. Training loads of exercise:

15 x 3 with the right and left leg each.

In our study participated only those who weren't involved in other physical activities or sports to exclude other training loads impact.

Measuring Instruments: In order to collect data for contact time, and speed running is used these measuring instruments:

- Brower Timing Systems 2010, which is built to be applied as a measuring system to assess the time and speed movement. Brower Timing Systems 2010, in our study it was used for testing the speed of running in 0-30m,
- Leonardo Mechanograph® GRFP standard variant of STD is an instrument that measures the contact time from drop jump 40cm and 60cm.

The methodology of tests performing: The study is conducted for a 6-month period (October 2015-March 2016) of the academic year including the time of subject selection, testing time and the experiment.

- The tests **t1 (before)** and **t2 (after)** are extended for 2 (two) weeks. Testing and retesting was performed in the same

ways and conditions. In the statistical analysis are not included the data of injuries / left subjects from the experimental phase.

The groups developed tests to measure the indicators:

1. 0-30m; 30-60m; 60m running speed in meter/second
2. Dj (drop Jump) from h=40cm and 60 cm.

Results

In results are collected data of contact time from two height 40cm and 60cm and running speed in m/sec for three measured distance 30m;30-60m; and 60m.

For elaborating data, we used T-test for significate value for pre-post testing, differences with the control group and Pearson correlations to show the correlations between components of contact time and the speed of running.

Table 1. T-test for significate value of contact time for t1 to t2

T-test t1-t2									
Results from t1 - t2 test	Paired Differences	t	df	Sig. (2-tailed)					
	95% Confidence Interval of the Difference								
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Experimental Gr	C-time-60cm	0,02	0,02	0,00	0,01	0,02	4,02	18	**0,00**
	C-timet-40cm	0,00	0,03	0,01	-0,02	0,01	-0,42	18	**0,68**
Control Gr	C-time-60cm	0,00	0,02	0,00	-0,01	0,01	-0,13	19	**0,90**
	C-time-40cm	-0,02	0,05	0,01	-0,04	0,01	-1,40	19	**0,18**

Results from Table.1 shows that the contact-time from **h=60cm** have more improvement and significant value for **p<0.05**. This significate value we think has come as a result of the same model of movement that was used in training.

Table 2. Independent t-test for Experimental and Control group, and their significance value

Control Gr vs experimental Gr		Equality of Means													
												95% Confidence Interval of the Difference			
		t		df		Sig. (2-tailed)		Mean Difference		Std. Error Difference		Lower		Upper	
		t1	t2	t1	t2	t1	t2	t1	t2	t1	t 2	t1	t2	t1	t2
C-time h=60cm	Equal variances assumed	0,01	1,40	37	37	0,99	**0,17**	0,00	0,02	0,01	0,01	-0,02	-0,01	0,02	0,04
	Equal variances not assumed	0,01	1,42	34,8	30,6	0,99	**0,17**	0,00	0,02	0,01	0,01	-0,02	-0,01	0,02	0,04
C0time h=40cm	Equal variances assumed	0,28	1,07	37	37	0,78	**0,29**	0,00	0,02	0,01	0,02	-0,02	-0,01	0,03	0,05
	Equal variances not assumed	0,28	1,09	36,5	29,4	0,78	**0,29**	0,00	0,02	0,01	0,02	-0,02	-0,01	0,03	0,05

Based on the results obtained from table 2, we can see an improvement of significant value on post-testing, but not significant for $p<0.05$

In the table below we have shown correlations results between contact time by 2(two) heights 40-60cm and speed of running for 3(three) measured distances.

Table 3. Correlations values between contact time (h=40cm and h=60cm) and speed of running(m/sec) for three measured distances.

		Control Gr.		**Experimental Gr.**	
Correlation between contact time (h=40cm and h=60cm) and speed of running		C-time 60cm	C-time 40cm	C-time 60cm	C-time 40cm
Speed of running **0-30m**(m/sec)	Pearson Correlation	-0,12	-0,33	0,01	**-,605****
	Sig. (2-tailed)	0,62	0,16	0,96	**0,01**
	Sum of Squares and Cross-products	-0,06	-0,21	0,00	-0,27
	Covariance	0,00	-0,01	0,00	-0,01
Speed of running **30-60m**(m/sec)	Pearson Correlation	0,09	-0,20	0,09	**-,540***
	Sig. (2-tailed)	0,71	0,40	0,71	**0,02**
	Sum of Squares and Cross-products	0,07	-0,22	0,06	-0,41
	Covariance	0,00	-0,01	0,00	-0,02
Speed of running **60m**(m/sec)	Pearson Correlation	0,00	-0,26	0,05	**-,566***
	Sig. (2-tailed)	0,99	0,27	0,85	**0,01**
	Sum of Squares and Cross-products	0,00	-0,21	0,02	-0,32
	Covariance	0,00	-0,01	0,00	-0,02
	N	20	20	19	19

According to table 3. We can see a moderate to strong negative correlations r= -605 between contact time by h=40cm and speed of running for 0-30m. But all results of speed of running with correlations in contact time have shown significance value for $p<0.05$.

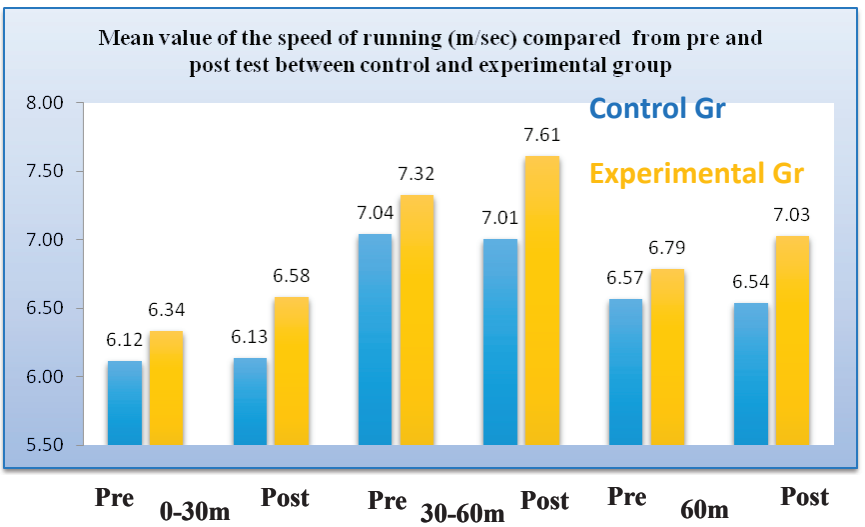
In the table below we have shown the significant value on the speed of running calculated from T-test.

Table 4. Significant value on speed of running calculated from T-test for all measured distances t1- t2

T-test t_1-t_2		Paired Differences					t	df	Sig. (2-tailed)
		Overage value	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Control Group	0-30m t_1 m/sec 0-30m t_2 m/sec	-0,02	0,13	0,03	-0,08	0,04	-0,58	19	**0,57**
	30-60 m t_1 m/sec 30-60 m t_2 m/sec	0,04	0,22	0,05	-0,07	0,14	0,73	19	**0,47**
	60m t_1 m/sec 60m t_2 m/sec	0,03	0,16	0,04	-0,04	0,11	0,92	19	**0,37**
Experimental Group	0-30m t_1 m/ sec 0-30m t_2 m/sec	-0,25	0,05	0,01	-0,27	-0,22	-19,86	18	**0,00**
	30-60m t1 m/sec 30-60m t2 m/sec	-0,29	0,09	0,02	-0,33	-0,24	-13,15	18	**0,00**
	60m t_1 m/sec 60m t_2 m/sec	-0,24	0,09	0,02	-0,28	-0,20	-12,18	18	**0,00**

The experimental group has shown significate value for $p<0.05$ to three measured distance compared with the control group.

The graph below showed the trend of the mean value of the speed of running in m/sec between groups and compared for pre and post testing results for 0-30m;30-60m;60m.



Graph 1. The trend of the mean value of the speed of running in m/sec between groups and compared for pre and post testing results for 0-30m;30-60m;60m.

Statistic analyze of T-test		Overage value of Control group		Overage value of Experimental group	
		Results of running time in m/sec	% of improvement	Results of running time in m/sec	% of improvement
Pair 1	0-30m - t_1	6,12	**0.32%**	6,3	**4.7%**
	0-30m - t_2	6,14		6,6	
Pair 2	30-60m - t_1	7,04	**-0.56%**	7,32	**3.96%**
	30-60m - t_2	7,01		7,61	
Pair 3	60m - t_1	6,57	**-0.45**	6,79	**3.53%**
	60m - t_2	6,54		7,03	

Table 5. Summary of overage value results of running time in m/sec and the improvement from pre and post testing for distances 0-30m ;30m - 60m ; 60m

Conclusion

The experimental group has shown significate results for R-value in correlations of contact time 40cm and the speed of running for three distances measured, when for 0-30m r=-0.605**; 30-60m r=-0.540* and for 60m r=-0.566*.

Negative sign before the R-value shows the negative correlation between contact time and the speed of running, meaning when contact time value decreases the depended value of the speed of running increase, which occurred even in our study on the speed of running values measured in m/sec.

The experimental group shows improvement in speed running results for 0-30m in overage group value with 4.7% m/sec. Compared with the control group, the result of distance 0-30m was significant for sig≤0.05. For distance 30-60m the improvement of speed of running in overage group, the value was 3.96% m/sec. Compared with the control group, the result of distance 30-60m shows no significant value (sig =0.11) for sig≤0.05. For distance 60m the improvement of speed of running in overage group value was 3.53% m/sec. Compared with the control group, the result of distance 30-60m shows no significant value (sig=0.08) for sig≤0.05.

Depend on results we can conclude that the method of training in the experimental group using plyometric exercises shows more impact in the correlation between contact time measured from Drop Jump (h=40cm) and the speed of running from 0-30m, so the improvement of contact time is more correlated with the acceleration phase.

