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STUDIA UBB EDUCATIO ARTIS GYMN., LXI, 2, 2016, pp. 5 - 14
(RECOMMENDED CITATION)

WEIGHT TRAINING IN GYMS OF CLUJ-NAPOCA AS LEISURE PHYSICAL ACTIVITY: WARM-UP AND COOL-DOWN PHASES

REMUS-CRISTIAN VĂIDĂHĂZAN[1*], IACOB HANȚIU[2], ADELINA STAICU[3]

ABSTRACT. The human body becomes more efficient as it reaches adequate levels of physical fitness. Practicing regular exercise combined with good nutrition decreases the time needed for recovery and reconstruction of all tissues (Bushman, Clark-Young, & American College of Sports Medicine, 2005). The type of activities that people practice lifelong determines their functional capacity that they will keep for their own musculoskeletal system, with important implications for the whole body. The practice of weight training plays an important role in delaying and reducing the negative effects that aging has on the human body (American College of Sports Medicine, 2013). **Objective of the study:** The objective of this study was to investigate the weight training practiced as a leisure activity in Cluj-Napoca's fitness gyms. We were interested in methodical approach implemented by practitioners for warm-up and cool-down. **Methods:** The research was conducted from 14 August 2013 to 20 August 2014 in Cluj-Napoca's weight training gyms. The subjects were practitioners of all gyms where weight training is practised, and where we were granted access. We registered between 4 and 6 practitioners in every gym. A total of 155 practitioners were interviewed, 81 of them accepted to participate to our study. **Conclusions:** The methodical approach of weight training workouts is faulty for many practitioners. For most of them, the warm-up phase does not present proper importance and the majority of practitioners do not do it right. The situation is even worse if we analyse the implementation of cool-down phase. This part of workout is missing to almost all practitioners. Practitioners of weight training does not relate to dynamics of heart rate when they plan the warm-up and the cool-down for their workout. The heart rate dynamics recorded for weight training workouts were on a wide range of values. Practitioners presented different approaches and the lack of research it is a demand for all of us to continue the research in this field.

Keywords: warm-up, cool-down, fitness, weight training, leisure, Cluj-Napoca.

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REZUMAT. ***Antrenamentul cu greutăți în sălile de fitness din Cluj-Napoca ca activitate fizică de timp liber: aspecte privind pregătirea organismului pentru efort și liniștirea acestuia la sfârșitul ședinței de antrenament.*** **Obiectivul studiului:** Obiectivul acestui studiu a fost investigarea şedinţei de antrenament specific acestei activităţi de timp liber din perspectiva începutului şi sfârşitului antrenamentului. Ne-a interesat abordarea metodică pe care practicanţii din sălile de fitness din Cluj-Napoca o realizează când încep şi când termină antrenamentul cu greutăţi. **Subiecţi şi metode:** Cercetarea s-a desfăşurat pe perioada unui an, din data de 14 august 2013 până în data de 20 august 2014, în sălile de fitness din Cluj-Napoca. Subiecţii studiului sunt practicanţi din toate sălile de fitness în care se efectuează antrenamente cu greutăţi şi în care ne-a fost acordat accesul, între 4 şi 6 practicanţi din fiecare sală de fitness. Au fost intervievaţi 155 de practicanţi. 47,74% au refuzat participarea la studiu, iar 52,26% şi-au dat acceptul. **Concluzii.** Din punct de vedere metodic mulţi practicanţi abordează deficitar antrenamentele cu greutăţi în sălile de fitness. Pentru mulţi dintre ei pregătirea organismului pentru efort nu prezintă importanţa cuvenită, iar la foarte mulţi dintre practicanţi aceasta este realizată necorespunzător. Problemele sunt şi mai mari atunci când este nevoie de includerea părţii de liniştire după efortul din partea fundamentală. Această parte de antrenament lipseşte la un număr foarte mare de practicanţi. Practicanţii antrenamentului cu greutăţi nu se raportează la dinamica FC atunci când îşi construiesc partea de pregătire a organismului pentru efort sau cea de liniştire după efortul din partea fundamentală. Dinamica FC în antrenamentele cu greutăţi înregistrate variază pe o plajă foarte largă. Abordările practicanţilor au fost foarte variate, iar lipsa cercetărilor pe această direcţie ne obligă să continuăm studiile pe această direcţie de cercetare.

Cuvinte-cheie: pregătirea organismului pentru efort, liniștirea organismului după efort, fitness, antrenament cu greutăți, timp liber, Cluj-Napoca.

Introduction

The human body becomes more efficient as it reaches adequate levels of physical fitness. Practicing regular exercise combined with good nutrition decreases the time needed for recovery and reconstruction of all tissues (Bushman, Clark-Young, & American College of Sports Medicine, Action Plan for Osteoporosis, 2005). The type of activities that people practice lifelong determines their functional capacity that they will keep for their own musculoskeletal system, with important implications for the whole body. The practice of weight training plays an important role in delaying and reducing the negative effects that aging has on the human body (American College of Sports Medicine, 2013).

The American College of Sports Medicine (ACSM), in 2005, presents the following structure for leisure activities (American College of Sports Medicine, 2005, p. 136):

- A warm-up period (approximately 5 to 10 minutes),
- A stimulus or conditioning phase (cardiorespiratory fitness, flexibility, resistance training) (20 to 60 minutes),
- An optional recreational game (provides variety),
- A cool-down period (5 to 10 minutes).

Every workout should begin with a warm-up phase. The warm-up must be a transitional phase from rest to conditioning phase. This transitional phase should allow the body to prepare for the physiological, biomechanical and energetic changes that will occur in our body (American College of Sports Medicine, 2009). Warm-up aims physiological and psychological preparation for training tasks (Bompa, 2002; Sbenghe, 2005).

A proper warm-up must raise body temperature with 1^0-2^0C and raise the heart rate in the range of 120-130 beats/minute (Sbenghe, 2005). A positive effect given by the appearance of perspiration is lowering the temperature at skin level. Thus, the difference of temperature between the skin and the body increases, which results in a low blood flow necessary to transfer the excess of heat to skin (Wilmore & Costill, 1993).

We have to note some negative effects that improper warm-up can have on our bodies. It was observed, following research conducted over the years, a statistical increase in the number of people diagnosed with cardiovascular disease who underwent acute myocardial infarction or death during strenuous activities (Giri, Thompson & Kiernan, 1999; Mittleman, Maclure, Tofler, Sherwood, Goldberg & Muller, 1993; Siscovick, Weiss, Fletcher & Lasky, 1984; Thompson, Funk, Carleton & Sturner, 1980; Vuori, 1986; Willich, Lewis, Lowel, Arntz, Schubert & Schroder, 1993; cited by the American College of Sports Medicine, 2009, p. 10).

This risk exists even for people not diagnosed yet with cardiovascular disease, but participating in strenuous activities. The risk is greater among the adults than among the young practitioners, probably due to the high prevalence of cardiovascular disease as we age. The risk is higher among sedentary individuals who do not practice regularly exercise and participate sporadically in intense physical activities (American College of Sports Medicine, 2009).

Physical activity practiced regularly reduces, in time, the risk of cardiovascular disease but intense physical activity practiced sporadically increases the risk of death for people susceptible to heart disease (Thompson, et al., 2007). Intense exercise may increase risks in coronary arteries (Thompson, et al., 2007) or

may enhance the activity of platelet aggregation (thrombocytes) induced by catecholamine in sedentary individuals who are not accustomed to intense physical activity (Kerstin, Ellis, Bernard, Errichetti, Rosner & Michelson, 1993; Li, Wallen & Hjemdahl, 1999; cited by Thompson et al, 2007, p. 2360). For example, "an analysis of a database with 2.9 million members of a large commercial health/fitness facility chain reported 71 deaths over a 2-year period" (Thompson, et al., 2007, p. 2361). "Nearly half of the exercise-related deaths were among members who exercised infrequently or less than once a week" (Thompson, et al., 2007, p. 2361).

The conditioning phase should not end the training session. It is recommended a cool-down phase at the end of every workout (Plowman & Smith, 2002; Weinberg & Gould, 2006). The cool-down is just as important as the warm-up. "Just as it is essential to warm up, it is important to cool down at the end of a workout" (Delavier & Gundill, 2011, p. 37).

This part of the training session refers to an activity performed at low intensity exercises and represents a transitional period from the conditioning phase to rest (Ratamess Jr., 2012). "It helps return the body to homeostasis in a controlled manner" (Ratamess Jr., 2012, p. 189). It is important that this phase to be gradual (American College of Sports Medicine, 2005). A controlled cool-down attenuates the effects of stress imposed to circulatory system during conditioning phase and helps the return of heart rate to rest values (American College of Sports Medicine, 2005).

A reduction of coronary perfusion can be enhanced by a decreased venous return, secondary to abrupt stop of physical activity, which explains the clinical observations that collapse may occur immediately after exercise (Thompson, et al., 2007). "Ischemia can alter depolarization, repolarization, and conduction velocity and thereby trigger threatening ventricular arrhythmias" (Thompson, et al., 2007, p. 2360). American College of Sports Medicine (2005) also sustain that the absence of cool-down after physical activity can increase the risk of cardiovascular complications. The cool-down maintain adequate venous return, thereby reducing the potential for postexercise hypotension and dizziness" (American College of Sports Medicine, 2005, p. 138).

Objective of the study

The objective of this study was to investigate the weight training practiced as a leisure activity in Cluj-Napoca's fitness gyms. We were interested in methodical approach implemented by practitioners for warm-up and cool-down.

Methods

The research was conducted from 14 August 2013 to 20 August 2014 in Cluj-Napoca's weight training gyms. The subjects were practitioners of all gyms where weight training is practised, and where we were granted access. We registered between 4 and 6 practitioners in every gym. A total of 155 practitioners were interviewed, 81 of them accepted to participate to our study. To build the sample we used a non-random sampling as a member of the population probability of being selected in the sample could not be determined. For each of the 81 subjects was recorded only one session of training.

The data needed for research were recorded on a sheet of observation during the workout. Heart rate was recorded with Polar equipment integrated into our personal methodical approach (Văidăhăzan, Hanţiu, Pop, & Pătraşcu, 2015). After workout it has been applied a questionnaire to find out the practitioners point of view on the importance of warm-up and cool-down.

To decide whether practitioners have achieved the objectives of warm-up and cool-down we have concluded that some conditions must be met. For warm-up these conditions were:

- Warm-up must last at least 5 minutes;
- Warm-up must include aerobic activity and analytical exercises that prepares the joints;
- Heart rate must not exceed 130 beats / minute during the first 5 minutes of training session.

For cooling-down, these conditions were:

- Cool-down must last at least 5 minutes;
- Cool-down must include aerobic activity with decreasing intensity;
- At the end of the cool-down heart rate must not exceed 120 beats / minute.

Results

Of the 81 subjects 69.14% (56 subjects) were male and 30.86% (25 subjects) female, aged between 18 and 60 years. We present in Table no. 1 a distribution of subjects by age.

Table 1. Distribution of subjects by age

	≤ 20 years	21-25 years	26-30 years	31-35 years	36-40 years	41-45 years	46-50 years	≥ 50 years
Percentage	8.64	27.16	29.63	12.35	8.64	2.47	1.23	9.88

Practitioners were asked to give different degrees of importance for warm-up phase. Table no. 2 presents their answers, depending on the importance given.

Table 2. The importance of warm-up

	Not important	The least important	Somewhat important	Quite important	Very important
Percentage	3.70	7.41	1.23	28.40	59.26

For a significant number among practitioners (87.65%) the warm-up it is quite important or very important.

Analysing the observational sheets we noted that 76.54% included the warm-up phase in their workout, but only 7.41% (6 practitioners) met all conditions that we consider mandatory for a proper warm-up. Table no. 3 offers an overview.

Table 3. Overview for warm-up phase

	Warm-up included intentionally	All conditions for a proper warm-up were fulfilled
Percentage	76.54	7.41

Table no. 4 presents the level of the heart rate maximum during the first 5 minutes of workout.

Table 4. Heart rate maximum in the first 5 minutes of workout

	Less or equal to 130 beats/min.	Interval of 131-140 beats/min.		Interval of 141-150 beats/min.	Interval of 151-160 beats/min.	Interval of 161-170 beats/min.	Interval of 171-180 beats/min.
Percentage	32.10	29.63		12.35	9.88	7.41	8.64

Practitioners were asked to give different degrees of importance for cool-down phase. Table no. 5 presents their answers, depending on the importance given.

Table 5. The importance of cool-down

	Not important	The least important	Somewhat important	Quite important	Very important
Percentage	4.94	13.58	12.35	28.40	40.74

For a significant number among practitioners (69.14%) the cool-down it is quite important or very important.

The cool-down was analysed only on 80 practitioners because one subject have not included weight training in his workout when he was monitored.

Out of 80 practitioners, only 8.75% were consciously including specific content for cool-down. Only one practitioner, of those who included consciously the cool-down phase in their workout, met all the mandatory conditions we looked for in a proper cool-down.

Table 6. Overview for cool-down phase

	Warm-up included intentionally	All conditions for a proper warm-up were fulfilled
Percentage	8.75	1.25

Table no. 7 presents the level for heart rate maximum at the end of workout.

Table 7. Heart rate maximum at the end of workout

	Less or equal to 120 beats/ min.	Interval of 121-130 beats/ min.	Interval of 131-140 beats/ min.	Interval of 141-150 beats/ min.	Interval of 151-160 beats/ min.	Interval of 161-170 beats/ min.	Interval of 171-180 beats/ min.	Interval of 181-190 beats/ min.
Percentage	18.75	15.00	22.50	18.75	7.50	5.00	8.75	3.75

Discussions

Both the warm-up and the cool-down are very important in the dynamics of weight training workout. The correct implementation of these phases in the workout structure is based on importance that every practitioner gives for these phases. Subjects in our study give greater importance for warm-up, as evidenced by the results presented above. Both phases, however, have achieved high scores (over 50%) on the scale of assessments for the most important criteria: "Quite important" and "Very important".

Although almost 90% of practitioners admitted that warm-up is quite important or very important to them, only 76.54% of subjects intentionally included specific content in their workout. Analysing further, we observed that a very small percentage of subjects (7.41%) fulfilled the mandatory requests for a proper warm-up. This fact suggests a lack of knowledge regarding the implementation of warm-up in personal workout.

Analysing the maximum heart rate in warm-up phase of every workout we observed that for 67.90% of subjects the heart rate value exceeded 130 beats / minute in the first 5 minutes of workout. For 16% of subjects heart rate exceeded even the value of 160 beats / minute. Thus, we have to note an improper methodical approach for the beginning of a workout for majority of practitioners.

For many subjects included in our study (69.14%) the cool-down is quite important or very important. Even so, we have noted that only one subject fulfilled all the conditions that we consider mandatory for a proper cool-down phase.

Heart rate recorded at the end of workout showed values greater than 120 beats / minute for 81.25% of registered practitioners. For 17% of subjects the value of heart rate was greater than 160 beats / minute. These records suggest an improper methodical approach for the final part of a workout for majority of practitioners.

Conclusions

The methodical approach of weight training workouts is faulty for many practitioners. For majority of them the warm-up does not present proper importance and the majority of practitioners do not do it right. The situation is even worse if we analyse the implementation of cool-down phase. This part of workout is missing to almost all practitioners.

Practitioners of weight training does not relate to dynamics of heart rate when they plan the warm-up and the cool-down for their workout.

The heart rate dynamics recorded for weight training workouts were on a wide range of values. Practitioners presented different approaches and the lack of research it is a demand for all of us to continue the research in this field.

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STUDY ON TRUNK ASYMMETRY IN CHILDREN AGED 10-15 YEARS

BÉLA JÓZSEF BALLA[1], IACOB HANȚIU[1]

ABSTRACT. **Background**: A school screening for trunk asymmetries was performed in 2015, to assess children and teenage population the prevalence of these asymmetries. **Objectives:** To report the prevalence of trunk asymmetry in normal children and adolescents in Cluj-Napoca, by a cross-sectional study. **Methods**: The traditional Adam's forward bending test and scoliometer readings were used during the screening program to collect quantitative data. The angle of trunk rotation was measured to quantify the existing trunk asymmetry. A number of 373 subjects (199 male and 174 female) were screened, with a mean age of 13.0 ±1.48 (girls 12.73±1.51; boys 13.26±1.41). **Results**: The subjects were divided into two groups according to the severity of trunk asymmetry. In the first group, asymmetry was 1 to 6 degrees and in the second group was 7 or more degrees. The mean frequency of (severe) asymmetry of 7 or more degrees was 1.84% in boys and 7.28% in girls. The mean frequency of symmetric (angle of trunk rotation = 0 degrees) boys and girls was 70.5% and 66.7%, respectively. **Conclusions**: 47.7% of boys and 41.7% of girls were found to be absolutely symmetric in all regions of the spine. Girls are found to have a higher frequency of asymmetry than boys do. Right trunk asymmetry was more common than left. These findings are also supported by several studies from other European regions.

Keywords: trunk asymmetry, school screening, scoliosis, scoliometer measurement.

REZUMAT. **Studiul asimetriei trunchiului la copiii cu vârsta cuprinsă între 10-15 ani. Introducere**: În 2015 a fost efectuat un screening școlar pentru depistarea asimetriei trunchiului, cu scopul de a raporta prevalența acestei asimetrii la copiilor de vârstă școlară. **Obiective:** Raportarea prevalenței asimetriilor trunchiului la copiii și adolescenții sănătoși la Cluj-Napoca, printr-un studiu transversal. **Metode**: În cadrul acestui program de depistare au fost folosite testul Adam's – testul înclinării spre înainte - și măsurarea scoliometrică pentru a colecta date cantitative. Unghiul de rotație a trunchiului a fost măsurat pentru a cuantifica distorsiunile torsului. Au fost incluși 373 de subiecți (199 băieți și 174 fete), vârsta medie a elevilor fiind 13,0 ±1,48 (fete 12,73±1,51; băieți 13,26±1,41). **Rezultate**: Subiecții au fost împărțiți în două grupuri în funcție de severitatea asimetriei trunchiului. În primul grup au fost clasați cei cu asimetrii între 1 și 6 grade, iar în al doilea cei cu asimetria de 7° sau de la 7° în sus. Frecvența asimetriilor severe (7°≤) este de 1,84% la băieți și de 7,28% la fete.

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Frecvența spatelui simetric (unghiul de rotație a trunchiului = 0°) la băieți este de 70,5% și respectiv de 66,7% la fete. **Concluzii**: Din această cercetare reiese că fetele sunt mai afectate de asimetriile spatelui decât băieții. Asimetria toracică dreaptă este mult mai des întâlnită, decât cea stângă. Aceste constatări sunt susținute și de alte studii făcute în regiunile Europei.

Cuvinte-cheie: asimetria trunchiului, screening școlar, scolioză, măsurare scoliometrică.

Introduction

The purpose of scoliosis school screening is to detect back trunk asymmetry in children at risk to develop progressive scoliosis. Detection at an early stadium when the spinal deformity is likely to go unnoticed offers a unique opportunity for a less non-invasive (conservative) method treatment (Grivas, et al., 2007).

Currently, in Romania, there has not been any consistent or centralized preoccupation for scoliosis nor whatever type of physical deficiencies school screening. In the 1950-60,'s a periodical physical evaluation of the children was mandated by law and performed at the beginning of the school year (Ionescu, 1961). The deficiencies are often discovered through casual medical examinations, and in many cases the curves are far-gone progressed, so it is not possible to apply a conservative treatment, like physiotherapy and bracing.

In the last two decades, private and state associations organized some minor screenings, which aims to detect different kind of physical deficiencies (Avramescu-Oprițoiu, 2008; Câmpeanu, et al., 2013; Maroti, et al., 2001). In Romania, there are no studies with regard to scoliosis school screening.

The trunk asymmetry is a relatively known phenomenon and was found in numerous studies (Grivas, et al., 2006; Nissinen, et al., 2000; Willner, 1984) to correlate well with the prediction of future scoliosis in children and adolescents. During a scoliosis school screening, the amount of asymmetry of the trunk shape is considered the strongest indicator for referral and further orthopaedic assessment of the normal children and adolescent population. This asymmetry has resulted by the existence of a hump at the thoracic, thoracolumbar or lumbar area (Bunnell, 1984).

The most commonly used test for screening for scoliosis is the Adam's forward bending test and the scoliometer reading. The scoliometer was introduced in 1984 to limit the subjectivity of the forward bending test, it quantifies the trunk deformation by determining the angle of trunk rotation (ATR). Is it widely accepted that 7 degrees of ATR at any level of the spine is

the ideal criterion for referral (Bunnell, 1993). The reliability, the validity and the diagnostic accuracy of the scoliometer and Adam's forward bend test were evaluated in some studies. It was found that the use of this tool as a screening device is appropriate (Amendt, et al., 1990), at the same time the scoliometer and Adam's forward bend tests have adequate inter-examiner reliability for the assessment of thoracic curves (Côté, Kreitz, Cassidy, Dzus, & Martel, 1998; Murrell, Coonrad, Moorman, & Fitch, 1993).

The ideal age for scoliosis screening can vary, since it depends on the gender, age and the age of the menarche. The girls should be screened twice, at age 10 and 12, and boys once at age 13 or 14 (Labelle, et al., 2013).

Objectives

This cross-sectional study aims to report the prevalence of trunk asymmetry in normal children and adolescents from one of the largest cities in Romania, Cluj-Napoca, and to compare the obtained results with the results of other countries from Europe.

Materials and methods

In this study, 373 children (199 boys and 174 girls) aged from 10 to 15 years old were investigated, during a school screening program, between 2015 march and 2015 may. The scoliometer readings in standing forward bending position was performed and the trunk asymmetry was quantified by measuring the angle of trunk rotation at mid-thoracic (T_4-T_8), thoracolumbar (T_{12}-L_1) and at the lumbar (L_2-L_5) regions of the spine.

The scoliometer

The Bunnell scoliometer is a specially designed inclinometer that measures distortions of the torso. This device reveals children with a surface, mainly thoracic surface deformity. It does not reveal scoliosis per se. It was introduced in 1984 to limit the subjectivity of the forward-bending test. Is not sufficient to use this method alone for determining patient diagnosis and management, but based on a positive-frequency analysis the use of this instrument as a screening device would be appropriate (Grivas, Vasiliadis, Mihas, & Savvidou, 2007).

Traditionally, scoliosis screening is done either by Adam test or by using other optical techniques, while the radiographic measurement of Cobb angle is considered the golden standard (Patias, Grivas, Kaspiris, Aggouris, & Drakoutos, 2012). Although X-ray is the golden standard for diagnosis of idiopathic scoliosis, it is not used as a screening method because of the risk associated with radiation exposure (Kotwicki, et al., 2013).

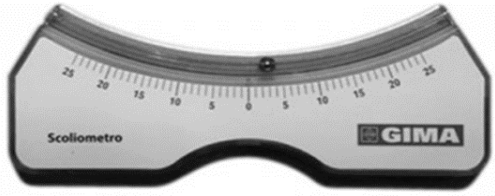

Figure 1. The scoliometer

The Adam's forward bending test

The subject was asked to bend forward, looking down, keeping the feet 15 cm apart, knees braced back, shoulders loose, hands positioned in front of the knees or shins with elbows straight, and palms opposed. The side of the hump determined the laterality of trunk rotation. Trunk asymmetry to the right side (higher hump on the right) was defined as right asymmetry and to the left (higher hump on the left) was defined as left asymmetry in each of the three mentioned regions and recorded in degrees. The scoliometer measurements were obtained successively at the same three areas of interest. Four rectangular lines on the floor of the sports court were drawn to help the subject in the positioning of their feet.

The examined children

The children were selected from two high schools from the centre of the city. The convenience non-probability sampling method was used to select the sample. The average age of the sample was 13.0 ±1.48 (girls 12.73±1.51; boys 13.26±1.41). 75% of the screened children come from the urban area and the remaining twenty-five percent from the rural area.

Scoliometer measurement equal to 0º was defined as symmetry at the particular level of the spine. Any other measured value was defined as asymmetry. According to the severity of the trunk asymmetry, the subjects were divided into two groups. In the first group, the scoliometer readings were less than 7º

and in the second group, the scoliometer readings were 7º or more. Right asymmetry was noted with a plus (+) and left asymmetry was noted with a minus (-). All subjects of the second group were referred to the hospital for further clinical and radiological examination.

Statistical method

For the statistical analysis, the SPSS-v.19 statistical package was used. Descriptive statistics were used to get descriptive information about the quantitative data. Were included the next statistical techniques: frequencies, mean, standard deviation. The frequency of symmetry, mild and severe trunk asymmetry for both boys and girls was quantified in standing forward bending position for the all examined regions of the trunk.

Results

In the investigated sample, it was found that greater part of the subjects have a mild or a severe trunk asymmetry. Mild asymmetry was present in 45.6% of subjects, however severe trunk asymmetry in 9.9% of the subjects.

Table 1. Prevalence of the asymmetry

	Symmetric	Mild Asymmetry	Asymmetry
Percent [%]	44.5	45.6	9.9

Forty-seven percent of boys and forty-one percent of girls were symmetric in the all regions of the back (ATR=0º) in standing forward bending position (FBP). If the three regions of the spine are separated and compared, there are differences between the regions and the two sexes. More than seventy percent of boys and sixty-nine percent of girls were symmetric in the thoracic region in FBP. For the thoracolumbar region, 67.3% of boys and 60.3% of girls were symmetric. 73.4% of boys and 70.7% of girls were found to be symmetric in the lumbar region, in the same position.

Mild asymmetry (ATR=1º - 6º) in the thoracic region was found in 28.6% of boys and in 24.1% of girls in standing forward bending position. In the thoracolumbar region, mild asymmetry was found in 29.7% of boys and in 29.3% of girls. In the last region, 24.6% of boys and 24.7% of girls were found to have mild asymmetry in standing position.

Table 2. Frequency of trunk asymmetry in boys and girls

Regions of the spine	Boys			Girls		
	Symmetric [%]	Mild asymmetry [%]	Asymmetry [%]	Symmetric [%]	Mild Asymmetry [%]	Asymmetry [%]
Thoracic	70.85	28.65	0.50	68.97	24.13	6.90
Thoracolumbar	67.30	29.70	3.00	60.34	29.32	10.34
Lumbar	73.37	24.63	2.00	70.69	24.71	4.60
Mean	70.51	27.66	1.84	66.67	26.05	7.28

Severe asymmetry (ATR ≥ 7º) in the thoracic region was found in 0.5% of boys and in 6.9% of girls. In the thoracolumbar region, severe asymmetry was found in 3.0% of boys and in 10.3% of girls. In lumbar region, severe asymmetry was found in 2.0% of boys and in 4.6% of girls in standing position.

The distribution of mild and severe trunk asymmetry – right or left – in standing forward bending position in the three examined regions of the spine in both girls and boys is shown in Table 2.

According to the severity of the trunk asymmetry, the subjects were divided into two groups. In the first group, the scoliometer readings were less than 7º and in the second group, the scoliometer readings were 7º or more. Right asymmetry was recorded with a positive sign (+) and left asymmetry with a negative sign (-).

All parents of the children and adolescence of the second group (ATR ≥ 7º) were informed by a letter of advice about their children condition. They were recommended to subsequently visit a hospital for further clinical and radiological examination.

Table 3. Frequency of asymmetry in *boys*.
Scoliometer readings at standing FBP

Regions of the spine	**Symmetric** [%]	**Asymmetric** [%]					**Severe asymmetry** [%]
		-2	-1	+1	+2	Total	(-2)+(+2)
Thoracic	70.85	0.5	9.56	19.09	0	29.15	0.5
Thoracolumbar	67.30	1.0	10.1	19.6	2.0	32.70	3.0
Lumbar	73.37	1.0	17.09	7.54	1.0	26.63	2.0
Mean	70.51	0.83	12.25	15.41	1.0	29.49	1.84

Table 2. and Table 3. show the difference in scoliometer readings between standing forward bending position at the three examined regions for boys and girls.

Table 4. Frequency of asymmetry in *girls*.
Scoliometer readings at standing FBP

Regions of the spine	**Symmetric** [%]	**Asymmetric** [%]					**Severe asymmetry** [%]
		-2	-1	+1	+2	Total	(-2)+(+2)
Thoracic	68.97	1.15	10.34	13.79	5.75	31.03	6.90
Thoracolumbar	60.34	1.15	8.62	20.70	9.19	39.66	10.34
Lumbar	70.69	2.30	13.79	10.92	2.30	29.31	4.60
Mean	66.67	1.53	10.92	15.14	5.74	33.33	7.28

The frequency of symmetry is greater in boys than in girls as shown in tables 2 and 3. The average score of symmetry in boys is over seventy percent while in girls is with four per cent less than in boys. The girls were found to dispose of a rather more severe trunk asymmetry than boys did, the ratio being four times greater in girls. The most affected part of the spine was the thoracolumbar part in both boys and girls. Mild asymmetry at this region was 29.7% in boys and 29.3% in girls, while severe asymmetry 3%, respectively 10.3% in girls.

Trunk asymmetry is more common in girls and almost in every region of the spine to the right side, with the exception of the lumbar area at mild asymmetries.

Discussion

This study respects the Bunnell's (1984) indications for a critical value of 7 degrees of the angle of trunk rotation in the scoliosis screening. Trunk asymmetries are found in normal children with no spinal curves because scoliometer measurements of 1º - 6º are considered associated with nonscoliotic spines. A spinal curvature is considered to be scoliotic if it is greater than 10º of Cobb angle. However, children with 5º - 6º of scoliometer measurements are good to be followed up clinically at a medical centre every 4-6 months (Grivas, et al., 2006).

We found that in the studied population, severe trunk asymmetry (which is associated with a possible scoliotic curve) is more common to the right side. This finding is supported by almost every study made on this topic (Grivas, et al., 2006; Grivas, Vasiliadis, Mihas, Triantafyllopoulos, & Kaspiris, 2008).

Seventy percent of boys and sixty-eight percent of girls were found to be symmetric in the thoracic region of the spine in the standing forward bending position. In the other two regions of the spine, we found the next values of symmetry for the boys and girls: thoracolumbar region 67% (boys) – 60% (girls),

lumbar region 73% (boys) – 70% (girls). In the screened population we found that the boys are more symmetric at all levels of the spine than girls do. These findings are supported by several other studies performed in Europe or in all over the world (Grivas, et al., 2008; Grivas, et al., 2006; Vercauteren, et al., 1982; Yong, Wong, & Chow, 2009).

At the all three regions of the spine 47.7% of boys and 41.4% of girls were found to be symmetric. A subject, whose spine was found to have asymmetry in one of his regions, was disposed to have asymmetry in all the three regions of the spine. The previous statement is more valid if the asymmetry is a severe one. The low proportion of the children to be symmetric is not an unusual fact. It is remarked in almost every study published on this topic, but a very extreme and low proportion of trunk symmetry is noted by Nissinen, Heliovaara, Ylikoski, & Poussa (1993). Only 8.3% of the children were found to be symmetric (thoracic hump between 0 – 2 mm) in the forward bending test.

It was found that severe trunk asymmetry is present in girls more than four times than in boys (7.28% – 1.84%, ratio = 3.96:1). Several studies show very similar ratios, but sometimes this gap between the female and male is greater. For example, Willner and Udén (1982) found in Sweden during scoliosis screening a total scoliotic incidence of 3.2% in girls and 0.5% in boys. The corresponding ratio was 1:3.6. Renshaw noted that the female to male ratio is 2:1 when Cobb angle is more than 10º; however, it reaches 5:1 or 6:1 when Cobb angle is more than 20º (Renshaw, 1988). The fourteen years old boys and the twelve years old girls were found to dispose of the most severe trunk asymmetries.

Conclusions

Overall, after a thorough analysis of the results of the school screening we might conclude that:

- the prevalence of back trunk severe asymmetry found in the studied population was 1.84% in boys and 7.28% in girls;
- the prevalence of back trunk mild asymmetry was of 29.24% in boys and 33.33% in girls;
- 47.7% of boys and 41.4% of girls were found to be absolutely symmetric in all regions of the spine;
- the most affected part of the spine is the thoracolumbar region in both boys and girls, but trunk asymmetries are more common in girls than in boys;
- it was found that severe trunk asymmetry (which is associated with a possible scoliotic curve) is more common to the right side;

- it seems that the 14 years old boys and 12 years old girls are disposed to have a higher prevalence of severe trunk asymmetries.

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TENNIS RACKET STRING TENSION AND ITS DURABILITY. CASE STUDY

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ABSTRACT. In junior tennis, the objectives and the content of training for 15-16 year old players is, according to Doboşi & Baciu (2004), mainly oriented towards elements like physical development, the increase of effort capacity of the body in submaximal and maximal efforts, development of specific skills of the limbs and hit involved segments, the improvement of preparation mechanisms for the main technical elements or the improvement of the tactical content of the main technical elements. This research is aiming a secondary aspect of junior tennis, and that is the identification and monitoring of the tennis racket's characteristics while using different stringing tensions. Our attention was oriented towards a characteristic of tennis, and that is the financial cost of practicing this sport: coach, trainer, court, equipment and so on.

Keywords: sports, tennis, junior, strings, tension, durability.