We believe that this is a logical result if we take into consideration that the exercises of this group, comprised of the 12 weeks training program, influencing on the elastic component of the muscle that can influence on generating elastic strength. From this point of view, we can conclude that the plyometric exercises, when used with a low and medial level of individual parameters can influence positively in the muscular strength.

In plyometric movements, muscles time contracting is very fast from eccentric on concentric movements, leaving no time for the muscle to rest. That is known as a stretch-shorten cycle. Realizing the stretch-shorten cycle without resting time, depending on the accumulation of elastic energy of connection muscles-tendon, by transmitting a greater force generating from the muscle. (Gulick D.T., et al 2008). The accumulation of elastic energy of connection muscles-tendon arrives appearing and generating it take-off phase.

Based on the experimental group and their achievements results by using plyometric exercise, we can confirm that the protocol of exercises used in this experiment which was involved two types of plyometric exercises (Depth jumping with two legs and Repeated jumps on one leg starting over a 40cm platform) shows significant result from pre and post-testing(t1-t2). This significant result was more correlated with the first measured distance 0-30m, thus in the acceleration phase. Cronin & Hansen (2005) have stated also that jumping, bounding etc., are exercises which can generate power, this fact is in common with the statement of Schimidtbleicher D., (1992) which emphasize that the athletic performance is improved more when generating force faster than the production of maximal force. But this correlation of force production and the speed of running is depended from the technical phase of the speed running. (Young et al., 1995). This correlation between the force production and the speed of running is shown even in our study at the contact

time from h=40cm and speed of running in the acceleration phase, which shows moderate to strong correlations value.

As conclusions of this analysis, we can affirm that for a better result in the training process is very important to balance in the right way the improvement of different parameters of strength and power. Plyometric exercises are, more and more present in the training process of developing maximal speed. Although our experiment with the plyometric exercises can effectively be combined giving another stimulus to the muscular system. We can conclude that the program with plyometric exercises is well accepted and positively influenced the improvement of the running speed.

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The Role of Technique in Improving the Performance of Junior Swimmers

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Abstract
Aim. Establishing a model of training as well as the judicious use of the most effective methods and means specific to and non-specific to swimming should lead to: - appropriate appropriation from the technical point of view of the 4 swimming procedures; - increasing the minimum driving qualities; - demonstrate the validity and applicability of methods used to follow the development of qualitative motor skills; **Methods.** In the general tendency to objectively human actions, there is also the need to rationalize the exercises used in training, hence the name „rationalization of effort on areas of intensity". With these tests we tracked and scored with grades from 1 to 10 of the crawl technique and recorded the performance of athletes in the 50m free sample. The repetitions were performed on distances of 12.5m, 25m in a maximum of 8 repetitions. The usual statistical indicators were used: arithmetic average, amplitude, standard deviation and coefficient of variability. **Results.** Performance dynamics for 50m - arithmetic average, global, analyzing the entire period of research, reveals that the greatest leap in the results is between the second and the third tests (Init.T.= 40,47±4,38 sec and at the Fin. T. = 37,82±2,38 sec with a Dif. = 2,65 sec). **Conclusions.** Evaluation of technical performance. In addition to physical training under the training plan, special emphasis has been put on technical training, which at this age has a primordial role, knowing that incorrectly acquired skills, hardly or not at all, can be corrected later. The results obtained in the tests carried out have improved continuously, and finally the progress is obvious.

Keywords: research, evaluation, methods, technique, speed.

Introduction

Sport training at swimming is the main form of organizing and systematic development of the current training, conceived as a system of norms, requirements, pedagogico-instructive principles of applying the methods and means of optimal and efficient exercising of psycho -motomical, temperamental, by effort according to the degree of physical-functional development, of the conduct, of the reasons for adherence to the objectives established according to the technical-material conditions and the existing organizational framework (Maglischo, Ernest, 2003).

The purpose of this research is to investigate the theoretical and experimental research on the important role of the technical component in junior children (14-15 years old).

The research hypothesis - increasing the training efficiency of the educational instructive process requires establishing precise objectives, a well-targeted and optimized drive system as well as the choice of the most efficient methods and means of action.

Methods

The improvement of the training methods requires the observation of two major milestones: the time spent and the recovery pause, whereby the duration of the return of the cardiac frequency can be adjusted and, implicitly, the payment of the 0xigen debt (diminution of fatigue), (Cirla, Luciela, 1999).

The learning of sporting techniques, as any motric learning process, does not take place linearly, ascendant, but after a discontinuous curve, characterized by ascending portions and plateaus (Bompa, T., 2003).

The development / education of motor skills is based on the mobilization of the energetic resources of the organism, therefore through systematic effort, not only of the nervous type (attention, memory, abstraction and generalization etc.), but also muscular (Cârstea, G., 2000).

In order to carry out the experiment the chosen athletes were selected children born in 2004-2005, members of the performance group within the Arad Municipal Sports Club.

Establishing a training model as well as the judicious use of the most effective methods and means specific and non-specific to swimming should lead to:

- appropriate appropriation from the technical point of view of the 4 swimming procedures;
- increasing the minimum of motor skills;
- demonstration of the validity of the methods used and the applicability of tests to follow the qualitative development of motor skills.

In the process of psychomotor education, actions are directed towards the accumulation of conducts, which gradually build up the basic components, which will contribute to forming a more accurate representation of the movements of the body and its segments (Grosu, Emilia, Florina 2009).

Experimental design

The experiment on verifying the efficiency of the means used in swim training was carried out during the period from June 2018 to March 2019.

In the general tendency to objectively human actions, there is also the need to rationalize the exercises used in training, hence the name „rationalization of effort on areas of intensity" (Bitang, Viorel, 2009).

For the good conduct of the experiment we applied three tests:

- Initial testing - 12 - June 13, 2018, Arad
- Interim Testing - 11 - 12.12.2018, Arad
- Final Testing - 25 - 26.03.2019, Arad

With these tests we tracked and scored with grades from 1 to 10 of the crawl technique and recorded the performance of athletes in the 50m free sample.

Between June and November 2018, emphasis was placed on technical exercises. Between November 15 and November 28, 2018, according to the period of increase in the volume of training, emphasis was placed on increasing the training volume, which was 3600 - 3800 m / training. Techniques were also used three times a week.

Between 29 November and 4 December 2019 corresponding to the narrowing period, according to the training plan, technical training continued. The repetitions were performed on distances of 12.5m, 25m in a maximum of 8 repetitions.

Between 13 and 20 December 2018, the transition period, 5 training sessions per week were given, focusing on swimming techniques, especially on arm movements and foot movements.

Between December 21st 2018 - January 2, 2019 - holiday. Between 3 January and 16 February 2019, emphasis was placed on technical exercises.

Between February 18 and March 10, 2019, the workload period followed by decreasing the intensity of the effort and the number of exercises with a focus on technique (3 / week).

Between 11 and 22 March 2019 corresponding to the narrowing period, workload decreased and increased intensity, repetitions of 12.5m and 25m were performed.

Statistical analysis

The usual statistical indicators were used: > arithmetic average, > amplitude, > standard deviation, > coefficient of variability

The experiment was performed on a single group that was considered a control sample at the initial testing, and the final one was considered an experimental sample (Dragnea, Adrian, 1992).

Results

The evolution of the sports results obtained by the subjects included in the study are those in Table 1.

Table no. 1. Evolution of the sports results obtained by the subjects included in the study - 50m distance.

Subj.	Year of birth	Initial testing (sec)	Intermediate testing (sec)	Final testing (sec)
1.	2004	36,95	36,36	33,77
2.	2004	37,64	38,95	37,44
3.	2004	38,71	37,39	39,85
4.	2004	38,88	39,51	36,98
5.	2004	40,81	40,70	37,90
6.	2004	43,32	42,86	39,01
7.	2004	52.20	46,56	40,63
8.	2004	33.30	33,29	34,34
9.	2004	36,05	36,11	34,19
10.	2005	36,48	37,32	35,26
11.	2005	36,52	36,98	35,55
12.	2005	38,80	38,73	37,60
13.	2005	40,67	39,05	38,40
14.	2005	41,09	40,73	40,01
15.	2004	45,76	45,51	41,25
16.	2004	35,98	36,29	36,21
17.	2004	43,86	43,01	40,80
18.	2004	44,26	43,97	39,70
19.	2004	45,87	44,01	41,95
20.	2004	42,32	41,87	38,70

Table no. 2 - Dynamics of experimental performance

Statistical parameters	Initial testing (sec)	Intermediate testing (sec)	Final testing (sec)	Diference Init.T. – Fin.T.
X	40,47	39,96	37,82	2,65
W	18,90	13,27	8,18	10,27
Am	3,54	2,93	2,00	1,54
S	4,38	3,48	2,38	2,00
Cv	10,82	8,70	6,29	4,53

Discussion

Global, analyzing the entire period of research, reveals that the greatest leap in the results is between the second and the third tests.

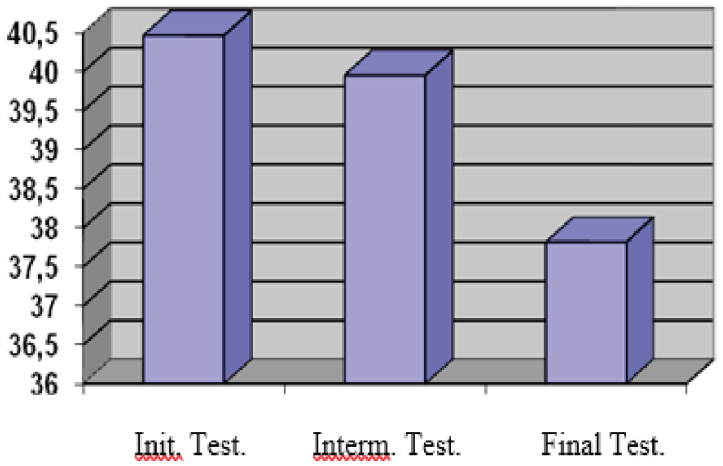


Chart no. 1. Performance dynamics - 50m - arithmetic average

The results show that the difference in the number of subjects fades, which is normal for a well-trained workout.