REZUMAT. ***Studiu de caz. Tensiunea cordajului rachetei de tenis şi durabilitatea acestuia.*** În tenisul de câmp practicat la nivelul juniorilor de 15-16 ani, obiectivele şi conţinutul pregătirii pe factorii antrenamentului, conform Doboşi & Baciu (2004), au ca direcţii dezvoltarea fizică armonioasă, creşterea capacităţii de efort a organismului la eforturi submaximale şi maximale, dezvoltarea la parametri superiori a îndemânării specifice la nivelul segmentelor de primă importanţă pentru deplasarea şi lovirea mingii, perfecţionarea mecanismelor de preparaţie a procedeelor tehnice sau perfecţionarea la parametrii crescuţi de eficienţă a conţinutului tactic al procedeelor tehnice de bază. Am acordat o atenţie specială unui aspect secundar al performanţei în tenisul de câmp, această cercetare îndreptându-se spre identificarea şi monitorizarea caracteristicilor rachetei de tenis odată cu variaţia tensiunii cordajului. În plus, am vizat şi o caracteristică importantă a tenisului de câmp şi anume costurile ridicate ale practicării acestui sport: antrenor, teren de joc, echipament.

Cuvinte-cheie: sport, tenis, junior, cordaj, tensiune, durabilitate.

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Introduction

This article is a starting point to a more comprehensive and complex research, linked to the tennis equipment with a specific orientation of tennis rackets, cordage types, the variations of tensions that can be used and also the variations of the connection.

As a starting point, in our research in tennis, we made a case study oriented to the identification and the monitoring characteristics of the tennis racket with the tension variation of the cordage (Table 1). In addition, we targeted a characteristic of tennis the high costs of playing this game: coach, tennis courts, equipment.

In an interview from 2009, Andrei Novăceanu, the general manager of Babolat Romania affirms: „Stringing is very important, it is the factor that can influence the performance of the racket. The tension is also important, because every type of stringing has got certain characteristics: there are very flexible stringings (multifilament) which offer strength and comfort, and there are rigid or inflexible stringings (monofilament) produced from polymers, which give durability. The tension of a racket influences, again, all the characteristics of the stringing. A softly stringed racket offers speed and comfort, but there is no control. A hard connected racket doesn't offer speed, but it offers control. In this situation, we have the lack of comfort due to the fact that the vibrations of the stringing with the impact of the ball are transmitted to the frame, further reaching the joints of the player, and creating health issues and discomfort" (Open Tennis, 2009).

Table 1. Stringing types and their characteristics

Diameter stringing	Elasticity	Durability	Spin	Feel	Comfort
Thin	+	-	+	+	+
Thick	-	+	-	-	-

Professional tennis players Dacian Craciun and Gabriel Moraru who have spoken in the same interview, mentioned above said the followings:

D.C. (308 ATP): „I'm changing the tension according to the balls, temperature and altitude. I have got many rackets in my termobag, with different tensions. In Bucharest, usually, I am playing with a tension of 27 kg. Anyway, I break a string during almost every game" (Open Tennis, 2009).

G.M. (264 ATP): „I have got a 300 pieces contract each year... I never use them. I use one per day. If I do not break them, I cut them. I like to have my stringing „fresh". I like my stringing to be rigid, so-called „wiry" at 22-20/23-21,

so quite soft. At competitions, I do it every day. I have got rackets with „normal" tension and 1 or 2 rockets with other tensions in my termobag. If I know there will be a rainy weather, I prepare my rackets to be softer, if there will be very hot, I use a harder stringing, 24-25. At Quito (Ecuador's capital, situated at 2.850 m high, n. r.), I had my racket's stringing at 30. I've never had a tension like that, even though I had to pay attention not to hit the ball over the wall" (Open Tennis, 2009).

Hypotheses (or Objectives)

Our intension was to identify how the player perceives the tension modification of the rocket's stringing. We presumed that a bigger tension of the rocket's stringing (26 kg) will reduce the number of the player's mistakes, the length of the balls sent by the player will decrease, which is not good in every situation. Regarding less tensioned stringing (22 kg), we were expecting to have bigger length of the hits, higher speed of the ball, and also a bigger number of unforced mistakes. We were expecting that the player will consider the medium tensioned stringing to be the most comfortable and the most suitable for the player's adaptation to the requirements of the game, from the efficiency point of view.

We were also interested in the durability of the stringing, in the approximate number of hits that the wire resists until it breaks. We hypothesized that tension can influence the lasting of this component.

Materials and Methods

For this study, we used three Head GrapheneXT MPA rockets, which we stringed with Pro's Pro, Synthetic 130 stringing, 130 with three different tensions (22kg, 24kg and 26kg).

During the experiment, our subject (N. G., 15 years old) participated at a strength measuring squeezing test, at the upper right arm, and after that during the training sessions the number of the approximate hits were registered using the three tennis rockets involved in the experiment. In order to determine the intensity of the effort, the heart rate of the subject was monitored.

Results

We calculated that a basket with 60 balls runs out in 2' 30'' (2 minutes and 30 seconds) while playing, in average the gathering of the balls takes about 4' 30'', so the whole cycle takes at about 7'. There are 480 hit balls in one training hour.

Regarding to the isolated game, we mention that the heart rate of the subject was at the average of 164 beats per minute (BPM) at the end of the effort, and after the active break, representing the gathering of the balls, the heart rate was 124 BPM, thus, it results an incomplete recovery.

While exchanging the balls („tied game") we estimated a number of 960 beats/ hour of game, we measured a 172 BPM medium heart rate, and a medium heart rate of 128 BPM after passive breaks of 5'.

Table 2. Advantages and disadvantages of stringing types

Tension stringing	Strength	Control	Durability	Feel	Comfort
Soft	+	-	+	+	+
Medium	-	+	/	-	+
Tensioned	-	+	-	-	-

During the servings, we approximated 200 hits/ hour. The strength of the subject's skilful arm was of 85 kg. The stringed rocket with 22 kg tension resisted approximately at 2190 hits, the one stringed with a tension of 24 kg resisted at approximately 1915 hits, while the rocket stringed with 26 kg resisted at approximately 1500 hits. While playing, the player was questioned about the control, comfort and the „feeling" of the rocket and the efficiency factors of the subject's hits were empirically evaluated.

Table 2 presents the advantages and disadvantages of every stringing tension type.

Conclusions

By analysing the results, we can conclude that the main myths regarding the durability and the efficiency of the rockets depending on the used tension were confirmed. In future studies, we will approach other factors which can influence the durability of the stringing and the quality of the game: the environmental temperature, the type of the used strings, the type of the stringing, the atmospheric pressure, the speed of execution of the hits, the printed effects on the balls, the physical strength of other parts of the body involved in hitting the ball, etc.

Linked to the possible financial economy, we can say that in the case of a sportsman who plays over 30-40 hours/month, a sensible economy can be made by using a less tensioned stringing, in the disfavour of a tensioned one with the price of the controlled ball being perceived by the player as weaker.

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CORE MUSCLE ASSESSMENT OF DANCERS

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ABSTRACT. Background. To assess habitual postures as well as postures considered correct by dancers of different styles, and the intensity of their (low) back pain. To examine spinal functional status, strength and flexibility of core muscles necessary for correct posture and lumbar motor control skills. Our hypothesis is that lower back pain and deviation in the functional status of the spine are more common among dancers aged 9-18 than in the average population, or other sportsmen. Despite regular trainings, weakness is observed in muscles needed for correct posture. **Methods.** Our survey sample consists of members of three different dance genres. Groups examined include a classic ballet, a hip-hop dance and a ballroom dance group (n=92, mean age:14.15± 2.96). Examination of habitual postures and postures considered correct was performed by a photogrammetric test, while the intensity of low back pain was measured by a visual analogue scale, and the Roland-Morris questionnaire. Lumbar motor control skills were examined by sitting forward lean test and the strength of core muscles by the core test. **Results.** In posture analysis significant difference was found in anterior view of the posture considered correct; ballroom dancers showed significantly better posture (p=0. 038), than the other two groups examined. During the examination of low back pain intensity by a visual analogue scale ballroom dancers reported about the negative effect of pain on performance to a significantly higher degree (p=0.019). Core test demonstrated significantly better core muscle strength among ballroom dancers (p=0.000), than in the other two groups. **Conclusion.** Neither habitual, nor the posture considered correct of the dancers meet the requirements of the biomechanically correct posture. Low back pain manifests at an early age among dancers affecting their performance. Lumbar motor control skills and core muscle strength are inadequate despite regular exercise.

Keywords: dance, low back pain, posture, core muscles

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Introduction

According to Vaganova the owner of the body is the trunk' and the owner of the trunk is the spine. Every movement derives from the trunk, and if its elaboration is adequate, its strength and flexibility allow any physical activity and load ability. Therefore, core techniques require attention, even more; potential trunk injuries may be prevented.

Posture is defined as a position held by the human body's maintenance and motor apparatus. Interaction of posture and gravity differs individually; posture expresses character, physical and emotional life. Posture is a dynamic state of equilibrium, maintained by the constant and diverse activity of hardly visible muscles responsible for posture (Frenkl, 1995).

From a biomechanical perspective, the correct posture is described as the physiologically proper stretch of ligaments and joint capsules, low physical effort of muscles due to harmonic cooperation of muscles responsible for posture, thus joint surfaces have steady loads. This time the pelvis is in the medial state and the sagittal curvatures of the spine above are physiological, the imaginary axis of the body runs through the cervical vertebrae 2-5 and the lumbar vertebrae 2-5, and the spinal kyphosis enables flexible force transmission. In improper postures, the axis is displaced, causing changes in the spinal curvatures.

These may result in muscle and joint load related complaints, and injuries in several spinal regions (Kapandji, 2007; Somhegyi et al., 2014). The low back pain is a serious public problem in Hungary, which utilization and health insurance indicators of outpatient physiotherapy activities are known (Molics et al. 2011; Molics et al. 2012; Molics et al. 2013a; Molics et al. 2013b; Molics et al. 2013c; Molics et al. 2015).

Besides strict shape and physical demands, different dance genres require greater than the physiological ranges of motion of the spine (Bria et al., 2011; Hergenroeder et al., 1993). The physiological range of motion of the cervical spine and the head is 50-60 degrees, although, in the case of classical ballet, contemporary modern dance and ballroom dance, the head has a much greater range of motion, achieving even 75 or 85 degrees. Furthermore, the whole spine is characterized by a more flexible, greater range of motion (Mády, 2013).

Different styles of dance may help develop correct posture and make it automatic. One of them is a modern dance technique, called Limón technique. In basic posture of the technique the feet are parallel exactly under the pelvic joints, wider than the pelvis itself, and the shoulders are above the pelvic joints. The spine is stretched, the head is up, and the body weight is equally distributed

between the two feet, thus, the dancer continuously feels and controls the body's vertical axis. Limón believed that when posture becomes automatic, movements turn to be stable, quick and light (Lewis, 2000).

However, there are dance and sports genres demanding postures other, than the physiological ones (Cupisti et al., 2004). Ballroom dance includes complex techniques, discipline, high performance, and competitiveness. Deviations from physiologically correct postures are mostly observed in female dancers. While dancing the upper trunk leans backward, the head and the neck as the elongated part of the spine is in lateral rotation.

This irregular position has to be maintained by the dancers causing several symptoms in the cervical region of the spine (Mády, 1998; McCabe et al., 2014). In her PhD thesis Teri Riding reports about examinations of a specific injury affecting the cervical region. The survey investigates 10 dancers with, and 10 dancers with no previous injuries. Concerning anthropometric data average height in the injured group was 167.40 cm, and the average body weight was 59.3 kg, while in the non-injured group they were 166.76cm, and 58.93kg.

Electromyographic (EMG) examinations were conducted to assess the status of the upper m. trapezius (cowl muscle), the m. splenius capitis (splenius), and the m. sternocleidomastoideus (head rotator muscle). The findings revealed that cervical injuries in the injured group resulted from injuries to those muscles; even more, there were also cases in the non-injured group where overstretching and weakness of those muscles were observed (Riding, 2006).

A dancer is an artist exposed to heavy physical exertion, who is able to portray and dance characters on the stage with delicate emotion. The extent of the load accompanying dance is almost the same as the one experienced in a team sport, known as American football. Astrand et al. measured excessively high lactic acid level after a solo dance in an American prima ballerina (10mmol/l), which is surprising, as similar values are measured in sportsmen after hockey or football matches (Beck et al., 2015; Dahlstrom et al., 1997; Schantz & Astrand, 1984). So high lactic acid level shows that ballet movements demand a significant anaerobic capacity. With regard to elements of physical exertion, it is impossible to set exact requirements for dancers, hence, besides physical demands – in most cases – special achievements complete the performance unifying the dance and the dancer, thus, raising the genre from the sphere of simple physical load (Bretus & Zórándi, 1998).

Research Objective

- to assess the dancers' habitual postures, and the ones considered correct by them, and the intensity of low back pain, as well as their spinal functional status;
- to assess the lumbar motor control skills;
- to assess core muscle strength and flexibility necessary for correct posture.

Hypotheses

- Habitual posture of dancers do not correlate with the biomechanically correct ones;
- Postures considered correct by the dancers do not correlate with the biomechanically correct ones;
- Low back pain in dancers occurs during training;
- Low back pain occurring during training manifests already in dancers aged 9-18;
- Certain functional loss in the spinal status develops already in dancers aged 9-18;
- Lumbar motor control skills and core muscle strength are inadequate in the age group 9-18.

Research Materials

Inclusion criteria: A minimum of 3 years dance experience in companies or schools.

Exclusion criteria: spinal disease requiring treatment, spinal surgery, sports injury in the last 3 months, participation in core prevention programmes in the last 6 months.

Sample: Our sample consists of dancers (n=92, mean age: 14.15± 2.95(9-24) years). The analysed groups are composed of a classical ballet group (n=30, mean age: 12.7±2.18 (9-19) years), a hip-hop group (n=30, mean age: 13.17±2.88 (9-24) years), and a ballroom dance group (n=32, mean age: 15.8±2.87 (10-22) years).

Ballet dancers have been dancing for 4.5 ± 2.51 (end values: 1-10) years on average, with 3±1.06 (end values: 2- 6) trainings a week, where the training period is 96±12.2 minutes (end values: 90-120), and also with an

average number of a monthly theatre performance from 1.3±1.68 (end values: 0-10) with the length of 35.1±26.11 minutes (end values: 0-120). The members of the ballroom dance group have been dancing for 6.07±3.09 years (end values: 2-15) on average, with the number of 3.05±0.98 (end values: 2-5) and the length of 90±0.00 (end values: 90-90) minute trainings. They have monthly theatre performances as well with the number of 1.47±1.24 (end values: 0-4) and the length of time 24.03±21.54 (end values: 0-120) in minutes.

The hip-hop dancers have been dancing for 5.03±3.13 (end values: 2-14) years, with an average weekly number of 2.43±0.69 (end values: 2-5) and length of trainings of 115.71±45.25 (end values: 60-180) minutes, completed by monthly theatre performances with a number of 1.68±0.67 (end values: 0-3) and the length of time with 44.82±27.77 (end values: 0-120) minutes.

The whole sample can be described as - despite their young age - dancers with an average of 5.22±2.97 years (end values: 1-15) dance experience, training 3.02±1.02 (end values. 2-6) times, for 100±28.08 (end values: 60-180) minutes a week. Besides weekly trainings they have regular monthly performances with a number of 1.49±1.27 (end values: 0-10) and the length of time 34.21±26.28 (end values: 0-120) minutes.

Examination/Test location: Institute of Physiotherapy and Sport Science, Faculty of Health Sciences, University of Pécs (Rét u.4, Pécs, H-7623, Hungary)

- Classical Ballet group: High School of Arts, Department of Dance (Radnics u.9. , Pécs, H-7624);
- Ballroom Dance Group: Kapronczai Elementary Institute for the Arts (Széchenyi u. 73/1, Szigetvár, H-7900);
- Hip-hop dance group: T-Dance Hip-Hop Dance Company (Légszeszgyár u. 22, Pécs, H-7622).

Research methods

Postural Assessment by Photogrammetry

Process of examination: Subjects to be assessed were taken photos of from three angles, one anterior and two lateral views. With regard to clothing, dancers were asked to be bare feet, wear tight-fitting clothes, and girls were not allowed to let their long hair down on the shoulder, in order to make the

neck and shoulder visible. Photos were taken by a NIXON COOLPIX L21 camera from a 2m distance in front of a symmetry matrix surface adhered to the wall (focus distance= 6.72m, flash: Flash fired, sensitivity: ISO200, normal exposition program, number F: 3.1). The height of the symmetry matrix surface is 2m, the width is 1m and the matrix size is 6,5x6.5 cm.

- For habitual posture assessment dancers were asked to take a posture they usually do.
- For the examination of the 'posture considered correct' dancers were asked to stand in a way they think is correct.

Assessment: Parameters defining posture were designated by numbers. In frontal plane, when lines of the shoulders and the pelvis were parallel, dancers were given 2 points, while if the lines were asymmetric 1 point was given to the subjects. The frontal plane axis bisects the line of the nose and the navel, and passes to the ground between the two feet, in the middle, it is the physiological frontal axis meaning 2 points, but in the case of aphysiological axis, with no bisection of the above mentioned body parts, only 1 point was given.

In the sagittal plane, physiological spinal curvatures were evaluated by 3 points, while the aphysiological ones by 2 points. I the sagittal plane the axis should bisect the ear, the L1 and L5 vertebrae, and eventually should pass to the ground in the lateral malleolus line, receiving 2 points. In case the axis did not bisect any of the above parameters, it meant 1 point (Smith, 2009).

***Visual Analogue Scale** (VAS)*

Visual analogue scales assessed intensity and severity of low back pain. Subjects were asked to mark the degree of low back pain intensity on a scale (0-100%) with regard to the effect of low back pain on performance during training (VAS1), the degree of pain during training (VAS2), and the degree of pain after training (VAS3). 0% meant no influential role in the question, but the 100% meant a significant influential role (Ogon et al., 1996).

The Roland-Morris questionnaire is composed of 24 statements concerning the relationship between pain and routine activities. Respondents were asked to mark the statement they felt adequate for the day. Thus, the result of the questionnaire is a point on a scale from 0-24, which is proportional to the degree of functional decrease (Davidson & Keating, 2002; Stratford et al., 1996).

Lumbar Motor Control Skills Test

- **Sitting Forward Lean Test**

The focus is on the person examined who sits on the examination couch with the popliteal space of the knee touching the couch. The hip and the knee are in a 90-degree flexion position; the inguinal region and the spine are in a neutral position. Setting the correct posture is assisted. From the S1 vertebra, 10 cm is measured upward in the medial axis of the spine, and a ballpoint marks the two endpoints of the distance. After marking, the subjects were asked to pull their right, then left knees to the chest 6 times, then stretch the lifted up arms backward also 6 times. It was followed by a leaning forward exercise 3 times with flat back.

During the exercises, the subjects were asked to adjust the original correct sitting posture before each movement, then the distance between the marked points were measured by a tape measure and recorded in mm. After the assessment, the difference of the two values was considered and given in mm. The values demonstrated a positive outcome when they were 10 cm after the exercises too, but a 3 mm deviation into both directions (10.4 cm and 9.6cm) already shows impaired lumbar motor control skills (Enoch et al., 2011).

Core test

Subjects were asked to get into a push up position with elbows on the ground (forearm support), making sure the whole body, from top to heel, is in a straight line (plank position). It was important to ensure that the shoulders are above the elbows, the head is straight as the elongation of the spines, and the hip is neither tilted, nor lifted too high, so that the lumbar lordosis is not increased. After fixing, the exact position time – how long the subjects could hold the position–was measured by a stopwatch (max120 s). The test was over when the subject gave it up, or the lumbar region control was lost. In every case, the actual second was recorded, then evaluated based on a core test table (Oliver et al., 2010). (Table 1)

Table 1. Evaluation of the Core test

Time	Level
>120 sec	excellent
76-120 sec	good

Time	Level
45-75 sec	average
< 45 sec	poor

Results

Posture assessment

- **Assessment of habitual posture**

The frontal view photogrammetric examination of the habitual posture did not detect significant differences (p=0.275) between the groups; 50% of hip-hop dancers, 68.8% of ballroom dancers, and 66.7% of ballet dancers showed symmetric values. Neither did the lateral habitual posture assessment (p=0.476). Considering lumbar lordosis, only 35.7% of hip-hop dancers, 43.3% of ballet dancers, and 56% of ballroom dancers demonstrated physiological curvatures. Increased lumbar lordosis was identified in 32% of hip-hop dancers, 33.3% of ballet, and 28.1% of ballroom dancers. (Table 2)

Table 2. Assessment of habitual posture

Parameters	Ballet (%)	Ballroomdance (%)	Hip-hop (%)	p-value
Habitual posture in the frontal plane				
1 point: asymmetric	33,3	31,3	50,0	0,275
2 point: symmetric	66,7	68,8	50,0	
Habitual posture in sagittal plane				
1 point: excessive	33,3	28,1	32,1	0,48
2 point: flat	23,3	15,6	32,1	
3 point: physiological	43,3	56,3	35,7	

- **Assessment of posture 'considered correct'**

The frontal view posture considered correct (Fixing a posture as a response to the instruction: Stand in a way you think is appropriate) was correct or symmetric in 46.4% of hip-hop dancers, 73.3% of the ballet and 75% of the ballroom dance group. The frontal view posture considered correct by the hip-hop dancers was significantly worse (p=0.038) than the ones in the

other two groups. It is important to note, that this value in the hip-hop group is 4.6%lower than the one measured in the habitual posture examination, which means that the posture considered correct is worse (less physiological) than the habitual.

However, this value has improved with 6.2% in ballroom dancers and 6.6% in ballet dancers. The lateral view of the posture considered correct has impaired both in the examined ballet and ballroom dancers, although, it remained stable in the hip-hop group. (Table 3)

Table 3. Assessment of posture considered correct posture

Parameters	**Ballet (%)**	**Ballroom dance (%)**	**Hip-hop (%)**	**p-value**
Considered correct posture in the frontal plane				
1 point: asymmetric	26,7	25,0	53,6	0,038
2 point: symmetric	73,3	75,0	46, 4	
Considered correct posture in sagittal plane				
1 point: excessive	53,3	34,4	53,6	0,22
2 point: flat	10,0	12,5	10,7	
3 point: physiological	36,7	53,1	35,7	

Assessment of low back pain

Visual Analogue Scale

- **Frequency of low back pain occurring during training (VAS1)**

Based on the answers acquired, no significant difference was detected (p=0.206), but the highest percent of dancers (12.8%) complaining of low back pain that occurs during training was among ballroom dancers. At the same time, pain only affected 9% of ballet and 8.04% of hip-hop dancers.

- **Effect of low back pain on performance during training (VAS2)**

The results demonstrated that low back pain most significantly occurs among ballroom dancers (p=0.019), that may affect their performance. 7.67% of ballet dancers and 5.89% of hip-hop dancers reported about existing low back pain, while among ballroom dancers 19.06% complained of that.

- **Frequency of low back pain occurring after training (VAS3)**

Similarly to the above, nor this parameter showed significant differences between the groups (p=0.079), although hip-hop dancers reported about pain occurring after training in the highest ratio (16.25%), while among ballet dancers it was only 10.17% and 10.63% in the ballroom dance group. (Table 4)

Table 4. Assessment of low back pain intensity

Parameters	Ballet		Ballroom dance		Hip-hop		Total		p-value
	mean value	Std. deviation	mean value	Std. deviation	mean value	Std. deviation	mean value	Std. deviation	
VAS1	9,00	18,26	12,81	15,49	8,04	10,91	10,06	15,26	0,206
VAS2	7,67	14,00	19,06	21,45	5,89	10,63	11,17	17,14	0,019
VAS3	10,17	16,84	10,63	11,62	16,25	14,94	12,22	14,65	0,079

The Roland-Morris Questionnaire

The Roland-Morris questionnaire demonstrated significant differences (p=0.011) between the groups. The results show, that low back pain affects the everyday activities of 56.7% of ballet dancers, who are followed by 32.1% of hip-hop dancers, and only 18.8% of ballroom dancers, who assess low back pain as an obstacle in everyday life. Considering the whole sample, the result is the following: 35.6% of the dancers assume that low back pain is a hampering factor in everyday life.

Functional Status Assessment of the Spine - Lumbar Motor Control Skills Test

Sitting Forward Lean Test

Based on the results there was no significant difference (p=0.298) between the examined groups. The least deviation from the 10 cm was found among ballroom dancers, where the mean value of the group was 10.28 cm. They were followed by the ballroom dancers with 10.3 cm. Although, the lumbar motor control value in these groups is near the upper reference limit (10.4cm) it is still within the 'good' category. The biggest deviation was observed in the hip-hop group, where 10.45 cm was the mean value after the exercises.

This result exceeds the normal upper reference limit, therefore, it can be claimed that the lumbar motor control skills of this group should be improved. If all groups are considered as the total sample, the mean value is 10.35 cm, which is in the normal range, but only 0.05 cm lower than the upper reference limit.

Assessment of Core Muscle Strength

Core test

Significant difference was found (p=0.000) in the core muscle strength between the groups. The best performance was given by ballroom dancers, who could hold the plank position for 97.38s on average, which is evaluated as 'good' relying on the table. They were followed by the hip-hop dancers with 76.89 seconds, also belonging to the above-mentioned category. The worst result was observed among the ballet group, with 54.6s, which was evaluated as 'average'. The total sample could hold the required position for 76.74 s, and this means a 'good' result.

Discussion

Posture

The photogrammetric assessment of habitual posture revealed lumber lordosis in significant percent of all the groups assessed. The increased curvature was observed in the highest percent among ballet dancers, while the lowest ratio could be seen among ballroom dancers. In the assessment of posture considered correct classical ballet and ballroom dancers showed improvement, however, the hip-hop group showed even more aphysiological posture when it was considered correct, than during the assessment of the habitual one. Therefore, the instruction "Stand in a way you think is correct" resulted in a more inappropriate posture. In the lights of the results it can be claimed, that despite the common belief that dancing improves posture, that dancers are not aware of the parameters of physiological postures, and incorrect posture is frequent.

Professional literature also confirms the above. Iunes et al. performed photogrammetric examinations of lumbar lordosis in 52 female ballet dancers aged 7-24. Dancers were compared to 59 non-dancers as a control group. Tests and examinations were performed for a 3-year period to assess lumbar lordosis

deviations. Their findings proved the significant increase in the occurrence of excessive lumbar lordosis among ballet dancers (Iunes et al, 2015).

Assessment of Low Back Pain

Visual Analogue Scales (VAS) could help detecting low back pain in early ages among dancers, which affects their performance during training, and which also occurs during and after training. Among the examined groups, ballroom dancers reported to the highest degree about debilitating low back pain that interferes with their performance, and that often occurs during training. Low back pain occurring after training is reported by hip-hop dancers with the highest percentage.

Professional literature has not mentioned VAS studies conducted among dancers, but visual analogue scales were used to reveal low back pain in sportsmen experienced during training. Külling et al. conducted examinations using VAS on professional male beach volleyball players to detect already existing and newly occurring low back pain. Based on their results 79% of the sportsmen (mean age: 28) reported low back pain during training (Külling et al, 2014).

The Roland-Morris Questionnaire

Existing low back pain has a significant effect on everyday activities of dancers. It is mostly observed in ballet dancers, and the least among ballroom dancers. Considering the total sample, we have seen, that despite young ages of the dancers, a remarkable number reported low back pain as an influential factor in everyday life.

Professional literature has not mentioned studies conducted among dancers with that questionnaire. Most articles-concerning the questionnaire - mainly introduce assessments of severe stage spinal patients, which detected the degree of functional loss and the symptoms interfering with everyday life. Nevertheless, articles with studies of sportsmen are available. These examinations using the Oswestry Disability Index showed that back pain, as well as low back pain, are frequent due to exertion, and they have adverse effect on routine activities (Fairbank & Pynsent, 2000; Gillis et al., 2015; Vela et al, 2011;).

Lumbar Motor Control Skills

Based on the results of the Sitting Forward Lean Test we can say that the results of the groups do not exceed the upper reference limit of the 10.4cm, yet,

they are only 0.5 cm below that, therefore, the number of the sample was higher, the assumed category for all the groups would most probably be the one as designated 'inappropriate' lumbar motor control skills. When dancers are differentiated by genres, the biggest deviation is observed among hip-hop dancers; they have the worst lumbar motor control skills. It may be due to inadequate attention paid to improving correct stage posture resulting from the genre-specific features that means 'stage' posture is rather sloppy (Garofoli, 2011). On the other hand, movements of classical ballet and ballroom include training and pole exercises that contribute to the development of correct lumbar motor control (Bretus, 1998; Moore, 1994).

Assessment of Core Muscle Strength

Applying the Core test we could receive information about the degree of core muscle strength that proved to be 'good' in all the groups. However, when groups assessed alone, ballroom dancers were observed to have the most outstanding core muscle strength; the mean values indicate a 'good' category based on the 'plank test'. The choreographer of the group informed us, that occasional core muscle exercises are included in the training. Besides these, the genre itself requires strong core muscles to execute a specific stage pose. The weakest core muscles could be observed among ballet dancers with the mean values pertaining to the 'average' category. Although classical ballet techniques demand a stage posture that seems to equal the physiological one, the technique – due to its characteristic features- does not focus on strengthening core muscles.

Previous research carried out among dancers assessed core muscle endurance by a side plank test. Those findings also confirm that core muscle endurance is inappropriate among dancers. Side plank tests often result in a significant difference between the sides, but it is a natural phenomenon, and can occur in anyone (Swain & Redding, 2014).

Conclusion

Each dance genre requires specific physical demands. One of the most frequent complaints that occur mostly in adults, but among professional dancers already during their studies is low back pain. Although literature mentions extremity injuries as the 1st place injuries affecting dancers, they are followed by spinal injuries caused by the weakness of core muscles, necessary for correct

posture (Campoy et al., 2011). When different spinal regions observed, lumbar region is the most vulnerable due to its muscle weakness, bad lumbar motor control skills and incorrect ingrained posture (Eustergerling & Emery, 2015; Twitchett et al., 2011).

Aphysiological posture often occurs in dancers, let it be either habitual or stage posture. Among them increased lumbar lordosis may be observed to the highest degree leading to low back pain, that already occurs in professional dancers at a young age. They may be rooted in core muscle weakness and inadequate lumbar motor control skills. Thus, neither the habitual posture, nor the posture considered correct is in accord with the biomechanically normal posture. Low back pain occurs early affecting their performance. Despite regular exercise lumbar motor control skills and core muscle strength are inappropriate.

In the light of the study, designing a core prevention program for dancers – already in use among sportsmen- may be needed to develop and raise awareness about biomechanically normal posture, core muscle strength and flexibility, as well as to improve lumbar motor control skills (Hill & Leiszler, 2011; Saeterbakken et al, 2011).

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SKILLS DEVELOPMENT IN CHILDREN WITH SPECIAL NEEDS THROUGH MOTION GAMES

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ABSTRACT. Introduction. The game has a decisive role in the social, emotional, thinking, psychological development, being used as a method of knowing their own body in relation to things surrounding it. The specific **objectives** of this study are identifying and selecting the games for the children with special needs and their application in order to develop skills. **Material and methods**. The research was carried out on a group of six students with special education needs, students of the School Centre for Inclusive Education, Cluj-Napoca and was conducted during the period February 2016- May 2016. In selecting the games, we took into consideration the following criteria: content of the games that include movement skills, the subjects' physical capabilities of performing these games, the level of accessibility and comprehension. **Results**. Based on the support of motion games that were constantly performed, we could observe the improvement of hand skills for the six subjects of the study. **Conclusion**. In the study conducted on those six students, we are able to sustain the fact that most important and appropriate element, that in the same time has a remarkable impact in movement activities at children with special educational needs, is the game. As a conclusion of this study, we may safely state that motion games that have been adapted and applied were efficient in order to develop hand skills, students registering progress on several levels: sensory movement, social, creative, moral and even therapeutic, confirming the objectives of the study.

Keywords: motion games, skills, children with special needs

REZUMAT. ***Dezvoltarea îndemânării la copiii cu nevoi speciale prin intermediul jocurilor de mişcare*****. Introducere**. Jocul are un rol determinant în dezvoltarea individului în plan social, emoţional, psihic şi cognitiv, constituind o metodă de cunoaştere a propriului corp în raport cu lucrurile care îl înconjoară. **Obiectivele** specifice acestui studiu sunt: identificarea şi selectarea unor jocuri aplicabile la copii cu nevoi speciale şi aplicarea acestora în vederea dezvoltării îndemânării. **Material şi metode.** Cercetarea a fost realizată pe un grup de 6 elevi cu cerinţe educative speciale, elevi ai Centrului Şcolar pentru Educaţie Incluzivă, Cluj–Napoca şi s-a desfăşurat în perioada februarie 2016–mai 2016. În selectarea jocurilor am avut următoarele criterii referitoare la conţinutul jocurilor ce cuprind calităţile motrice

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respectiv îndemânarea, posibilităţile fizice ale subiecţilor de a le executa, accesibilitate şi comprehensiune la nivelul textului. **Rezultate**. Cu ajutorul jocurilor de mişcare care au fost aplicate constant în cadrul cercetării, s-a putut observa îmbunătăţirea îndemânării celor şase subiecţi supuşi studiului. **Concluzii**. În urma studiului efectuat asupra celor şase elevi, putem să susţinem faptul că elementul cel mai adecvat, important şi care totodată are şi un impact remarcabil în desfăşurarea activităţilor motrice la copiii cu cerinţe educative speciale, îl constituie jocul. În urma acestui studiu, putem afirma că jocurile de mişcare adaptate şi aplicate au fost eficiente în scopul dezvoltării îndemânării, elevii înregistrând progrese pe mai multe planuri: senzoriomotor, social, creativ, moral şi chiar terapeutic, adeverind astfel obiectivele studiului.