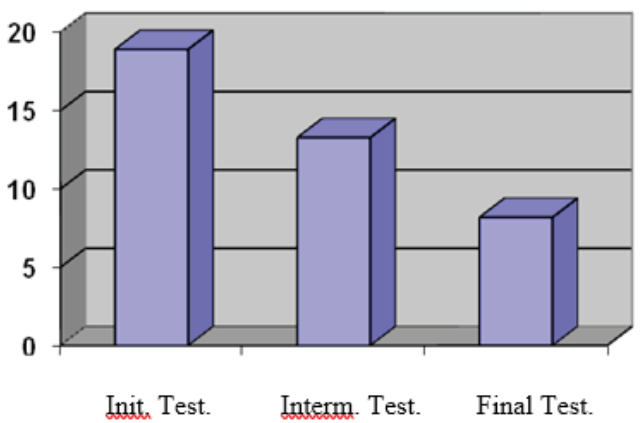


Chart no. 2. Evolution of amplitude during the experiment

We observe the same homogenization of the results in the investigated sample, as in the case of amplitude. At the final measurement, this statistical indicator changes by more than 1.5 seconds.

It is also observed in this case the tendency to homogenize the value of the subjects in terms of registered performances. Thus, although the statistic states that between 0 and 10%, the sample is very homogeneous, with the exception of the first test, the results obtained fall within these limits

Table no. 3 - Status of notes during the experiment

Parametri statistici	Testarea iniţiala	Testarea intermediara	Testarea finala	Diferenţa T.iniţial –T.final
X	5,7	6,6	7,6	1,9
W	1,6	1,6	1,8	0,2
Am	0,27	0,22	0,20	0,07
S	0,40	0,34	0,37	0,03
Cv	7,01	5,15	4,86	2,15

Evaluation of technical performance. In addition to physical training under the training plan, special emphasis has been put on technical training, which at this age has a primordial role, knowing that incorrectly acquired skills, hardly or not at all, can be corrected later.

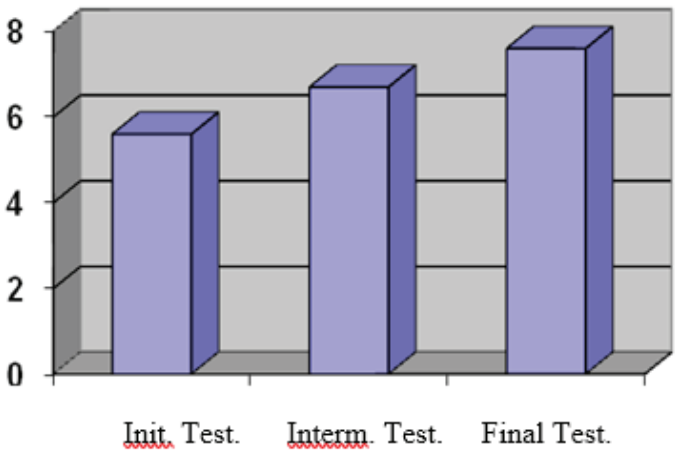
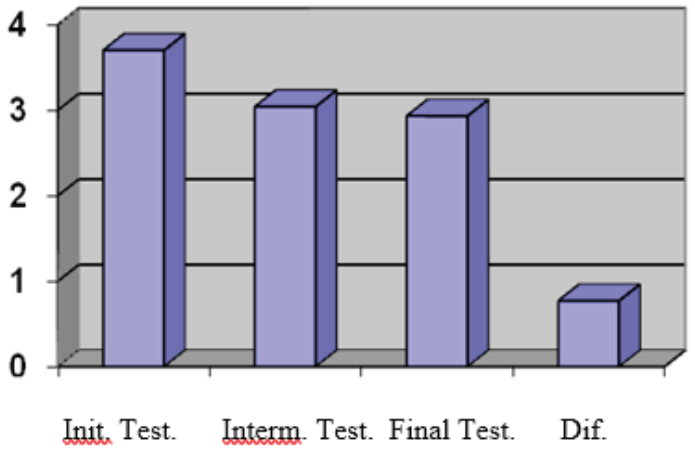


Chart no. 3. Evolution of the average score.

Throughout the research period, the progression is about. 2 notes, indicating that the means used for technical training were judiciously chosen and used, the dynamic stereotype of swimming improving qualitatively.



C**hart no. 4.** Dynamics of the variability coefficient

The analysis of the distribution indicators shows the homogenization of the experimental sample in terms of the quality of the swimming act. The evolution of the coefficient of variation shows a homogeneity of the subjects included in the experiment since the first test, but this in conjunction with the improvement of the arithmetic mean indicates that the hypothesis was confirmed

Finally, we can assert, as a result of the analysis of the data collected, that the research hypothesis is confirmed, the differences between the control sample (considered in the initial testing) and the experimental (considered as final testing) are significant.

Summary and Perspectives

- the results obtained in the tests carried out have improved continuously, and finally the progress is obvious. The other

statistical indicators considered had specific values for well-established and trained collectives.

- the appreciation of the technique, although more difficult to achieve, but in our case based on a rigorous algorithm, has shown an improvement of the technical skills, which can be put on the judicious choice of the independent variables.
- the obtained results, both on the motor and on the technical accuracy, confirm the statistical experimental hypothesis.

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Eating and Sports Habits of University Students in Szeged

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Abstract

Aim. The Institute of Physical Education and Sports Sciences of the University of Szeged conducted an online survey on students studying at different university faculties. The main purpose of the study is to find out how health-conscious today's students are, what are their eating, fluid consumption and sports habits. **Methods.** In our descriptive basic research the mode of data collection is structured, largly standardized questionnaire that uses mostly colosed questions and a Likert scale and the survey could be conducted online. The questionnaire was filled in by 746 people, 69.8% were women (521 persons) while 30.2% (225 persons) were men. **Results.** Their answers gave the following picture: 50% of the students are currently doing sports, most of them do it as a hobby and with friends. As a result of sport activities more than 50% of them changed their eating habits in a positive direction. Nearly 75% of students consider their eating habits healthy. They use different type of diets regularly. The majority eat more times a day and drink acceptable amount of water. The vegetable consumption is higher than fruit intake. Just every tenth students eat fast food every week. **Conclusion.** For the results mentioned above, it would be important for students to have courses in life-style or life coaching, because who do not know the connections between sports and nutrition do not feel their importance either. Implamenting and organizing special programmes would also help to transform a young adult into a conscious and active adult.

Keywords

Higher education, nutrition, sport, fluid intake, physical activity

Introduction

As a common point of many definitions we are most responsible for our own health. This is greatly influenced by our behaviour, health behaviour, daily habits, that is the way we live. Everyone should be responsible for their own health as much as possible (Egészségügyi törvény, 1997). The chance of developing genetically inherited diseases is often determined by lifestyle factors, because lifestyle is a set of behavioral choices that strongly depend on the socio-economic circumstances of individuals and the availability of alternatives (Milio, 1981). This means that the person makes behavioral decisions about their lifestyle, but this decision significantly influenced by circumstances (culture, position in society) and personality (motivation, conflict and stress management) (Pikó, 2006). Thanks to the National Core Curriculum every day physical education has been introduced in ascending system since the school year 2012, so the right attitude can develop from a young age. At the same time it is well known that physical activity decreases with age in a gender-related way (mainly among girls) and this can be justified both among international and domestic (Pikó and Keresztes, 2007) young people. Keresztes, Szilágyi & Horváth (2014) conducted a research on similar topic as present study. It was concluded that although university students take part in leisure-time physical activity, only 38.6% of them do it once or twice a week. Koroknay and Pfau (2019) examined whether there is a detectable difference in the awareness of non-sport students and sport students in their sporting habits. This primary research has shown that students are recognized the benefits of sport and it is seen as a means of preserving health. In the study of the physical activity of university students (Vári, Sajben & Pálhidai, 2019) it was founded that students perceive their fitness as much worse than their health. According to a university survey (Papp-Váry, Schwang, 2012) the lifestyle and consumer habits of them were also examined. They surveyed whether students are conscious consumers, are they satisfied with their body weight, how often they are dieting, and what is typical of their nutrition. In general, students in higher educa-

tion tend to take into account what others think about them, important to be member of a group and relationship with their friends. During these years they are going through a varying degrees and very dynamic process of physical, intellectual, emotional and social development. Harmful passions can develop, and being away from home or becoming independent is also an influencing factor. The daily routine, the short breaks between classes, and the hard study and exam periods also affect the regular eating and physical activity. A survey (Hámori, Horváth, 2018) examined at how much the students work during their studies. The number of young people working regularly reached one third. This is very important because the amount of leisure time is reducing also the time available for sports.

Our research focused on young adults who are able to choose their own lifestyle and can do to live a longer and healthier life. This is only a small part of the whole study which investigated the lifestyles of student studying at different university faculties, with particular regard to eating habits and the impact of sports activities on the body. The main purpose of the study is to find out how health-conscious today's students are, how they eat, exercise, how physical activity affects them, and how they integrate them into their daily lives. Our questions focused on the following: Do students consider sport as part of their lifestyle? How much sports they did in the last period and how much time are they spending on a weekly basis? What is the reason for doing or not doing sports? What are the most common sport activities that entertain college students? In what kind of framework do they exercise? How does sport affect their performance and nutrition? Do they controll the changes of body weight? Are they dieting regularly? How many vegetables and fruits do they consume daily? How many meals do they have a day and which is the main meal? Does the breakfast appear in their daily activities? How much fluid do they consume daily and what does it consist of? How much do college students go to fast food restaurants?