Cuvinte-cheie: jocuri de mişcare, îndemânare, copii cu nevoi speciale

Introduction

The game is both a way and a method of educational rehabilitation and integration (Marolicaru, Boros-Balint, and Macra-Oşorhean, 2011). It stimulates the sensory movement, intellectual, creative, self-consciousness and moral area, having a terapeutical and relaxing effect (Macra-Oşorhean, Ciocoi-Pop, and Petrus, 2011, pp. 174.). Therefore, „The game has a decisive role in the social, emotional, thinking, psychological development, being used as a method of knowing their own body in relation to things surrounding it." (Macra-Oşorhean, Ciocoi-Pop, & Petruş, 2011, pag.174.)

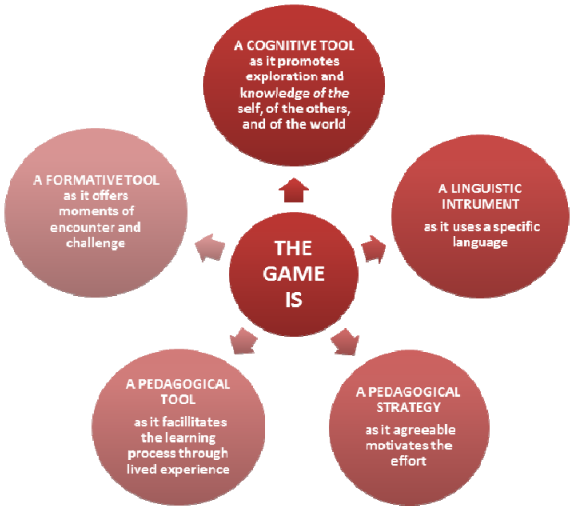

Figure 1. Interdisciplinary aspects of the game
(Macra-Oşorhean, Ciocoi-Pop, & Petruş, 2011, pag.175.)

It is good to know that the game is an important way of educating children with special educational needs. Games applied to children with special educational needs should be shaped based on their prophylactic or therapeutic needs. (Marolicaru, Boros-Balint, and Macra-Oşorhean, 2011).

The motion game as a way of physical activity complex, is a form of movement, which due to some features of shape, content and effects, can be used since infancy (Macra-Oşorhean, M.-D., Simon-Ugron, Á, & Illés, L., 2014).

Motion games applied to children with special educational requirements are effective both in achieving progress as well as in the development of motion skills in communication. Activities, including games of motion can be applied to other subjects, at any age. In the way that they record outstanding results, these may vary by increasing the complexity of the activities (Macra-Oşorhean, M.-D., Simon-Ugron, Á, & Illés, L., 2014).

A *skill* is "the ability of the body to perform acts and actions, especially in unusual and varied conditions, with maximum efficiency and minimum energy consumption from the performer" (Cârstea, 2000, pp. 67).

Forms of manifestation:

- *general skills* that are necessary to carry out all the movement acts and actions by people;
- *specific skills* which are characteristic of those who practice and require different sports branches;
- *skills in other movement qualities:* speed, strength and resistance (Cârstea, 2000, pp. 68).

Methodological procedures of development/education:

- performing movement acts and actions in similar conditions;
- performing movement acts and actions in complex conditions;
- performing movement acts and actions in variable conditions (Cârstea, 2000, pp. 69).

Objectives

The specific objectives of this study are:

- identifying and selecting the games for the children with special needs;
- their application in order to develop skills.

Material and methods

The studied group

The research was carried out on a group of six students with special education needs, students of the School Centre for Inclusive Education, Cluj-Napoca and was conducted during the period February 2016- May 2016. The group involved consists of five boys and one girl, aged between 15 and 19 years.

Table 1. Presentation of the studied group

Name	Age	Sex	Provenience	Medical data
B.E.	16 years old	male	institutionalized	Mild mental impairment, dyslexia, dysgraphia, instrumental disorders, epilepsy under treatment, coordination disorders, divergent strabismus
A.D.	16 years old	male	institutionalized	Mild mental deficiency, infantile autism, dyslexia, dysgraphia, instrumental disorders, flat foot
M.G.	17 years old	female	institutionalized	Serious mental deficiency, atypical autism, retardation in movement
P.I.	18 years old	male	institutionalized	Epilepsy in history, dorsal kyphosis, mild mental impairment, polymorphic dyslalia, dyslexia-dysgraphia
G.P.	17 years old	male	institutionalized	Infantile autism, Tourette Syndrome, dyslexia, dyscalculia, instrumental disorders, extra weight hypotrophy
S.C.	19 years old	male	institutionalized	Infantile autism, syndrome of underdevelopment of language

Research methods

Personal data of students have been extracted from files and from conversations with family members. The methods used, which have allowed us to collect data and information about subjects and later analysing and organizing according to objectives, were observation, interview, analysis of documents and case study.

Applied motion games

After reading and thoroughly analysing a series of books collections regarding this domain, we selected motion games, these constituting the material that was the basis for this study. Some games have been selected to

be performed identical as given in the sources recorded, others processed, or adapted to the needs and particularities of specific pupils with special educational needs.

In selecting the games that we intended to use in this study, we applied the following criteria: the content of games that include movement skills, the physical possibilities of the subjects to execute them, the level of accessibility and comprehension (understanding the content and compliance with the rules of the game). In the following sections of this study, we aim at presenting a few of the movement games that have been used in our research:

a) "The relay skill"

Corrective values*:* development of skills, attention, speed, direction, controlling movements

Place of venue*:* the gym

Materials needed: chairs, jumper training

Organization and conduction of the game: the teams are arranged behind the starting line. At 10-15 m from the starting line will be put next to each team one chair having on it a jumper training. At the teacher's signal the first player in each team runs towards that chair, gets dressed with the blouse tracksuit and turns up in front of the start line, undresses the blouse, giving it to the next one. This second one puts the blouse on, runs towards the seat, puts the blouse on the chair and runs back handling the relay to the next player who continues the race in the same way. It wins the ultimate team whose player has passed the start line first.

Methodological indications:

- a worn out tracksuit should be chosen;

- students' attention is drawn to the importance of letting width-wise in normal state (not have sleeves inside etc.).

b) "Pay attention to the ball"

Corrective values: attention development, movement control, concentration capacity.

Place of venue*:* classroom, courtyard

Materials needed: balls

Organisation of the game*:* children will be organized in a circle, and the player who has the ball may pass at any of the players. Players who receive the ball must pass as quickly so as not to be surprised with another ball.

Players who at the same time receive a ball and are surprised with the previous ball in their hand, drop the ball or throw the ball wrong have 1 point penalty. The players with the fewest penalty points win the game.

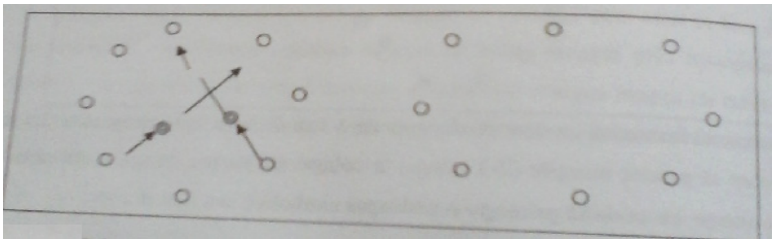

Figure 2. The game *"Pay attention to the ball"*(Hanţiu I., 2002, pp. 10.)

c) "The ball to the captain"

Corrective values*:* increasing the speed at movement execution, improving coordination, developing attention, the setting.

Place of venue*:* classroom, courtyard

Materials needed: balls

Organizing the game: students will be divided in two teams and each team choses a captain. The rest of the team will stay in front of a captain at a distance of 3-4 meters.

The captain will hit the ball and will get the ball from each player in turn. The team that finishes first passing the balls wins.

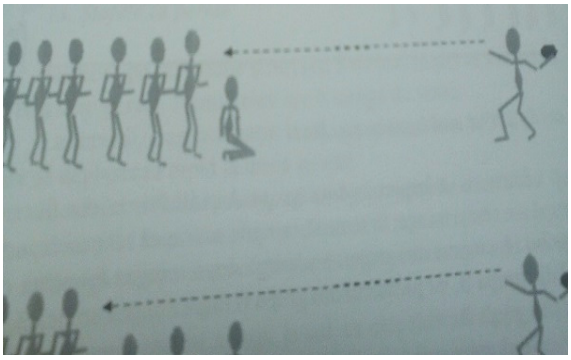

Figure 3. The game *"The ball to the captain"* (Hanţiu I., 2002, pp. 13)

d) "Ball on the ground"

Corrective values: development coordination.

Place of venue*:* classroom

Materials needed: balls

Organization of the game: students are divided into two teams. The components of each team sit in one column from departure line, having in front of them a ball. At the signal of the leader of the game, the first players of each team start crawling, toppling the ball on the ground with the help of their head.

The subjects cover a distance of 4 to 8 m up to a landmark that bypass and return to the team, passing the ball to the next player, and they go at the back of their team.

The game continues until all components go through the route. The team that finishes first wins.

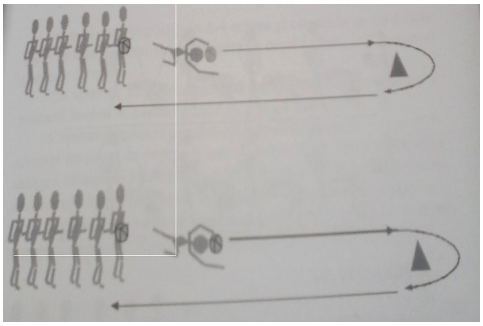

Figure 4. The game '*The ball on the ground*" (Hanțiu I., 2002, pp. 16)

Results

The activity of the subjects involved in the present study was observed and monitored throughout the duration of the research. Regarding the application of motion games, these have been applied throughout the whole period of systematic study.

Each student had their own different evolution because each of them has a personal pace of development.

When organizing the activities there have been taken into account the differences between them and individual peculiarities and therefore, it has been used different treatment for each. There have been emphasized more the particularities related to psychomotor skills.

A very important aspect is that during the activities scientists tried to make available some alternatives which would constitute a way of developing a movement quality, more exactly, handskill.

Based upon the help of motion games, that were constantly applied, we could observe the improvement of hand skills for the six subjects of the study. Fulfilling and obeying the rules imposed by each game individually,

fighting until the end of the game, involving active and conscious activities, positive attitude and optimism, all of these issues have contributed to a greater appreciation of the group of students participating in this study. We believe that through activities developed with the subjects, we bring major changes not only in the domain of hand skills, but also at the level of psychomotor skills, for coordination and self-control.

The received psychomotor results with B.E. - In terms of movement skills the subject walks disorderly, with imbalances, runs erratically, throws the ball without having a corresponding trajectory.

The received psychomotor results with A.D. - When making movements we can notice a small deficit, fails to execute very good catching the ball. He/she makes quick movements, we can notice balance disorders.

The received psychomotor results with M.G. - He can throw accurately the ball and catches it, hits the ball on the ground, he manages to fulfill his tasks as correctly as he can and makes him great pleasure to participate in sports activities.

The received psychomotor results with P.I. - When he has to throw the ball he does it aggressively, throws without direction and powerfully; he picks and throws up some objects with little precision.

The received psychomotor results with G.P. - We can notice balance during walking and he runs in a chaotic manner. During the game with the ball, having a proper coordination of upper limbs he throws and grabs the ball precisely.

The received psychomotor results with S.C. - He has a good balance and manages to hang on his peaks and on his ankles. He has a good coordination, so accuracy at throwing and catching the ball. When it comes to running, he does not hesitate, but enjoys it and runs more than his teammates, proving a good resistance.

Conclusions

In the study conducted on those six students, we are able to sustain the fact that most important and appropriate element, that in the same time has a remarkable impact in movement activities at children with special educational needs, is the game. Even though the game of motion is an activity performed happily by children, it does not have the ability to remove and eliminate the movement disabilities level exist, but may lead to their improvement, if applied seriously and consistently.

After applying the movement games over the studied group, we came to the following conclusion:

Subject B.E., because of his difficulties at movement level, experiences great effort in throwing and catching, space orientation, conducting exercises based on maintaining his body balance.

Even though at the beginning, subject A.D. refused to execute what has been asked of him, he momentarily focuses and plays the games with great pleasure.

The subject G.P. has good motion skills with a fast pace, he manages to execute quite well the games finishing the indicated task, right in time. The availability for activities, the involvement and attention level, the development of movement skills, the adapting capacity and confidence in their own forces, are aspects that contribute to the further development of independence, thereby facilitating the social integration.

At first, the subject S.C. used to throw the ball in an aggressive manner, giving the sensation that all the time he wants to hit his playing partners, now the subject throws the ball more carefully, coordinating his movement and managing to communicate with the other players.

At the beginning, subject M.G. refused to participate in the games but now he is pleased to be part of the game.

Subject P.I. is the student with whom we could finish any task, he is pleased to make sporting activities, especially when it comes to running, he does not hesitate proving a good resistance.

As a conclusion of this study, we can safely state that the motion games that have been adapted and applied were efficient in order to develop hand skills, students registering progress on several levels: sensory movement, social, creative, moral and even therapeutic, confirming the objectives of the study.

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PHYSIQUE, BODY COMPOSITION AND AEROBIC PERFORMANCE OF MALE TEACHER EDUCATION STUDENTS

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ABSTRACT. Students in teacher education programs will have all sorts of assignments related to education at the public school setting, so it is important for them to carry a healthy active way of life and become a role model in this area as well. The aim of our survey was to characterize the status of physique, body composition and aerobic performance of male teacher education students at the beginning of their first year in program and at the end. All first year male students were selected at the teacher training program at Apáczai Csere János Faculty, University of West Hungary (N=102). Results in most areas were within a normal adult range. There were no difference in the physique characteristics between students in general teaching program and students in PE and sport program (Height, Weight, Metric and Plastic Index), but there were significant difference in body composition and Cooper-test results. The results did not change significantly over the year. It would be important to support teacher education students with scheduled and professional health-related training program based upon their individual needs and expectations towards healthy active living.

Keywords: teacher education, male students, physique, body composition, aerobic performance

Introduction

It seems that an unambiguous negative trend currently characterizes people's way of life, their different addictions and their level of fitness in most European countries. The complex and undesirable consequences of inactive lifestyle are now well recognized and necessary steps have been taken in many

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societies (Ridgers et. al., 2009). It is well documented that sedentary lifestyle is a strong risk factor for all age groups in chronic and non-communicable diseases (Pischon et al. 2008). However around one third of adolescents and adult population is physically inactive worldwide (WHO, 2011).

Measuring anthropometric characteristics is a useful mean to verify significant aspects of the population's health status (Radu, Hazar & Puni, 2014). Regular physical tests are also important because it reflects the body's adaptation to long-term physical and mental load and so ultimately the level of health (Degens et al., 2013; Meyers et al., 2015). The most accurate way to characterize the level of adaptation is to measure maximum oxygen intake and oxygen transfer under laboratory conditions. However, in everyday practice it is less complicated and inexpensive to use certain field tests (Szmodis, 1978). It is important to consider that abilities other than the functional capabilities of organs and organ systems also influence physical performance (Jaakkola et al., 2013; Blanchfield, et al., 2014). When anthropometric characteristics and performance are assessed, then all abilities and skills are considered altogether that impact performance level.

In most statistics from European countries, men appear as more active than most women are (Gerovasily et al, 2015). However, there are still questions raised about the characteristics of active lifestyle, body composition and performance as related to gender.

Higher education setting could serve efficient means to consolidate students' personal and professional lifestyles for healthy active living (Romaguera et al. 2011). Teacher education students will have teaching assignments at the primary or secondary school level, so it is important for them to understand their health and fitness status and become a role model in this area as well. From this information, future teachers' dedication and healthy active behaviour can be evaluated. Role modelling is a clear expectation towards teachers so the system of higher education gives students a good opportunity to adopt a healthy lifestyle.

The health-related indicators of the Hungarian population have been declining with cardio-respiratory problems and obesity being the main mortality causes (Szabó & Frenkl, 1996). Risk factors of metabolic and cardiovascular diseases are already present at school-age children and have a negative effect not only on physical but also on cognitive and affective functions (Anderssen et al., 2007; Aber et al., 2009). According to Gerovasily et al. (2015), the 18-64 years population's 32,8% of physically inactive and 52,7% highly active in Hungary.

The aim of our survey was to characterize the status of physique, body composition and aerobic performance of male teacher education students at the beginning of their first year in college and at the end. It was also our goal to compare the general education majors with those of the PE and Sport majors.

Methodology

Sample

All first year male students were selected at the teacher training program at Apáczai Csere János Faculty, University of West Hungary (N=102). The sample was divided into two groups based upon their field of study. Students in Non-PE group were gathered from general education program and they participated in two physical education lessons a week (non-PE group) (n=51, M_{age}=19,35). Students from the PE group were from the PE and Sport program and participated in 2-3 PE and health related theoretical and 6-8 physical activity practical courses (n=51, M_{age}=19,50).

Every participant signed an informed consent form. The research was conducted in agreement with the Declaration of Helsinki.

Data collection

Physique was examined according to the suggestions of Conrad (1963), body composition was determined following the methodology of Drinkwater and Ross (1980). Conrad's technique assumes the knowledge of body dimensions. It characterizes physique along two main paths of evolution. Types are summarized in indices derived from body geometry. The metric index (MIX) that describes variants of physique and body ratios, and the associated plastic index (PLX) that characterizes the development status of the musculoskeletal system, form a rectangular coordinate system, in which individual types are represented by discrete points.

The vertical axis is MIX: the linear function of the chest diameters (width, depth) adjusted with body height (roundness factor), that proved to be specific to the picnic or leptosome nature of physique (Szmodis et al., 1976). The horizontal axis is PLX: the arithmetical sum of three measures that are specific to the skeletal system and to the muscular system (shoulder width + lower arm girth + hand circumference). The growing number of experiences related to the index refers to the fact that MIX (which is based on bone

measurements) indicates what and when has been realized from the hereditary (genetic) tendencies (Mészáros et al., 2001).

The body composition assessment method by Drinkwater and Ross determines the quantity of each body component, the sum of these must equal to the body weight that can be measured easily. With this methodology, the human body can be divided into the following fractions: striated muscle mass, bone mass, essential and storage body fat, and residual mass, which is mainly the visceral mass. To describe body composition, muscle mass as a percentage of total body weight we utilized. Also, body fat values were calculated in percentages of body weight (BF%) according to the suggestions of Pařišková (1961) and used measurement data of skinfold tests at biceps, triceps, subscapular, suprailiac and calf. With the 12 minute walk-run test (Cooper-test) aerobic endurance was estimated. Cooper found a correlation of r=0,9 between running performance and the maximum oxygen intake (VO_2 max) measured during spiroergometry (Cooper, 1970).

All tests were carried out in the beginning of fall term in 2010 and at the end of spring term in 2011. Each student was assessed twice to see if there are any differences in the parameters. The data of those students that missing in one or more measurements were taken out before statistical analyses.

Data analysis

After calculating basic statistical indicators (mean, standard deviation), the difference between two groups were carried out with two-sample t-test ($p<0.05$). To assess if there were any difference between the two data collections, paired t-test was applied ($p < 0.05$).

Results

PE vs. Non-PE groups

There were no difference between the age of the PE and non-PE and the standard deviations are moderate. The statistics of the two groups (PE; Non-PE) with the results of the two-sample t-test are shown in tables 1 and 2.

There was no difference observed in the physique characteristics of the two groups (BH, BW, MIX, PLX), but discovered a significant difference in body composition (BF %, M %) and Cooper-test result averages at both measurements (Tables 1 and 2). At the first examination the metrical index that refers to the linearity of the physique showed remarkable deviation

around the mean value (PE_{2010}: 36,36, non-PE_{2010}: 44,61), which did not decrease for the second assessment (PE_{2011}: 35,33; non-PE_{2011}: 44,27). In case of the relative body fat mass there were already notable deviations at the first assessment, which increased further for the second one (PE_{2010}: 29,64; non-PE_{2010}: 26,59; PE_{2011}: 37,47; non-PE_{2011}: 30,13).

Table 1. Indicator differences between the groups in the fall of 2010

	PE_{2010} students (n=51)			**Non-PE_{2010} students (n=51)**			
Variable	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**p**
Age (year)	19,35	1,10	5,68	19,5	1,15	5,89	NS
BH (cm)	177,57	7, 64	4,30	177,42	7,51	4,23	NS
BW (kg)	70,41	11,74	16,67	69,42	10,47	15,08	NS
MIX	-1,32	0,48	36,36	-1,30	0,58	44,61	NS
PLX	87,69	4,79	5,46	86,56	3,96	4,57	NS
BF %	14,81	4,39	29,64	17,9	4,76	26,59	p<0,05
M %	45,19	1,81	2,21	43,02	2,94	6,83	p<0,05
Cooper (m)	2570,8	343,9	13,37	2295,1	319,1	13,90	p<0,05

Abbreviations: BH = body height, BW = body weight, MIX = metric index, PLX = plastic index, BF % = body fat percent, M % = muscle mass percent, Cooper = Cooper-test, NS = the differences between the averages is not significant, *= the differences between the averages is significant; CV=coefficient of variance.

Table 2. Indicator differences between the groups in the spring of 2011

	PE_{2011} students (n=51)			**non-PE_{2011} students (n=51)**			
Variable	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**p**
Age (year)	19,8	1,11	5,68	20,1	1,2	5,89	-
BH (cm)	177,41	7,57	4,25	177,2	7,27	4,10	NS
BW (kg)	71,65	12,48	17,41	69,25	10,0	14,44	NS
MIX	-1,33	0,47	35,33	-1,31	0,58	44,27	NS
PLX	88,31	4,96	5,61	86,21	3,58	4,15	NS

	PE$_{2011}$ students (n=51)			**non-PE$_{2011}$ students (n=51)**			
BF %	14,17	5,31	37,47	16,46	4,96	30,13	p<0,05
M %	45,57	1,95	8,34	43,88	2,07	4,71	p<0,05
Cooper (m)	2559,7	304,9	11,91	2268,8	274,8	12,11	p<0,05

Abbreviations: BH=body height, BW=body weight, MIX=metric index, PLX=plastic index, BF %=body fat percent, M %=muscle mass percent, Cooper=Cooper-test, NS=the differences between the averages is not significant; CV=coefficient of variance.

Pre- and post-test

The differences over time within the groups are presented in tables 3 and 4. There were no difference between the results of groups PE$_{2010\text{-}2011}$ and non-PE$_{2010\text{-}2011}$.

Table 3. Differences between the two examinations of PE group (n=51)

	PE$_{2010}$			**PE$_{2011}$**			
Variable	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**p**
Age (year)	19,35	1,1	5,68	19,8	1,1	5,68	-
BH (cm)	177,57	7, 64	4,30	177,41	7,57	4,25	NS
BW (kg)	70,41	11,74	16,67	71,65	12,48	17,41	NS
MIX	-1,32	0,48	36,36	-1,33	0,47	35,33	NS
PLX	87,69	4,79	5,46	88,31	4,96	5,61	NS
BF %	14,81	4,39	29,64	14,17	5,31	37,47	NS
M %	45,19	1,81	2,21	45,57	1,95	8,34	NS
Cooper (m)	2570,8	343,9	13,37	2559,7	304,9	11,91	NS

Abbreviations: BH = body height, BW = body weight, MIX = metric index, PLX = plastic index, BF % = body fat percent, M % = muscle mass percent, Cooper = Cooper-test, NS = the differences between the averages is not significant, *= the differences between the averages is significant; CV = coefficient of variance.

Table 4. Differences between the two examinations of non-PE group (n=51)

	non-PE$_{2010}$			non-PE$_{2011}$			
Variable	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**p**
Age (year)	19,5	1,15	5,89	20,1	1,2	5,89	-
BH (cm)	177,42	7,51	4,23	177,2	7,27	4,10	NS
BW (kg)	69,42	10,47	15,08	69,25	10	14,44	NS
MIX	-1,3	0,58	44,61	-1,31	0,58	44,27	NS
PLX	86,56	3,96	4,57	86,21	3,58	4,15	NS
BF %	17,9	4,76	26,59	16,46	4,96	30,13	NS
M %	43,02	2,94	6,83	43,88	2,07	4,71	NS
Cooper (m)	2295,1	319,1	13,90	2268,8	274,8	12,11	NS

Abbreviations: BH=body height, BW=body weight, MIX=metric index, PLX=plastic index, BF %=body fat percent, M %=muscle mass percent, Cooper=Cooper-test, NS=the differences between the averages is not significant, *=the differences between the averages is significant; CV=coefficient of variance.

Discussion, conclusions

Obesity is viewed as an imbalance between the energy amounts of intake nutrition and the level of physical activity (Farrel et al., 1998; Blair and Brodney, 1999; Wei et al., 1999). Flegal and Troiano (2000) already consider a little overweight as major health risk if it comes together with abdominal obesity. Our results demonstrate an average development regarding body height and body weight (Bodzsár, 1999; Fehérné, 1999; Joubert et al., 2006).

Differences between body dimensions, physique and body composition of the same gender, similar biological age and race are significant, which means that the anthropometric characteristics of healthy individuals may vary within very broad limits (Frenkl et al., 1987; Mészáros et al., 1989; Carter and Heath, 1990; Bouchard, 1991). The mean values and deviations of metric and plastic indices that represent growth types of our subjects show the differences in body composition. The metric index that refers to the linearity of the physique is slightly within the negative domain, the subjects are metro-leptomorf types. A normo-plastic musculoskeletal system is associated with this form indicator. The mean values of the metric index are basically identical at both groups. When evaluating the results we cannot ignore the huge standard deviations

(around 35-45%) of the metric index. It is assumed that this remarkable deviation around the mean value is due to the high variability of body composition and to relatively low sample size.

The almost linear growth of body fat mass is a non-necessary, but a general consequence of secular changes (Eiben, 1985; Bodzsár, 1998; Mohácsi et al., 1994; Mészáros et al., 2001; Frenkl & Mészáros, 2002). Values of relative body fat mass are within the physiologically normal range, but the difference between the groups is significant at every assessment. Relative deviations were around 30% at the beginning and have increased significantly by the end of the test period.

We also found participants in both groups who were outside the healthy domain. It is certainly a fortunate sign and a justification of the positive effect of regular exercises on body composition that the members of the PE group are at the lower end of the healthy range (14-18%), but deviations are great even in their case (Zaccagni et al., 2014). Body composition is a highly variable attribute, and as we know, it depends on gender and age, and also on physical activity, hence we emphasize that teacher education students choose area of subject domain (for example physical education, arts, languages, etc.) after their successful entrance examination.

There are those students in the program who never competed in any sports, but after entering the university, they decided to study sports science. This explains that extreme physique and disadvantageous body composition are appearing within the PE group also.

The muscle mass relative to body weight is at the ideal level of around 45% only in case of the PE group. The difference exists between the two groups at every examination. Within the Non-PE group moderate physical activity resulted in the retardation of the musculoskeletal system (M% Non $PE_{2010\text{-}2011}$: 43,02%-43,88%).

According to Heyward (1998), field tests might be used to assess cardio-respiratory performance, as they enable the examination of a huge population within a short period of time, but field tests cannot be used for diagnostic purposes. The results of the Cooper-test can be considered good in case of the PE group and average in case of the Non-PE group (Cooper, 1968; Zwiren et al., 1991; Grant et al., 1995). The difference of means was not remarkable within the groups but was significant between the two groups at the time of each test. The fact that these endurance performances lower than the results of high school boys 20-25 years ago (Barabás, 1988) demonstrates a clear need for a change at the local and societal level as well.

The weaker physical performance of the Non-PE group is not surprising, it is more a straight consequence of their inactive lifestyle (Catenacci and Wyatt, 2007; Hamilton et al., 2008). Without any doubt, the main determinants of the physical performance are the quantity, quality and frequency of practice even on this moderate performance level (Rhea et al., 2003; Lustyk et al., 2004; Duncan et al., 2005). The irregular physical activity of the Non-PE group could not provide the frequency and intensity that is required for biological adaptation (Haskell et al., 2007).

As a general conclusion, we can state that the teacher education students, especially Non-PE students – do require scheduled and professional supported health-related training program based upon their individual needs and expectations towards healthy active living (Sebőkné, 1999). During their university program, students should study subjects related to health, physical education, mental hygiene and nutrition – with adequate theoretical and practical contents.

This knowledge and experience might better promote the realization of the preventive and recreational value of healthy lifestyle, physical activity and sport; the familiarization with methods of measurement and improvement of fitness and also their self-employed application; plus the independent expansion of this set of skills (Standage et al., 2003; Moreno Murcia, Coll & Ruiz Pérez, 2009). With this, future teacher will be able to develop the necessary competences for best student learning. For this reason, we cannot avoid the establishment of "theoretical" physical education classes in universities, which could provide a framework for the transfer of the above outlined knowledge.

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GAMES AS A MEANS OF DEVELOPING THE POTENTIAL OF STUDENTS IN PRIMARY BIOMOTRIC

GHEORGHE GABRIEL CUCUI[1]*, IONELA ALINA CUCUI

ABSTRACT. As pointed out in sport-related published literature, games have a very important influence on the psychological development of children. Children play almost all the time giving them greater flexibility and creativity to their behaviors. It gives children the impression inexhaustible conditions that contribute to the knowledge about the world and life. Formed and develops direct observation capabilities, and indirectly, the game creates a larger drive. The game is the main activity through which the child makes contact with the complexity of the environment, which facilitates widening system of knowledge, skills and abilities, improving representations, sense of observation, initiative and way of thinking.

Keywords: game, development, students.

REZUMAT. Jocul – mijloc de dezvoltare a potenţialului biomotric al elevilor din ciclul primar. Jocul are o influenţă deosebit de importantă în dezvoltarea psihică a copiilor. Copiii se joacă aproape tot timpul conferindu-le conduitelor lor multă flexibilitate şi creativitate. Acesta oferă copiilor condiţii inepuizabile de impresii care contribuie la îmbogăţirea cunoştinţelor despre lume şi viaţă. Formează şi dezvoltă în mod direct capacităţi observative, iar în mod indirect, jocul creează o mai mare antrenare. Jocul constituie principala activitate prin intermediul căruia copilul ia contact cu complexitatea mediului înconjurător, lucru ce îi facilitează lărgirea sistemului de cunoştinţe, priceperi şi deprinderi, perfecţionarea reprezentărilor, spiritul de observaţie, iniţiativei şi modului de gândire.

Cuvinte-cheie: joc, dezvoltare, elevi

Introduction

The game has a very important influence in physical and mental development of children, and is the main point of interest for students of all ages and both sexes (Scarlat, Scarlat, 2002). Children play almost all the time giving them greater flexibility and creativity to their behaviors.

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From childhood to old age, man is playing in permanent reasons (needs, impulses, needs, etc.) interior and / or exterior (which push towards different actions) (Colibaba, Bota, 1998).

The game gives children the impression inexhaustible conditions that contribute to the knowledge about the world and life. Formed and develops direct observation capabilities, and indirectly, the game creates a larger drive.

The whole game form competence, skills activated, increases the ability to understand complex situations creates capacity restraint and dosing forces physical and spiritual abilities of concentration, obedience to the context rules and the desire to succeed in games with rules voltage affective complex situations capacities to solve problems, creativity.

For the child, the game requires a certain physical effort, but also consumption, nervous even when it is the simplest and easiest ludic activities. The game is the main activity through which the child makes contact with the complexity of the environment, which facilitates widening system of knowledge, skills and abilities, improving representations, sense of observation, initiative and way of thinking.

The profound meaning of the game is conveyed by their contribution to the harmonious physical development, personality, by providing a functional balance between their behaviors, physical and mental.

This research aims to highlight the implications of movement games in physical education class and the development of children in physical education classes as games of movement of a predominantly.

Using the game in physical education class contribute to the development of analytic perception, to guide willful attention and observation, the development of memory driving, imagination, suppleness, thinking, ability to apprehend and anticipate the situation changes, initiative and independence, development harmonious physical, motor and improving indices manifestation of competition between students (Cârstea, 2000).

Research methods

Various aspects included in practicing various forms of physical exercise, harvesting the most significant data to highlight their content, their processing to develop conclusions and establish further new hypotheses are increasingly necessary to conduct research in the area of physical education and sport.

Methods:

- Bibliographical study method - I studied literature circumscribed discussed.
- Observation method - I noticed conducting educational process in terms of game involvement on students.
- The experimental method - to verify the working hypothesis we used this method to quantify the contribution of the game to improve children biomotrici indices.
- Test method - this method is found in the form of control samples that were tested subjects research. Control samples supported by students (5x5m shuttle, long jump from a standstill lasting running, throwing the rounders the place) highlights the use of the method of measuring their efficiency.
- Statistical and mathematical method - us to process and systematize data recorded during the research.
- The graphic method - I used this method for viewing data obtained in this research and an easier understanding of the dynamics phenomena pursued and relations between them.

Results

For the development of this research samples were randomly selected students, and part of secondary school Coresi in the town of Targoviste, Jud. Dîmboviţa. The two samples are established for the investigation of A Class III with a staff of 20 students having a mean age 9.3 years (experimental group) and Class III B with a staff of 22 students with average age of 9.4 years (control group).