Methods

In our descriptive basic research the mode of data collection is structured, largly standardized questionnaire that uses mostly colosed questions and a Likert scale. The surveyed group had almost all online access, so the survey could be conducted online. The respondents could complete the questionnaire online at docs.google.com online questionnaire editor page from May 17 th, 2018 to 10th of July, 2018. We targeted different university groups, student communities, faculty administrators, and faculty members to help our work. The students shared the questionnaire with each other through various university user interfaces (Coospace, Neptun) and other community sites. During the indicated period, 746 respondents completed the questionnaire. The number of elements is high, generalizability extends to students studying in Szeged. Excel spreadsheet was used to record data. We used it as an analysis method: frequency analysis, distribution analysis. Each respondents are student of the faculties of the University of Szeged. The majority of the respondents 69.8% were women (521 persons) while 30.2% (225 persons) were men. The average age is 22.4 years, the youngest student is 18 years old and the oldest student is 51 years old. The distribution between the faculties was the following: Faculty of Sciences (18.1%), Faculty of Economic Sciences (17.3%), Faculty of Law (14.6%), Faculty of Health Sciences (10.7%), Faculty of Humanities (10.4%), Faculty of Education (14.2%), Faculty of Medicine (6%) Faculty of Agriculture (5.4%). Fills were also received from the remaining 4 faculties but not in significant proportion. 79.1% of the respondents live in Szeged during the study term, while only 56.4% in the exam period. In addition their studies 48.2% of them are not working, 27.3% occasionally and 24.5% regularly. These results also influence the time spent on sports.

Results

Sports habits

Examining sports habits, firstly we were curious about whether how many of the surveyed believe that sports should be part of

their lifestyle. 92% of men and 94% of women answered yes to this question. In spite of the high rate of yes answers, only 20% of respondents achieved the recommended minimum three or more sports activities over the past 3 months. This represent 24% for men and 16% of women. This rate is 20%-15% for the men with the answer 2-3 times a week. We received 18%-28% with the answer 1-2 times a week. Over the past 3 months, 13% of the responding men and 11% of the women have never exercised. Currently regularly claims to be an athlete the 55% of men and 49% of women, so 52% on average. In the case of non-athletes, the following reasons were given for leaving sports (Figure 1)

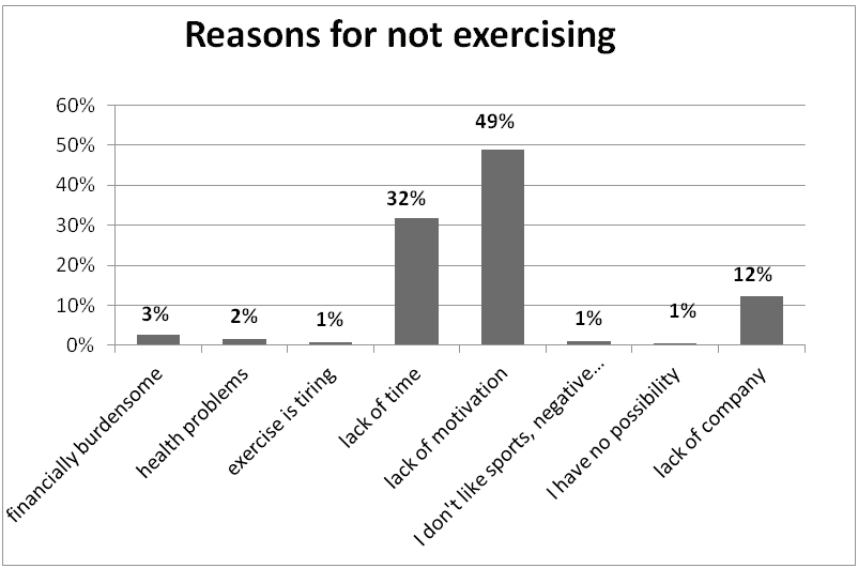

Figure 1 – Reasons for not exercising.

Lack of time and motivation is the major problem for university students. Due to the strength of sport in social relations, only 12% refers to the lack of company. The answers of those who exercise regularly show a much more interesting picture (Figure 2).

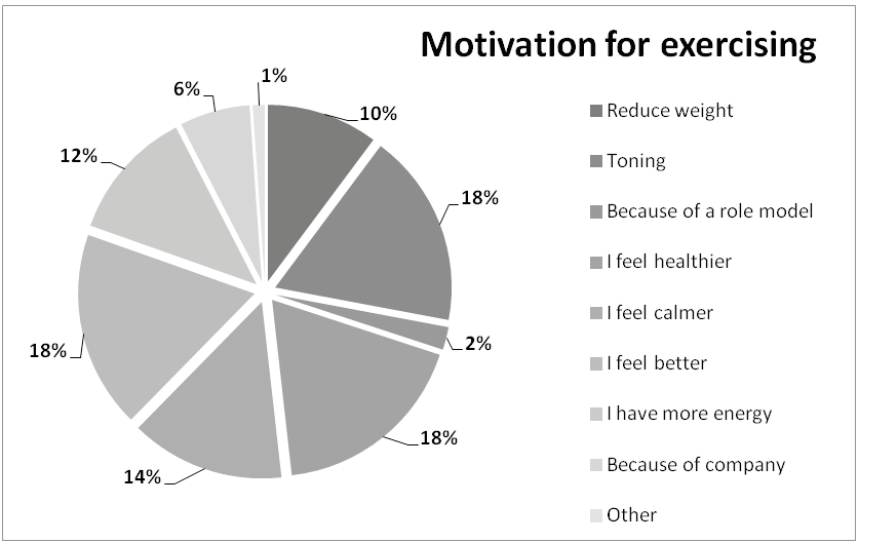

Figure 2. – Motivation for exercising.

As can be assumed, other rankings can be set between men's and women's responses. While the order of the men is (1.) feeling better, (2.) feeling healthier, (3-4.) toning and feeling calmer, (5.) having more energy, (6) losing weight, because of company, whereas for women this is different. For them the most important is (1.) toning, followed by (2-3-4.) feel heathier, feel better, feel calmer, (5.) more energy and finally the eight loss and company answers. We also tried to collect the possible sports activities, as it is very important that a young people wants to play a team or individual sport. Women mainly prefer individual sports (gymnastics, yoga 15%, gym workout 13%, running 12%, cycling 12%, fitness courses 10%), which does not mean that they are going alone for trainings. Men prefers endurance sports and ball games (gym workout 24%, cycling 12%, ball games 14%, running 12%). 44% of respondents sports with friends without any formal background or organized framework, 41% of them take part in sports alone (36% male, 435 female) and the remaining 16% in an association with an organized background.

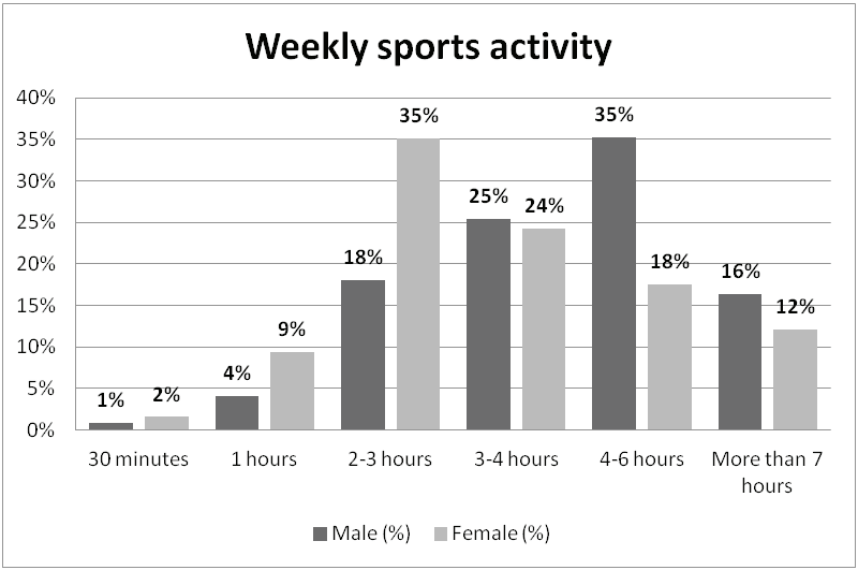

Figure 3 – Weekly sport activity.

Among the students surveyed, women spend less time exercising weekly on average (Fig.3).

Sport effect

It is important to examine the impact of sport on body (Figure 4), since knowing the good and bad is easier to make a decision that can greatly influence your lifestyle. Thanks to the physical and mental refreshing effects of sport, most have already experienced the ability to focus more or longer on a particular thing after a sport activity. Anyone who invests energy in shaping the body, improving their endurance, well-being through sport, it is natural for them to pay more attention to the diet and to consume and buy quality food consciously. Better appetite and higher fluid intake are natural part of physical activity, so it is not surprising that there is a high percentage of people who answered yes.

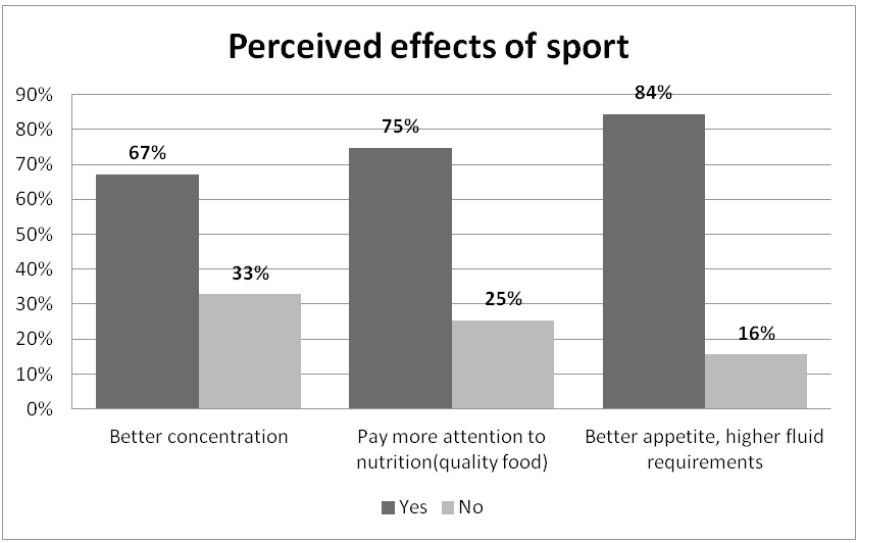

Figure 4 – Perceived effects of sport.

Eating habits

In terms of self-evaluation it is very important how we evaluate our eating habits. On the five pont Likert scale, men and women showed nearly the same results. Men scored 3.1 on average, while women rated 3.3 on average on the healthiness of their diet. 4% of them are eating unhealthy and 6% are completely healthily. Scores of 3 and 4 were given almost the same rating (35% and 39%). Nutrition and body weight change are highly correlated, so we addressed this in our study. The values in Table 1 illustrate the relationship between body weight monitoring and diet frequency.

Table 1 Monitoring of weight changes and dieting habits

Monitoring of weight changes			Dieting habits		
Frequency	**Male**	**Female**	**Frequency**	**Male**	**Female**
every day	5%	7%	always	4%	7%
weekly	32%	25%	quite often	4%	7%
monthly	19%	19%	occasionally	11%	20%
occasionally	31%	38%	rarely	15%	19%
never	13%	11%	never	67%	47%

The gender difference is manifested by the fact that the majority of men check their body weight on weekly basis, while women only check it occasionally. More women diet than men and the reasons can be a New Year's vow, the beach season, and a big event.

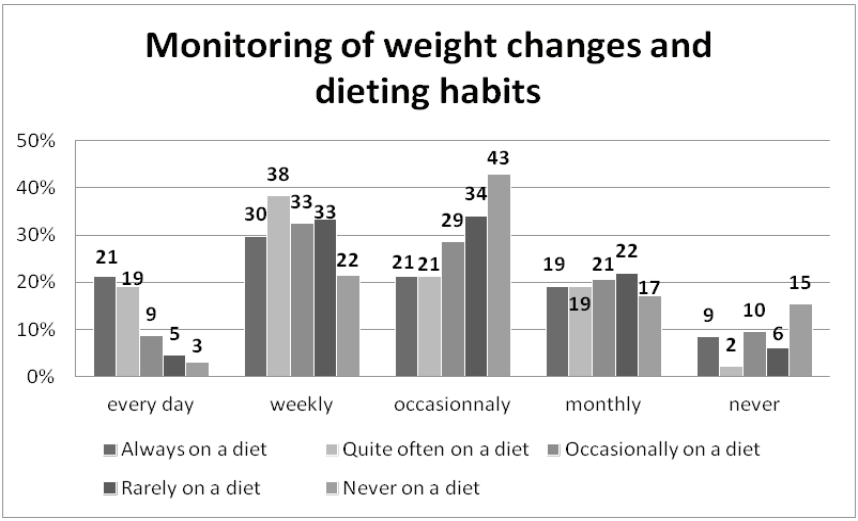

Figure 5 – Monitoring of weight changes and dieting habits.

We compared (Figure 5) how often they control their weight and how often do diet. Those who check the every day answer, can react immediatelly to the smallest change, so it is not surprising that most of them indicated the ,,always on a diet ,,answer. In a separate question, we asked if they were following a special diet and if so, for what reason. These include the diet of different sensitivities as well as vegetarianism, paleo, vegan diet. 12% of men and 21% of women answered yes. The majority of them (59% of men and 46% of women) use special diets due to changes body composition, the health reason is the next highest response rate (41% of women and 17% of men). A very important question from early childhood is how much vegetables and fruits we consume. Their intake int he body is important for the amount of fiber ingested and because of their high vitamin content. Many diets are based on these ingredients. In answering this question, not only fresh but also frozen and canned vegetables and fruits were included.

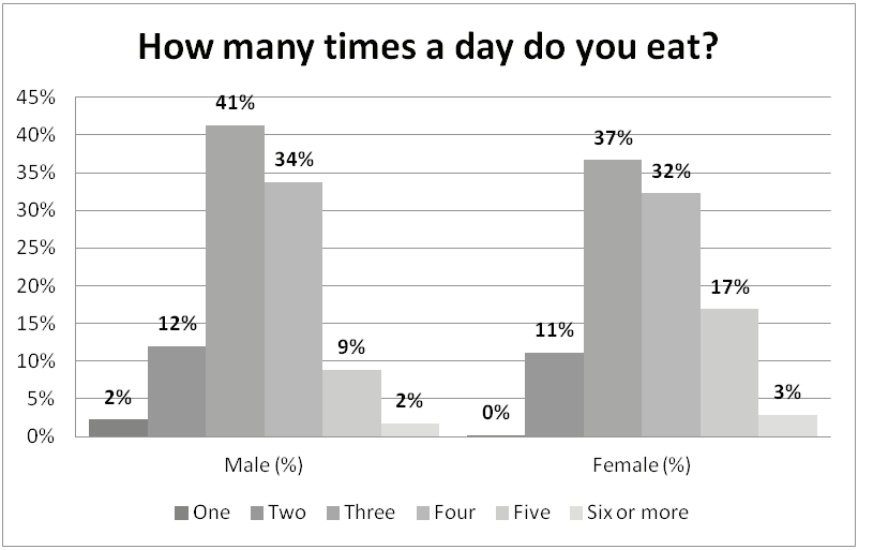

Figure 6 – Vegetable and fruit consumption.

Table 6 summarizes the results, but we also looked at the issue by gender. The daily intake of vegetables (52%) and the fruit (48%) is higher for women than for men. Most men do not consume such foods, just on a weekly basis (41% vegetable and 51% fruit consumption). 7% of men and 9% of women eat vegetables several times a day. Fruit consumption was lower, as only 3% of men and 7% of women ate fruit several times a day. The „I don't eat vegetables" answer were selected by 4% of men and 2% of women. In terms of fruit consumption the result was 2-2%.

The number of times we eat a day is greatly influenced by our work, studies, free time, finances and other options.

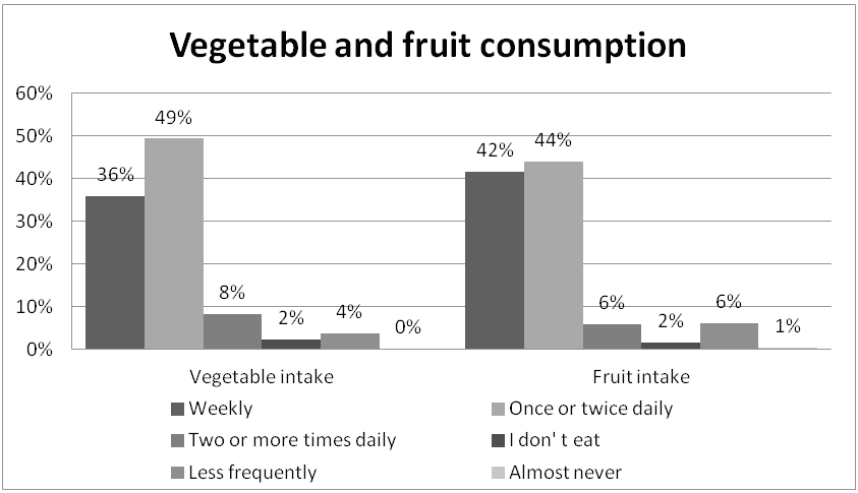

Figure 7 – How many times a day do you eat?

There is no big difference between men and women (Figure 7), buti it is noticeable that many women already eat five times a day, probably based ont he „more time, less food" priciple. The answers also revealed that nearly half of the students (47% of men, 55% of women) had breakfast every day, which is considered the most important mela of the day. 21% of men skip breakfast 2-3 times a week and 19% of them 4-5 times. Women are only a little more conscious because based on their results we see that 18% of them skip breakfast 2-3 times and 16% 4-5 times a week. 6% of men and 7% ofwomen never have breakfast. According to Hungarian traditions, the main meal is lunch, which is usually a hot meal, and 73% of men and 72% of women consider lunch to be their main meal. Of course it is also possible to consume it over a very wide time, as the lunch areas are open from 11 am to 3 pm. Probably family people (22% of men and women) are those for whom a common dinner is the main meal. „Have breakfast like a king, have lunch as a rich one, and have dinner as a poor" priciple was followed by those, who marked the breakfast as the main meal (5% of men and 6% of women). Because of their tight scheule, many people choose fast food restaurant sas their dining destination. Our question was how many people go to fast food restaurants at least 2-3 times a

week. Our summary shows that 17% of men and 9% of women. In the next set of questions we asked the average amount of fluid taken daily. There are several formulas for the recommended daily amount, but the most influential factor is whether the person is older or younger, possibly a child, live a passive or active life, do a sedentary work, spend a lot of time indoor or outdoor, and the time of day or the season also influencing factors. Many people are not aware that the daily intake of fluid includes the water content of the food they eat. The following figure (Figure 8) shows the the response rate to the question.

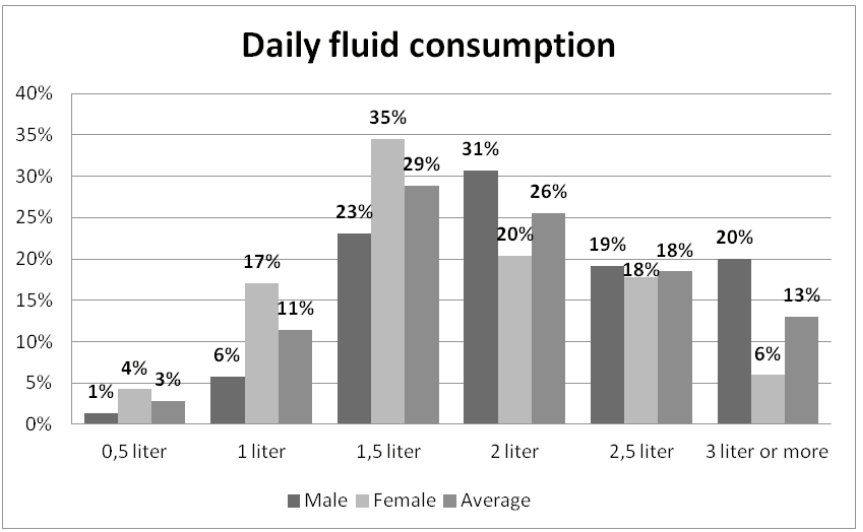

Figure 8 – Daily Fluid Consumption.