The research was conducted under optimal conditions, an important and it has brought the sport provided by the school where the research was conducted.

It is equipped with a well-equipped gym in material terms. The teaching material provided (balls, ropes, gymnastic banks, fixed ladder, basket basketball, handball gates etc.) can be used by students during physical education lessons.

The sports offers the possibility of conducting physical education classes and outdoors, under optimal conditions, so students can benefit from the high quality of the educational process.

The research included three distinct phases:

- The first stage - October 2014 meant debut with the election theme of research and studying literature.

- Stage II - a - November 2014 - April 2015, consisted of: establishing samples and control samples, test subjects, data processing and interpretation, selection operating means;

- Phase III - May 2015 - making the final testing, data processing and interpretation, drawing conclusions.

To verify the research hypothesis, based on the results, we used the analysis of the sample Motrici parameters evolution. From the results obtained and presented in following table reflects a potential increase biomotric thus improving the performance of children for each sample separately.

Table 1. Evolution of the results achieved by the sample subjects

Sample	The shuttle 5x5m			Long jump from standstill			Running the length			Throwing the rounders in place		
	T.i.	T.f.	Dif.	T.i.	T.f.	Dif.	T.i.	T.f.	Dif.	T.i.	T.f.	Dif.
Experimental group	6.69	6.42	0.27	1.20	1.27	0.07	2.24	2.22	0.02	20.05	28	7.95
Control group	6.65	6.48	0.17	1.20	1.24	0.04	2.22	2.21	0.01	17.40	24.63	7.23

T.i.- initial testing; T.f. – final test; Dif. - difference between average.

The evolution of these parameters driving was highlighted in the following graphs.

From the chart one can observe the evolution of the sample for test results subjects shuttle 5x5m. This sample shows an evolution of 0.27 sec. for the experimental group and the control group, we see a trend lower, being 0.17 sec.

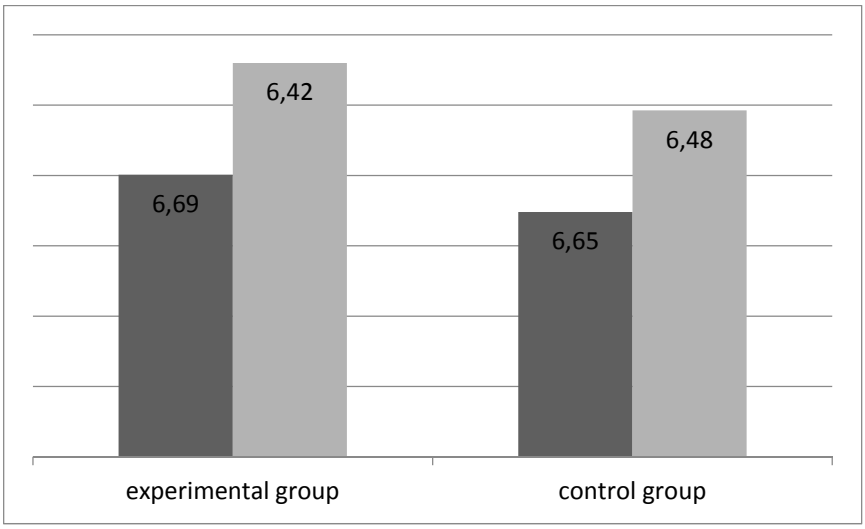

Figure 1. Evolution sample test results shuttle 5x5m

Regarding the long jump test from standstill, results and highlighted in the chart below reflects the increasing of our performance. Group progressing experiment of 0.07 m, while the control group progressing with 0.04 m in this sample.

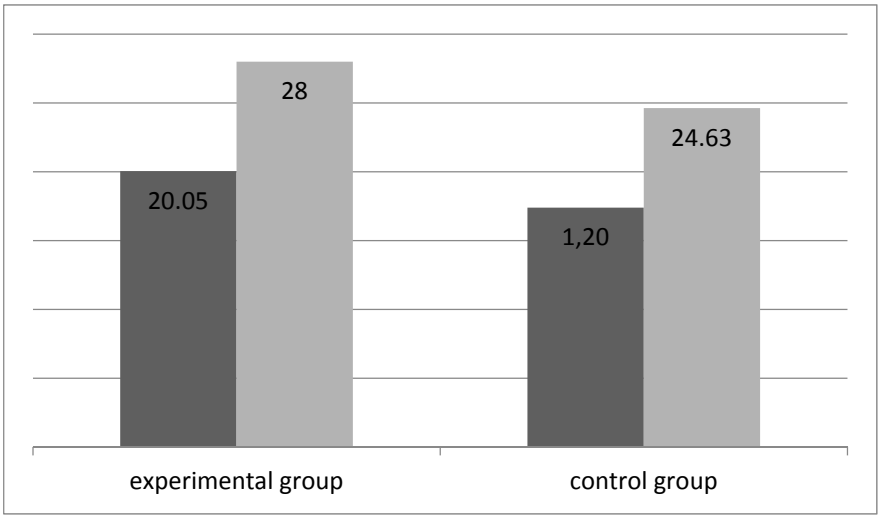

Figure 2. Evolution sample test results long jump from standstill

From figure no. 3 which highlights developments in test subjects lasting running we can see that there is also progress performanţial. Group records and experiment for this test an evolution of the indices higher (0.02 minutes) than the control group (0.01 minutes). Research into the control group recorded an average of 2.22 minutes results reaching its end at an average of 2.21 minutes, resulting performanţial better than the final testing of the experimental group (2.22 minutes).

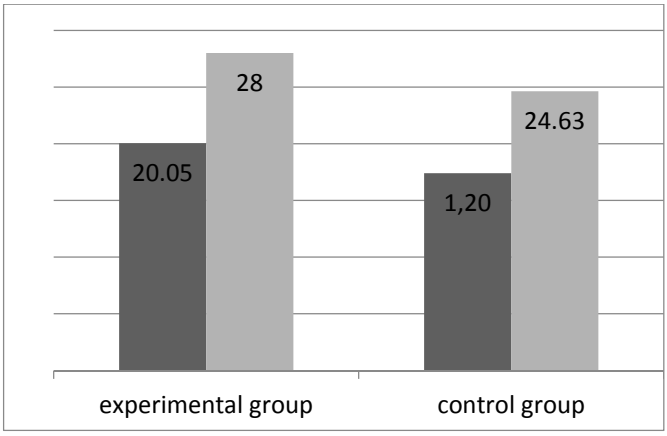

Figure 3. Evolution sample results of running the length

Regarding sample of rounders throwing from the spot evolution is significant for both groups. Group experiment succeeds the final testing results an average of 28 m by 7.95 m more than the initial testing. We can say that progress is being made and the same for the control group (7.23 minutes), the difference between the two groups being given by the performanţial obtained in the two tests.

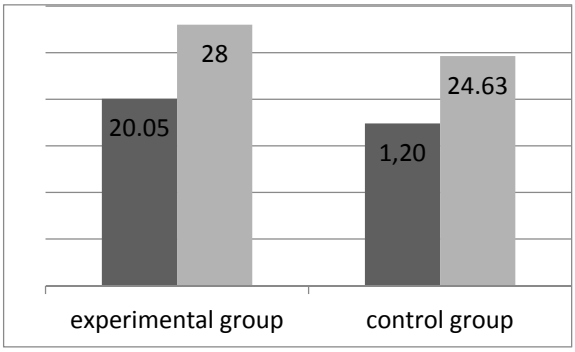

Figure 4. Evolution at throwing the sample results from place rounders

Discussions

In order to achieve the research purpose, the structure of the physical education lessons group experiment subjects were found two motion games. They were aimed at stimulating children's motivation, increasing the potential psycho-motor in relation to the requirements of the physical education curriculum specific to this age group. Regarding the control group, during this period has been operated continuously and systematically in the process of physical education of the experimental group were used by the teacher of physical education and sport, the traditional means for achieving the objectives of the curriculum of physical education and sport in force.

Reporting the results of experimental studies group specialized in the field (Scarlat, Scarlat, 2002; Moisescu, 2009) and on the standards of the World Health Organization and Evaluation System National Physical Education and Sports in keeping average target group see a slight tint parameters which accentuates the benefits of progressive movement games used during physical education classes and sports.

Conclusion

Specialized studies in psychology and pedagogy have shown that using games contribute to a better development of the educational process and concepts that ownership is made easier through the game. The child from infancy through game play, he enters the relationship with the surrounding nature and a wealth of knowledge assimilated.

In physical education, the game has a predominantly because through it develops psycho-motor abilities, motivation, will, race, vital body functions, leading to a natural and harmonious development of the child. This research highlights those aspects of the game moving, constantly using their physical education class.

Intervention made in the structure of "Unit" which was aimed introduction to physical education lesson two games of movement to meet the learning objectives has improved the educational process and to improve the driving performance of the students. Motion games were selected so as to contribute to the development indices loads.

Because of the interest shown by children, games led to acquiring skills used in team games because the games were used fixings throwing, jumping, etc.

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THE ROLE OF ICE SKATING AND ICE HOCKEY EDUCATION IN EVERY DAY PHYSICAL EDUCATION

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ABSTRACT. Sport and physical education are strategically very important areas for the leaders of the country, which caused serious changes in the education during the last few years. In this study those difficulties were investigated which schools had to face because of the Public Education Act (accepted in 2011), and how the problems were solved, what kind of changes had to be done during the everyday work. The aim of this study was to assess the different opinions about the introduction of everyday physical education (PE) and to investigate why schools chose ice skating and ice hockey to replace the PE lessons. The results show that everyone considers PE lessons useful and that ice skating and ice hockey are popular activities among the participating schools.

Keywords: everyday physical education (PE), ice skating, ice hockey

Introduction

Physical education as an institutionalized form of sport activity is a special, complex area and as it gives foundation of the studies, it influences the whole personality of the students (Révész & Csányi, 2015). It positively influences the life of the students and helps to develop many useful skills and personal features. It enhances their self-confidence, vocation and endurance, too. Physical education and sports are a very important stage in the socialisation of the kids (Elbert, 2010). Beside its complex personality developing effect, PE is also responsible for the health and the training level of the students. Its aim is to form a health-awareness attitude in students that will escort them through their life (Révész et al. 2014). As mentioned in other studies, establishing a positive

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awareness attitude towards health had been of utmost importance until the 2010's, because our country performed badly in all physical activities (Eurobarometer 72.3, 2009). It significantly lagged behind the average of the EU member states in mental health indices, as well (Eurobarometer 73.2, 2010). Due to the physically more active lifestyle, the competitiveness of the country increases productivity and reduces the level of health expenses, which at the same time stimulates the economy of the country (Ács and Kovács, 2015). Therefore, it can be observed that huge changes started in school year 2011 in the physical education system that has been of great importance (kormany.hu 1).

Based on the order, everyday physical education had to be introduced first in the first, fifth and ninth classes in September 2012. At present, the whole system is in operation in all classes. These changes coincided with the curriculum reform and with the assuring of the needed financial background (kormany.hu 2) which is also important to know to understand the regional problems.

Principles and aims of 2012 National Core Curriculum (NAT) for physical education and sport

Before the introduction of the NAT in 2012, the requirements were not compulsory, they were only offers; the aim, tasks and requirements were not defined (Hamar, 2009). According to the 2003 and 2007 NAT regulations, the development quality of PE and sport was in relation to the possibilities of education organization and pedagogy. The aim was to foster local traditions, to improve the quality of facilities and equipment, because these significantly influence the efficiency of education. In NAT 2012, there were significant modifications in the domain of PE and sport. These were important changes compared to the previous one. A highlighted aim is to make regular sports and lifelong health-conscious physically active lifestyle is a demand in the students' life. The importance of this has significantly grown in proportion of all number of lessons thus ensuring the development of personality of the students through motor activity.

Putting into action and introduction

According to the Act of 2011 about Public Education, everyday physical education lessons have to be organized in an antecedent system as follows:

Table 1. Schedule of launching everyday physical education

School Classes	2012/2013	2013/2014	2014/2015	2015/2016
1.	5 lessons	5 lessons	5 lessons	5 lessons
2.	Everyday PE	5 lessons	5 lessons	5 lessons
3.	Everyday PE	Everyday PE	5 lessons	5 lessons
4.	Everyday PE	Everyday PE	Everyday PE	5 lessons
5.	5 lessons	5 lessons	5 lessons	5 lessons
6.	Everyday PE	5 lessons	5 lessons	5 lessons
7.	Everyday PE	Everyday PE	5 lessons	5 lessons
8.	Everyday PE	Everyday PE	Everyday PE	5 lessons
9.	5 lessons	5 lessons	5 lessons	5 lessons
10.	Everyday PE	5 lessons	5 lessons	5 lessons
11.	Everyday PE	Everyday PE	5 lessons	5 lessons
12.	Everyday PE	Everyday PE	Everyday PE	5 lessons

School year lesson everyday physical activity (Szakál, 2012)

In accordance with the data provided by this table, the daily PE lesson system had to be introduced first in the first, third and ninth grade. The five PE lessons per week were introduced in all classes in school year 2015/2016 causing difficulties in many schools (eduline.hu, 2013).

Ice hockey curriculum of studies

From the viewpoint of juniors, teaching of ice skating and ice hockey in the primary schools has a great role in the development of Hungarian ice hockey. Among the aims of education, the followings can be found: to gain positive and excellent experience through skating and hockey and proper age-related sports training acceptable by the profession. Primary school students can be divided into four age-groups: the supermini (class 1-2), mini (class 3-4), preparatory (class 5-6) and kids (class 7-8). The aim of training, the teaching material and the requirements are different matching the certain ages.

Based on the above-mentioned facts, the following questions can be formulated: 1.) What difficulties schools had to face due to the 2011 new Public Education Act 2.) How did they solve the problems and what changes did they have to do during their work?

Hypotheses

- H1: It is assumed that the students, parents, and the teachers have positive attitude to the introduction of everyday physical education programs.
- H2: It is assumed that the primary schools could not have been able to organize all the 5 PE lessons inside their schools.
- H3: It is assumed that choosing ice skating and ice hockey was a positive decision and it responds to the aims of the school and the NAT.

Methods

Data collection was carried out on the ice-rink of the Canadian Hungarian Ice hockey Club (1117 Budapest, Bogdánffy utca 12.) and in the primary schools of the 11th district of Budapest where ice skating and ice hockey education is common. The self-completion questionnaire and interview methods were applied in order to collect specific data (Babbie, 2003). Separate questionnaire was compiled for the students, for the parents and for the teachers. The questionnaire of students included only closed questions with two alternative answers (yes-no). In the parents' and teachers' questionnaire the five level Likert-scale method (5 meaning fully/completely, 1 absolutely not), and open questions were used. The first, second and fifth classes were assessed in the sample schools. Pupils/students from first and fifth classes started their ice skating and ice hockey education in September 2013, 3 months prior to testing. Pupils in the second classes had one year experience. The parents and teachers' opinions of the same school were also studied.

Altogether 253 persons ($N_{students}$= 143), 96 parents ($N_{parents}$ = 96), and 14 teachers ($N_{teachers}$ = 14) filled in the questionnaire. The data was processed with the MS Office Excel 2014 Program. Averages, standard deviations, proportions were calculated. Some diagrams have been prepared for the better understanding. Six interviews were made with school directors.

Results

Opinions on the introduction of daily physical education classes

The first question surveyed the opinion of parents, students and teachers about the increased number of PE classes.

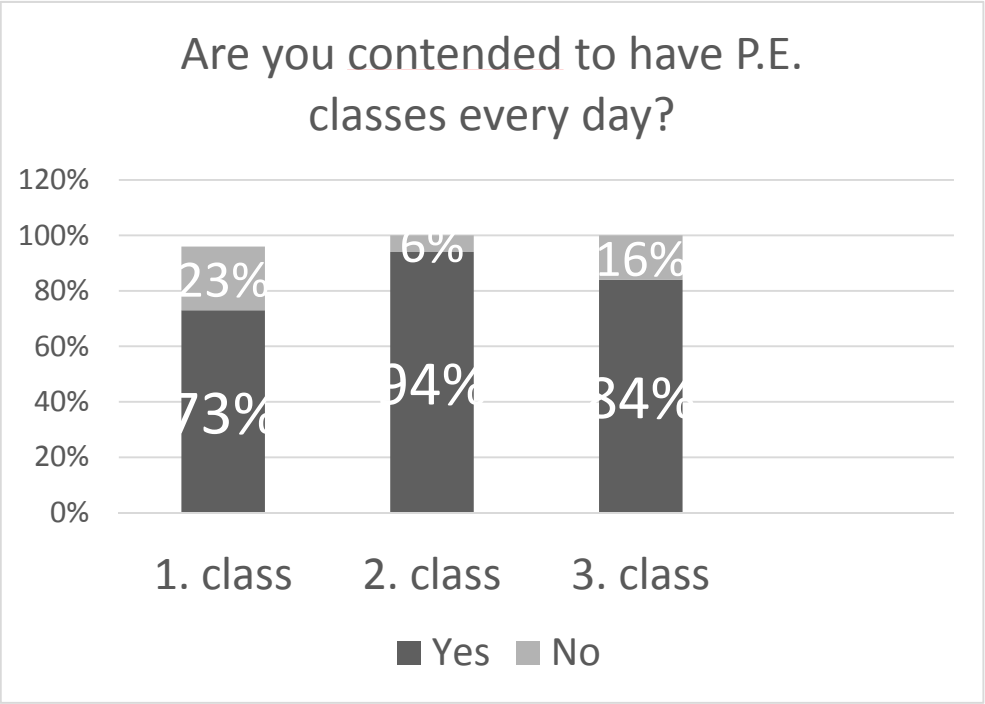

Figure 1. Opinions of the parents, students and teachers about daily PE classes

The majority of students like this frequency of PE lessons: 83, 67% of the asked students answered with yes. The Liker-scale questionnaire showed the same result: 85% of the parents and 86% of the teachers agreed with it.