Women achieved higher rate below 1.5 liters, while men achieved all values above this. Most men surveyed consume more than 2 liters of fluid per day. There were 3 categories of fluid quality. The following results were obtained.

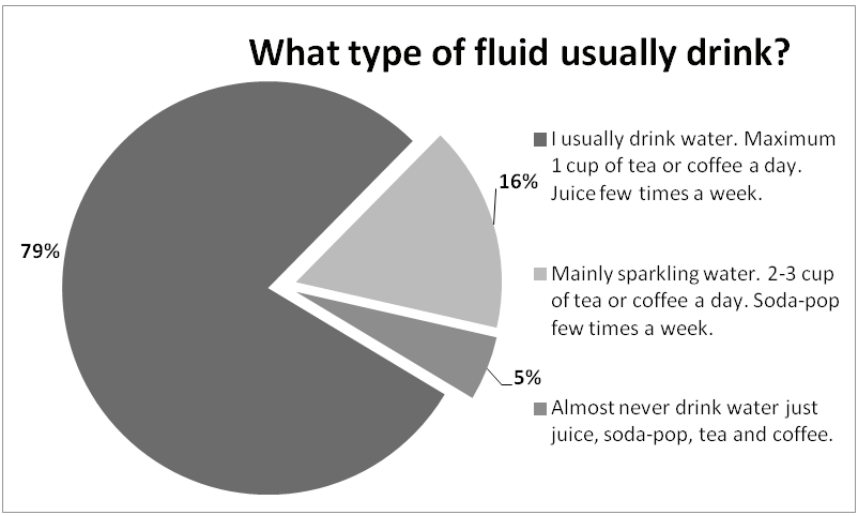

Figure 9 –What type of fluid do you usually drink?

The vast majority (Figure 9) usually drink water and only minimal amounts of other types of liquids such as tea, coffee, soda-pop or juice. There is no big difference between men's and women's responses. All three categories were chosen in almost equal rate. We have examined the consumption of energy drink, which can be mentioned as a harmful passion, in another survey.

Discussion

Koroknay and Pfau (2019) finding that university students are aware of the benefits of sport, and this result is the same as what we get, so the vast majority of students consider physical activity an important part of their lifestyle. Even though they have experienced on their own skin that they are changing their eating habit sin a positive way and helping to reduce the everyday stress, many people spend only 1-2 times a week with sport. Pikó and Keresztes found that the level of physical activity decreases with age and has been proved here. In the survey of Keresztes és mtsai. (2014) and Papp-Váry and Schwang (2012) have similarly low results az ours.

Although young people are taking part in sports, their physical activity is below recommended levels. We know that sport plays a very important role in social relationships, so it is also important what students do, with whom, and with what background. The difference between women and men of course apparent, because the types of exercise that women prefer are carried out in groups so that one cannot be alone if they want to. Men prefer the individual sports and ball games and spend more time exercising weekly. University students consider a wide range of aspects when deciding on sport activities. There are several reasons why people don't regret money and time for physical and mental health. In our world where externality is very important, it is surprising that the most important reason is to be healthy and feel better by sport. Of course weight loss and toning also appear, but not among the most important reasons. For those who do not exercise the main reason is lack of motivation and lack of time. The lack of time is perhaps still acceptable as most students work besides their study, however finding no outside or inside motivation for a young person to play sports is almost unacceptable. Many people check their body weight regularly and although we have not asked whether they are satisfied with it, the majority is presumably not. Many people use some form of diet on a regula and occasional basis. Nutrition is an essential part of body weight control, which is probably the main reason for the high consumption of vegetables and fruits. It would be easier to eat an apple, banana or some kind of seasonal fruit daily, but nevertheless the consumption of vegetables is higher. According to student feedback, more than 80% of them have got possibility to eat more than 3 meals a day and for most lunch is the main course. The importance of breakfast is also proved by the fact that, despite the early hours it is important for many to start the day with breakfast. A lot of information comes to us about how much and what kind of fluid we should drink. Proper amount of coffee and tea can solve many health problems but too much is harmful. Unfortunatelly, sugary drinks are not the most recommended category, but they are still popular, especially with fast food. Rushing lifestyle makes eating in fast-food restaurants unavoidable, but it's not the most typical.

Conclusion

Our research was good to see in which field need to develope or guide the students of the University of Szeged. All in all the question is the glass full or half empty? Can we be satisfied with the results presented or not? Half of the students take part in a variety of sports. Of course the time allotted for this may not rach the recommended amount for everyone, but this may vary. The benefits of sport are known and recognized, but nearly half of them do not exercise because of many reasons. Because of the large number of dieters, most people try to change their lifestyle in a positive way by changing their nutrition. Almost half of interviewed are able to have breakfast in relaxed environment and eat fruit and vegetables regularly. Higher levels of sporting activity are likelyto result in more fluid intake, which would result in an important change. For the reasons mentioned above, it would be important for students to have courses in lifestyle or life coaching, because who do not know the connections between sports and nutrition do not feel their importance either. Implamenting and organizing special programmes would also help to transform a young adult into a conscious and active adult.

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The Use of Aerobic Gymnastics as the Means of Realizing the Objectives of School Physical Education Specific to High School Education

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Abstract
Introduction. Aerobic gymnastics has a great influence on the locomotor system because the exercises used play an important role in shaping the shape and structure of our body, especially on the component parts of the locomotor system: bones, joints, muscles, ligaments and tendons.
Methods. The use of the means and methods of aerobic gymnastics in the physical education lessons of the school will lead to the achievement of some goals of physical education and sport specific to education. **Results.** It was assumed that conducting physical education activities within the student training system, with the dominant application of the aerobic means, will allow to increase the influence of the instructional-educational process on the training of the necessary motor skills and experience, as well as the formation of the movement need. Some of the results obtained are: Push-ups: EG/Ti = 6,3±1,63 and EG/Tf = 8,8±1,13 while CG/Ti = 5,3±1,88 and CG/Tf = 6,3±1,63; Abd.flexion: EG/Ti = 12±1,41 and EG/Tf = 14±1,5 while CG/Ti = 11±2,05 and CG/Tf = 11,6±2,01; Runing resistance: EG/Ti =4,39±0,07 and EG/Tf =3,85±0,43 while CG/Ti = 4,38±0,1 and CG/Tf = 4,35±0,08. **Conclusions.** The hypothesis works to confirm, this allows us to affirm that it is possible for aerobic gymnastics and to contribute to the achievement of the proposed goals and to create the physical conditions for the students by increasing significant manifestation to provide their motor and psychomotor skills.

Keywords: aerobics, objectives, high-school

Introduction

For the health of the modern man the lack of movement, the abuse of nicotine, coffee and other toxic substances are risk factors for his life.

Plutarch said: „Movement is the greatest source of health ..." and Dr. Ph. Tisie states: „Exercises can replace some drugs, but no medicine in the world can replace exercise."

Sedentarism, that is, lack of movement leads to a gradual decrease in the possibilities of intellectual and physical effort of both the young generation and the adult population.

Having a healthy body means not only a correct development of the body's forms and functions, but also the existence of optimal relationships between the functions of the body and the ever changing conditions of modern society (Dragnea, şi colab., 2006).

The students and the students during the works and the study have a vicious position of the body, the group and the dorsal and vertebral muscular chains ensure the positions of the trunk in the deceptive position, but they are deceived, if they can be put into operation and they should not have to stop may be longer the spatial musculature fatigue and remain diminished the tone of muscle care may be progressively atrophied. The stomach musculature is short after what can lead to tilting of the trunk before, and the muscles of the abdomen relax becoming weak and weak (Antoniale, 2003, Craciun, 1984). All of these lead to kyphotic, lordotic, scoliotic deviations of the spine, and then decreased pulmonary ventilation and improved cardiovascular function.

The movement is „Feeding the joints", through which traction, pressure, compression and stretching are exerted on the bone - muscles that act as stimuli that increase bring in nutrients and growth in certain dimensions, which can be functional (Baroga, M.; Baroga, L., 1989)

In the muscles engaged in exertion, a rich network of capillary vessels was observed, an important increase in the consumption of oxygen that favors the increase in the capacity for exertion. So physical exertion determines both changes in structure and important functional changes (Cărpinişeanu, R., 1981).

Aerobic gymnastics has a great influence on the locomotor system because the exercises used play an important role in shaping the shape and structure of our body, especially on the component parts of the locomotor system: bones, joints, muscles, ligaments and tendons (Buiac, Suciu, 2007; Popescu, C., Suciu A., 1988).

Methods

The use of the means and methods of aerobic gymnastics in the physical education lessons of the school will lead to the achievement of some goals of physical education and sport specific to education.

It has been assumed that conducting physical education activities within the student training system, with the dominant application of aerobic means, will allow to increase the influence of the instructional-educational process on the training of the necessary motor skills and experience, as well as the formation of the movement need.

In our study we use 20 pupils from high school, 10 in experimental group (5 male and 5 female) and 10 in control group (5 male and 5 female)

In order to verify the subjects on the neuro-muscular composition and special resistance, the following tests were used:

- Endurance test - the endurance test is performed with top start consisting of the distance run of 800 m girls and 1000 m boys. The timing method was used for the resistance tests.
- Push-up - from the lying face support, the performer performs the action of full-bending of the arms at the level of the elbow joint. Only the correctly repeated repetitions were counted.
- Abdominal flexion from the back - is performed individually, from the position lying on the back, the legs extended and fixed at the ankles, hands to the neck - lifting the trunk to vertical (900) and returning to the initial position, for 30 seconds;

- Mobility in the foreground - bending the front trunk from the sitting position. To perform the test, a wooden crate is required, on which a 50 cm long ruler is fastened using a nail. Grade 0 (zero) to the performer and the figure 25 (after some authors 23) exactly on the edge of the box.

Seated with the legs extended (held by the knees of a partner) without shoes, the soles will be supported on the vertical side of the crate or the bench.

The trunk bends forward (in a slow motion, not suddenly) with the arms outstretched and close so that the tip of the fingers slide as far as possible on the ruler.

At maximum stretch, we hold position 3 seconds. It is measured centimeters.

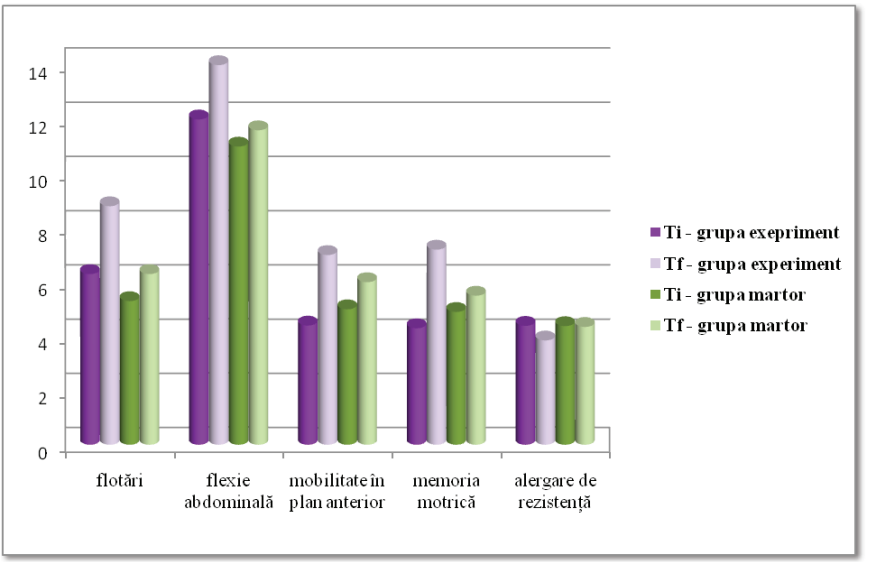
- Motor memory - 10 exercises structures will be executed in 8 steps, in which the movements are not repeated. The exercise is demonstrated by the teacher in a slow tempo and only once. The student reproduces the movements seen, it is not obligatory to repeat the sequence given by the instructor. The number of exercises correctly recorded is recorded.

Results

After the training programme with aerobic exercises, applied on the experimental group in some parts of the PE clases, we obtain the results wich we show in the table below. The control group work at their PE clases normaly, using the curricula in use.

Tests and measurements	X±□x				Ti - Tf	Ti - Tf	Cv%			
	Experiment group		Control group				Experiment group		Control group	
	Ti	Tf	Ti	Tf	D	D	Ti	Tf	Ti	Tf
Push-up	6,3 ±1,63	8,8 ±1,13	5,3 ±1,88	6,3 ±1,63	2,5	1	25,97	12,90	35,63	25,97
Abd.flexion from the back (rep. in 30 ‘’)	12 ±1,41	14 ±1,5	11 ±2,05	11,6 ±2,01	2	0,6	11,78	8,24	18,68	17,33
Forward mobility (cm)	4,4 ±4,06	7 ±4,21	5 ±3,82	6 ±3,46	2,6	1	92,2	60,1	76,41	57,63
The motor memory (rep. executed correctly)	4,3 ±1,25	7,20 ±0,78	4,9 ±1,52	5,5 ±1,43	2,9	0,6	29,10	10,95	31,09	26,06
Running resistance (800m girls and 1000 boys)	4,39 ±0,07	3,85 ±0,43	4,38 ±0,1	4,35 ±0,08	0,54	0,03	1,60	0,95	2,30	1,84

Table nr. 1. Statistical indicators (mean, st. dev, CV and dif.), on the tests performed and values on the EG and CG.



Graph nr. 1. Comparison of the results obtained by the two groups (experiment group and control group) on the 5 tests performed.

Conclusions

The dynamics of the presented indices indicate that the final results of the test have undergone positive changes compared to the initial ones, at all the analyzed parameters.

Analyzing the dynamics of the statistical results regarding the basic motor skills registered in the two groups, we can see that in the experimental group in which the students were trained by the means of aerobic gymnastics, there was a significant increase of the indices in all the tests performed and in the control group in which the physical education activities were carried out with the application of the traditional means, the increase of the results is insignificant on all indications. In addition, it was determined that the application of the elements of aerobic gymnastics accompanied by musical accompaniment in the experiment group, contributed to the more rigorous, more pronounced formation of their basic physical qualities.

The hypothesis of the work was confirmed, this allows us to affirm that the means of aerobic gymnastics have contributed to the achievement of the proposed objectives and to the improvement of the physical condition of the students, significantly increasing the manifestation of their motor and psychomotor qualities.

From the observations made and the results obtained, it turns out that, under the current conditions created in the school institutions, one of the most efficient and accessible means of physical education of the students could become the aerobic gymnastics, obligatorily accompanied by the musical accompaniment, applied in according to the age particularities of the children.

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An Explorative Literature Review of The Influence of Physical Exercises on Bone Mineral Density

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Abstract
Introduction: With age, bone mineral density decreases, and as a result the risk of fracture increases. It is known that practicing physical exercises helps maintain or increase bone mineral density in both men and women. Fractures resulting from osteoporosis become increasingly common in women after age 55 years, resulting in substantial bone-associated morbidities, and increased mortality and health-care costs. Physical exercises stimulates the bone and it adapts to the applied mechanical forces, stimulating the obsteoblast and inhibiting osteoclast formation and activity. ***Purpose:*** The purpose of this study is to highlight the benefits of physical exercise on bone cells and bone mineral density, respectively. ***Methods:*** We searched Science Direct, Springer Link, Web of Science and PubMed for articles and reviews in the English language pusblished between 2000 and 2020, although older references were also used when appropriate. The following terms were used to give as broad range of studies as possible: „osteoporosis", „bone density", „bone mass", „physical exercise", „strength training", „osteoblast", „osteoclast", „bone physiology". ***Results:*** We limited the search to the following study designs: controlled clinical trials, guidelines, meta-analyses, systematic reviews and randomised controlled trials. Of all the articles found, we selected 98

scientific articles from which we selected the most conclusive information. ***Conclusion:*** In conclusion, we recommend practicing physical exercises from childhood, since numerous studies carried out in young, adults and in the elderly demonstrate the beneficial effects of physical exercise on bone cells, especially on osteoblasts.

Keywords: osteoporosis, bone mass, osteoblast, osteoclast

Physical exercises and bone density

Regarding the treatment of osteoporosis, the National Osteoporosis Foundation recommends that it starts with a non-pharmaceutical approach, including weight-bearing exercises that result in increased muscle mass and bone mineral density (Hinton, Nigh, & Thyfault, 2015).

Numerous nonpharmacological interventions can be implemented to reduce the risk of bone loss and fracture, and these prevention methods are recommended not only for osteoporosis patients, but for the entire population (AACE Osteoporosis Task Force, 2003), (North American Menopause Society, 2006).

It is anticipated that there will be approximately 89 million people aged 65 and over by 2050 (Jacobsen, Kent, Lee, & Mather, 2011). With the increase in the number of elderly people worldwide (Quirino, Modesto-Filho, Vale, Alves, Leite, & Brandao-Neto, 2012), the interest for one's own health is increasing, as it is known that with the aging, the physical decline appears, cardiorespiratory capacity decreases (Weiss, Spina, Holloszy, & Ehsani, 2006), (Kendall & Fairman, 2014), body fat and adipose tissue increases (Nassis & Geladas, 2003), (Kim, Shin, Lee, Myung, & Kim, 2012) which may lead to increased morbidity and mortality worldwide (Rossi, et al., 2011), (Quirino, Modesto-Filho, Vale, Alves, Leite, & Brandao-Neto, 2012).

The incidence of hip fractures globally is 2.7 million in persons aged 50 years or older, and half of these fractures can be attributed to osteoporosis (264.162 in men and 1.100.555 in women); What is

noteworthy is that 59.3% of hip fractures in women could be prevented (Oden, McCloskey, Johansson, & Kanis, 2013).

Unwanted weight gain, decreased muscle mass and bone density, increased risk of diabetes, high blood pressure, cardiovascular, rheumatic and cancer disorders can be prevented by exercising (Colberg, et al., 2010), (Paynter et al., 2010). Exercises that require carrying or overcoming some weights are very effective in increasing bone mass and muscle strength, conditions that are increasingly encountered by women in this period (Chahal, Lee, & Luo, 2014). Eliminating sedentarism from our lives would have a positive impact on population health (Lee, Shiroma, Lobelo, Puska, Blair, & Katzmarzyk, 2012).

There are numerous studies that have addressed different preventive strategies for osteoporosis, strategies that involved either pharmacological or non-pharmacological treatment, both aimed at reducing the incidence of fractures (Ensrud, 2013).

Exercises can maintain and increase bone mineral density (Flieger, Karachalios, Khaldi, Raptou, & Lyritis, 1998), (Snow-Harter & Marcus, 1991), bone properties, (Umemura, Nagasawa, Sogo, & Honda, 2008), (Falcai, Zamarioli, Okubo, Paula, & Volpon, 2015), bone formation and reduce bone resorption (Huang, Lin, Chang, Hsieh, Liu, & Yang, 2003), (Xie, et al., 2006), (Yang, Jia , Chong, Wang, Qian, & Shang, 2009).

Gravitational attraction and muscular contraction are two major mechanical forces acting on the bone during physical exercises and human body movement, both of which have bone stimulating effects (Warden, et al., 2013).

The American College of Sports Medicine recommends both aerobic exercises such as tennis, climbing stairs, walking with intermittent running times and increasing strength training to maintain bone health. For aerobic exercises they recommend 30 - 60 minutes a day, 3 - 5 times a week (frequency), with an intensity of 40% - 60% of MHR (maximum heart rate). For strength training, they recommend 5 to 12 repetitions maximum (with a load that allows the subject to perform at least 5 repetitions, but no more than 12) (intensity), for 30 - 60 minutes per day, 2 - 3 times per week.

These recommendations may vary depending on the particularities of each subject (American College of Sports Medicine, 2010).

When exercise generates sufficient strength on the bone, the subject does not need to carry extra weights on the ankles or hands to be effective and does not need to be prolonged. Short work periods followed by rest breaks after exercise seem to be just as effective (Turner & Robling, 2003). For example, exercises that involve pushing weights performed from the sitting position, such as leg press, can be as effective or even more effective than walking or running. The exercises used should target the proximal muscle groups of the target bone and which present risk factors for fracture (Hurley & Armstrong, 2012).

The influence of physical exercise on bone cells

It is well known that bone is stimulated by mechanical loads (Yokota, Leong, & Sun, 2011), and it responds to mechanical stress and adapts to the applied mechanical forces (Kohrt WM, Bloomfield, Little, Nelson, & Yingling, 2004), (Bailey & Brooke-Wavell, 2008), (Burgers & Williams, 2013).

Osteoblasts are stimulated by mechanical forces acting on the bone, which then produce different biological effects that are beneficial for bone health (Rubin, Rubin, & Jacobs, 2006).

Mechanical stimulation of bone has the effect of inhibiting osteoclast formation and activity, (Rubin, Murphy, Zhu, Roy, Nanes, & Fan, 2003), (Saunders, Taylor, Du, Zhou, Pellegrini, & Donahue, 2006).

Once the mechanical forces are exerted on the bone, the osteocytes detect the strain and activate the activity of the osteoblasts to form new bone (Ju, Sone, Ohnaru, Choi, Choi, & Fukunaga, 2013).

Osteocytes are thought to be the ones that feel the bone under mechanical pressure and then send signals to the nearest osteoclasts and osteoblasts to respond specifically to pressure / loading exerted (Bonewald LF, 2011), (Crockett, Rogers, Coxon , Hocking, &

Helfrich, 2011). If the osteocytes do not feel the mechanical load, the activation of the osteoclasts will resorb the bone (Bravo, et al., 1996).

The osteocytes occupy the gaps and are surrounded by the bone matrix. They can initiate and control local bone remodeling by integrating mechanical signals and converting them into biological messengers (Rochefort & Benhamou, 2013).

Thus, osteocytes receive mechanical stresses on the bone and then transmit them to cells on its surface (Bonewald & Johnson, 2008).

These forces increase both mineral density and bone strength, which may be some of the main reasons why physical activity is so beneficial for bone health, and it is recommended even for the prevention of osteoporosis due to the few side effects and the positive effect on osteoblast activity. (Cheung & Lora, 2012), (Niinimaki, 2012).

Exercises with moderate intensity promote bone formation and inhibit bone resorption. Thus, physical exercises have a positive impact on bone mass (Honda, Sogo, Nagasawa, Kato, & Umemura, 2008), strength, geometry and bone properties, which prevents and slows the development of osteoporosis (Welch, Turner, Devareddy, Arjmandi, & Weaver, 2008), (Senderovich & Kosmopoulos, 2018).

Mesenchymal stem cells are multipotent cells that have the ability to proliferate and differentiate into different cells including osteoblasts, chondrocytes and adipocytes. Physical exercises induce mesenchymal stem cells to differentiate into osteoblasts. A recent study compared the effects of endurance training and the effects of a sedentary lifestyle on CSM (mesenchymal stem cells) in rats and found that exercise can increase the number of cells that differentiate into osteoblasts (from mesenchymal stem cells) and inhibit adipogenic potential of these stem cells (Hell, et al., 2012), (Maredziak, Smieszek, Chrzastek, Basinska, & Marycz, 2015).

Physical exercises lead to increased mechanical signals such as dynamic tension, compression and hydrostatic pressure. These mechanical signals stimulate the osteogenetic differentiation of mes-

enchymal stem cells and inhibit adipogenic differentiation, which may be one of the main reasons why exercise prevents osteoporosis (Sawakami, et al., 2006).

Exercise-induced mechanical stress contributes to bone strength development by influencing collagen alignment when new bone is formed (Huiskes, Ruimermam, Lenthe, & Janssen, 2000). Thus, bone responds to mechanical loading by stimulating bone formation in areas where loading is high (Turner C. H., 2006), (Senderovich & Kosmopoulos, 2018).

Muscle activity transmits stresses to the bone, and their dynamic tightening leads to anabolic effects by stimulating the proliferation of osteoblasts (Kaspar, Seidl, Neidlinger-Wilke, Beck, Claes, & Ignatius, 2002).

On the other hand, the absence of physical activity, prolonged immobilization in bed and weightlessness have negative effects on the bone system by inhibiting osteoblast activity and by strengthening osteoclast activity (Meyers, Zayzafoon, Douglas, & McDonald, 2005).

When a subject is immobilized, the stimulus for the acquisition of bone mineral density is insufficient, which leads to increased bone resorption. This is due to the fact that osteocytes, as receptors for gravity, do not detect gravity that behaves as a physiological exciter of the bone (Herrero & Pico, 2016).

Maintaining bone mineral density starts from childhood

Practiced when we are young, exercise can have major bone structure benefits and even major benefits against fractures (Warden, Fuchs, Castillo, Nelson, & Turner, 2007), (Burrows, 2007). Exercise can positively influence adolescent bone growth, bone density, which helps prevent osteoporosis in adulthood (Kemmler, Bebenek, Stengel, & Bauer, 2015).

Regular exercise during growth can improve muscle strength by increasing the rate of bone formation, leading to a significant reduction in the risk of fracture in adulthood (Turner & Robling,

2003). An additional 10% in bone mineral density in childhood and adulthood may delay the development of osteoporosis by about 13% and consequently reduce the risk of fracture by 50% (Johnston & Slemenda, 1994), (Hernandez, Beaupre, & Carter, 2003), (Hello, Chevalley, Rizzoli, & Ferrari, 2007).

Adaptations to mechanical demands during youth turn into a higher bone resistance throughout life (Warden, Fuchs, Castillo, Nelson, & Turner, 2007), (Warden, et al., 2014). When physical activity is performed in the early years, it contributes to specific geometrical changes that offer biomechanical advantages, which leads to increased bone strength and decreased risk of fracture at an old age (Grau, Fuentes, Hdez, & Antonio, Exercise and Bone Mass in Adults, 2009).

Increased bone mineral density during youth may provide additional protection against osteoporosis at an old age (Loyd, Petit, Lin, & Beck, 2004), (Cech, 2012) and delay the risk of osteoporotic fractures (Beck & Snow, 2003), (Ondrak & Morgan, 2007), (DeBar, et al., 2006). Conversely, poor acquisition of bone density during childhood and adolescence is associated with an increased risk for fracture (Chevalley, Bonjour, Ferrari, & Rizzoli, 2011), (Bonjour & Chevalley, 2014).

Physical activity increases bone mineral density in children and adolescents (Ondrak & Morgan, 2007), (Hind & Burrows, 2007), (Loud & Gordon, 2006), (Greene & Naughton, 2006), (Vicente-Rodriguez, 2006), (Nikander, Sievanen, Heinonen, Daly, Uusi-Rasi, & Kannus, 2010). Children reach 50% - 60% of the maximum bone mass until puberty and increase to 90% (in boys) and 95% (in girls) by the age of 20 (Ondrak & Morgan, 2007).

The bone mineral density consolidation continues throughout the adult period, but the maximum bone mineral density at the level of the femoral neck and lumbar spine is reached at the end of 20 years (Weaver, et al., 2016), (Sandstrom, McGuigan, Callreus, & Akesson, 2016).

In adolescence, bone mass grows more than ever (Loud & Gordon, 2006), (Ondrak & Morgan, 2007), (Perez-Lopez, Chedraui, & Cuadros-Lopez, 2010). Individuals who are physically active dur-

ing childhood and adolescence will have an increased bone mass in adulthood. Achieving peak bone mass has a major influence on the development of osteoporosis (Matkovic, et al., 1994), (Rubin, Hawker, Peltekova, Fielding, Ridout, & Cole, 1999).

Also, it is generally accepted that the skeleton responds more quickly to physical exercises during childhood and adolescence than in the adult and the elderly (Kontulainen, Sievanen, Kannus, Pasanen, & Vuori, 2003). In addition, the benefits of exercise are maintained even after the intervention has ended, if it was initiated in childhood and adolescence and not in adulthood (Weeks & Beck, 2012).

Conclusion

Therefore, practicing physical exercises has positive effects on the bone mineral content and on the peripheral region of the bone, but on the bone mineral density the changes may not be so visible.

Although it is known that exercises that involve the transport/ carrying of weights are beneficial for bone formation (Papaioannou, et al., 2010), (Bergland, Thorsen, & Karesen, 2011), (Burke, Franca, Meneses, Pereira, & Marques, 2012), (Bighea, Patru, Bumbea, & Popescu, 2011), (P. Teixeira, Silva, Imoto, Kayo, Teixeira, & Goulart, 2008), (Dominguez, Prisby, Muller-Delp, Allen, & Delp, 2010), it seems that the degree of muscle strain and stress has a greater impact on osteogenesis, regardless of whether the activity involved involves the transport of weights (Beck, and others, 2011).

Thus numerous studies in children and adolescents (Macdonald, Kontulainen, Khan, & McKay, 2006), (Macdonald HM, Kontulainen, Petit, Beck, Khan, & McKay, 2008), (MacKelvie, Petit, Khan, Beck, & McKay, 2004), (Petit, Mckay, Mackelvie, Heinonen, Khan, & Beck, 2002), (Weeks, Young, & Beck, 2008), adults (Vainionpaa A., Korpelainen, Sievanen, Vihriala, Leppauluoto, & Jamsa, 2007) and the elderly (Cheng, Sipila, Taaffe, Puolakka, & Suominen, 2002), (Karinkanta, et al., 2007), (Kannus, et al., 2003), (Uusi-Rasi,

Sievanen, Pasanen, Oja, & Vuori, 2002) demonstrates the beneficial effects of physical exercise on bone health throughout life (Nikander, Sievanen, Heinonen, Daly, Uusi-Rasi, & Kannus, 2010).

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