Opinions on the difficulties of introducing daily physical education and on personnel and facility conditions

The surveyed schools are well-equipped and they have no personnel and facility shortages, but they would not have been able to teach the increased number of lessons in their own schools. Replacing two of the PE lessons with ice skate and ice hockey education out of school was very helpful for those schools. The personnel (eduline.hu, 2013) and facility conditions were not perfectly created for the introduction of everyday PE, as it caused a problem for even those schools which are better equipped than the average schools, not to mention the dressing rooms, hygienic and other conditions. The introduction of everyday physical education caused serious problems in about one quarter of Hungarian schools already in its first phase, as it turned out from the report prepared by the Ministry of Human Resources for the government.

Reasons for choosing ice skating and hockey as a supplement to daily physical education

Ice hockey is an extremely complex team sport, so it is suitable to develop several abilities required by other sports as well (Montgomery, 1988). From condition point of view it develops all types of strength/power, speed and endurance (Géczi at. al., 2012). The basics of the sport, ice skating moves, several muscle groups and at the same time, develops/improves coordination abilities (www.sportagvalaszto.hu). In the process of learning ice skating, various balancing abilities are developed, mainly dynamic and mixed (dynamic-static) capabilities. Moreover it improves all coordination abilities: kinaesthesia, sense of rhythm, spatial orientation and other complex abilities (Broďáni and Šimonek, 2008). Children's mental and cognitive skills pass through significant improvement during the play.

Examining all these positive effects and the curricula of the sports (nupi.hu) it can be said that introduction of ice skating and hockey in certain classes of primary school makes the development of the children's personality and the positive features necessary for preparing for life possible (Géczi et al., 2011).

Ice skating and ice hockey training classes as supplements

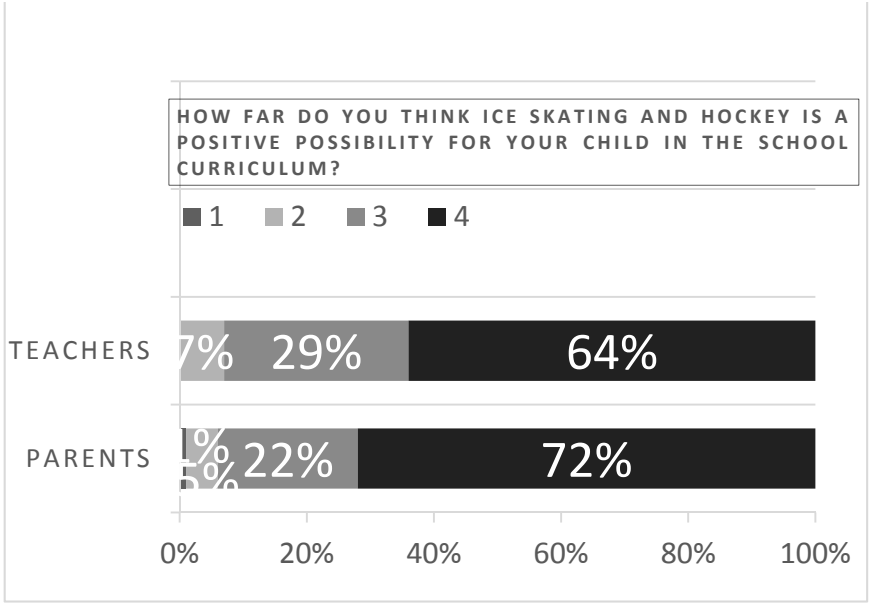

Figure 2. Opinions on ice skating and hockey education expressed by teachers and parents

In the questionnaire it was examined who and to which extent does someone think teaching of skating and hockey be positive. The idea was positively accepted by the pupils/students: 89.67% of the pupils/students like to go to skating education. A similar answer was received from both the parents and the teachers as in case of Hypothesis 2. Responses of teachers and parents are in Diagram 2.

94% of the parents and 93% of the teachers think that it is positive that the students take part in ice skating and ice hockey education within the frame of PE lessons, which is a remarkably high rate. We were also interested in the opinion of school directors about the attitude of the parents, teachers and students. We heard positive opinions from all groups. The students learned almost all tricks during the two months with huge enthusiasm and devotion and learned to skate confidently. The parents are watching their kids with interest and naturally, they are very helpful. The teachers like ice hockey very much, sometimes they even join the play, setting example to the kids.

In the study, all hypotheses are answered and justified. In Hypothesis I it was supposed that the introduction of everyday physical education bring about/evoke a positive reflection from pupils/students, parents, teachers and the management of the school. It can be stated that the first hypotheses has been proven.

Hypothesis II was that the schools would not have been able to solve the everyday physical education without outer help or support. In spite of the fact that the schools have very good facilities and infrastructural background, the help (2 ice skating and ice hockey lessons from the 5 PE lessons per week) was needed. Therefore, the second hypothesis was also proven.

In Hypothesis III the question was raised: was the choosing of ice skating and hockey a positive decision and did it correspond to the aims of the school and of the NAT. This assumption was proven by the answers of the headmasters.

Conclusions

In the study, the introduction of everyday physical education and its problematic background was studied, with a special focus on ice skating and ice hockey education as a possible solution for the mentioned problems.

The author thinks that there is a huge need for the introduction of everyday physical education in Hungary because of the health status of the citizens. A demand towards physical activity has to be created among the

children to do proper physical activities later on as well, according to their age and state of their body. Introducing ice skating and hockey in the teaching program of primary schools seems to be a perfect chance for reaching the mentioned aims, as children learn completely new movement forms and can have joyful moments. Based on all these it is thought that the schools have brought good decision when they introduced ice skating and ice hockey. The introduction of everyday PE lessons and the chances given by the NAT to replace two lessons from the five offers huge alternatives for the schools, thus influencing the relation of pupils/students to sport. The schools have to investigate the chances offered to them and have to find the best solutions.

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STUDY ON INCREASING THE EFFICIENCY IN VOLLEYBALL

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ABSTRACT. Starting from the analysis of the current global performance context in volleyball and our internal realities, we consider it appropriate to conceptually address the optimization strategy of the Romanian volleyball performance, by comparing the results of the second attack line, between two Romanian teams and one from the Italian championship and reporting them to the efficient result of an official volleyball match. The theme follows the progress of the volleyball game by aligning internal performance strategies to modern game trends that are based on surprising the opponent. Regarding the preparation and training area of volleyball, along with methodological orientation in modelling the content of preparation, it is necessary to implement in the collective and tactical structure of the second line of attack the element of surprise in the approach of an official game. The initiative represents a starting point for current and prospective coaches who want to improve the quality of the game, using the attack in the second line.

Keywords: volleyball, second line attack, quality

REZUMAT. Studiu asupra creșterii eficienței în jocul de volei. Pornind de la analiza tendinței globale în jocul de volei, în contextual relaității international considerăm oportună optimizarea concepțiilor de pregătire în voleiul de performanță, comparând rezultatele atacului din linia a II-a dintre două echipe din țară și folosind statistica unei echipe din Italia. Tema noatră urmărește strategii de pegătiri moderne în joc, pentru a surpinde adversarul cu soluții de joc tendențioase. Observând antrenamentele de volei și pregătirea meciurilor oficiale, este necesară implementarea în colectivul de jucători structura tactică de atac din linia a II-a ca element de surpriză pentru adversari. Initiative aceasta reprezintă un punct de vedere a antrenorului modern care vrea să ridice calitatea jocului utilizând atacul din linia a II-a.

Cuvinte-cheie: volei, atac din linia a II-a, calitate

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Introduction

The evolution of worldwide volleyball knows a great dynamic, in terms of both content and the spectacular development of the game and in the area of distribution and popularity, a natural consequence of the policy that FIVB has been practicing consistently in this direction (Cojocaru, 2007).

Progress, still upward in volleyball, cannot be conceived and built without a coordinated and integrated approach of all the components of performance, starting from human resources (athletes, technicians), science (research, methodology, medicine), technicality, tactics and organizational framework (specialized units, competitive systems, management) to the intimacies of the training process, the contents of training and programming, methods and tools, control, guidance, assessment, technical and tactical actions, patterns of play (Ioniță, 2007).

In this context of perspective in the performance of volleyball, we consider necessary the continuous improvement and modernization, not by simple selection of knowledge, but by restructuring of the entire performance system in relation with the appearance of the surprise element in the first phase of the game [6-*adaptation*]. The surprise element can only be, in our view, the attack in the second line (Cojocaru., Cojocaru, Țurcanu, Țurcanu, 2011).

Materials and methods

Starting from the analysis of the current global performance context in volleyball and our internal realities (National Women's Championship, A1 Division), we considered it appropriate to address the optimization strategy of the Romanian volleyball performance, by comparing the results of using the attack in the second line, between two Romanian teams and one from the Italian championship and reporting them to the actual result of an official volleyball match.

In this way, we try to find an answer to the question: does the attack in the second line represent a key element in the volleyball game?

Results and discussions

The proportion of the second line of attack from the total attack moments and the efficiency of them in the competitive season of 2012-2013 (table no. 1).

Table 1. The proportion of 2nd line of attack

Team name	2nd Line Attack	Efficiency
CSU Medicina Tg.Mureş	27%	21%
CSM Bucureşti	24%	32%
Foppapedretti Bergamo	33%	38%

The comparative results, in relation to the efficiency of the second line of attack at the game from 2012-2013 competitive season (result 3-0), between CSU Medicina Tg. Mureş, host team (Table no. 2) and CSM Bucureşti, guest team (Table no. 3).

Table 2. Efficiency of 2nd line of attack, CSU Medicina Tg. Mureş

Total attacks (%)	Total 2nd line attacks (%)	Effective attack moments in the 2nd line (%)	Effective attack moments in the 2nd line (score)
103 (100%)	13 (12.63%)	5 (38.47%)	13-11(set 1) 16-12(set 1) 11-11(set 2) 7-4(set 3) 11-7(set 3)

Table 3. Efficiency of II line of attack, CSM Bucureşti

Total attacks (%)	Total 2nd line attacks (%)	Effective attack moments in the 2nd line (%)	Effective attack moments in the 2nd line (score)
78 (100%)	6 (7.70%)	2 (33.34%)	2-5 (set 1) 4-5 (set 2)

The efficiency of the second line of attack at the game from 2012-2013 competition season (2-3 score), between the teams Foppapedretti Bergamo (host team) and Rebecchi Piacenza (guest) in Table no. 4.

Table 4. Efficiency of II line of attack, Foppapedretti Bergamo

Total attacks (%)	Total 2nd line attacks (%)	Effective attack moments in the 2nd line (%)	Effective attack moments in the 2nd line (score)
115 (100%)	25 (21.74%)	9 (36.00%)	9-9 (set 1) 17-16(set 1) 8-13(set 2) 10-17(set 2) 15-23(set 2) 2-5(set 3) 3-2(set 4) 5-8(set 4) 4-5(set 5)

Second line of attack statistics at CSU Medicina Tg. Mureș at National Championship A_1 Division, 2012-2013 (22 official matches), using Data Volley program (Table no. 5).

Table 5. Second line attack, CSU Medicina Tg. Mureș

Total attacks from 2nd line	Decisive attack until point 15	Decisive attack until point 20	Decisive attack until point 25
158 100%	30 57.70%	12 23.08%	10 19.22%

The percentage of efficiency of the second line attack from 2012-2013 competition season of CSU Medicina Tîrgu Mureș volleyball team is ilustrated, with a graphical representation, in figure no. 1. (Bocoș, Ciomoș, 2001).

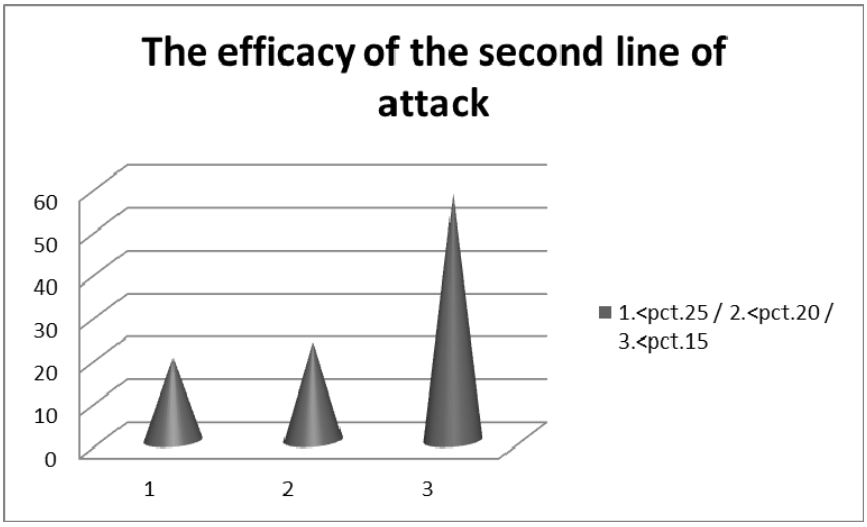

Figure 1. Schematic comparison between different moments of the game

Conclusions

Looking at Table 1 in relation to the percentage of the attack from the second line and its efficiency, we conclude that the attack from the second line in the Italian championship represents an element that is included in the collective tactical actions.

The game content, technical and tactical actions know a downward trend in the use of the attack from the second line and especially its effectiveness throughout the games played between the studied Romanian teams (Table no. 2 and no. 3), comparing with the Italian team (table no. 4).

In addition, after analysing the data provided in Table no.5, it appears that the percentage of using the second line of attack decreases as we move from point 15 of the game. This entitles us to say that the effectiveness of using this technical element decreases when approaching the 25th point of the set, which shows distrust in using the attack from the second line as a final element. This is also reinforced by the data provided in figure no. 1.

Extending sports performance through permanent innovation must be consistent with genuine own resources and current trends manifested in current volleyball performance. Our initiative represents a starting point for current and prospective coaches who want to improve the quality of the game, using the attack in the second line and increase game efficiency by framing this element in the greater picture of competitive volleyball.

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SPORT CONTESTS, GAMES AND PHYSICAL EXERCISES ON THE TERRITORY OF THE ROMAN EMPIRE

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ABSTRACT. The aim of this research is to bring the history of sport and physical education in the Roman Empire to the current knowledge. The intrinsic value of written and archaeological sources about ancient roman sports is great. Some literary, epigraphic and numismatic sources, those that are direct sources cannot be disputed. They must be taken as such. Archaeological sources, which are certainly more numerous and more widespread, can be interpreted both in terms of representation and interpretation. At the same time, however, the advertising policy of sports becomes difficult to understand, although it is comparable to nowadays policy, based more on interpretation.

Keywords: stadium, pugilat fighting, duumvirate, pancratium, pentathlon, palaestra.

REZUMAT. ***Întrecerile cu caracter sportiv, jocurile publice şi exerciţiile fizice pe teritoriul imperiului roman.*** Scopul lucrării este acela de a aduce istoria sportului, a educaţiei fizice din Imperiul Roman, la nivelul cunoştinţelor actuale despre acest subiect. Valoarea intrinsecă a surselor scrise şi arheologice antice despre sportul roman este mare. Unele surse literare, epigrafice şi numismatice, cele care sunt surse directe nu pot fi disputate. Acestea trebuie să fie luate aşa cum sunt scrise. Sursele arheologice, care sunt cu siguranţă mai numeroase şi mai răspândite, pot fi interpretate atât în termeni de reprezentare şi de interpretare. În acelaşi timp, politica de publicitate a sportului devine greu de înţeles, deşi este comparabil cu politica de astăzi, bazată mai mult pe interpretare.

Cuvinte-cheie: stadium, pugilat, duumvirat, pancraţiu, pentatlon, palestra.

Introduction

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Physical education and sport contests had an important place in the life of the Empire's inhabitants. Physical activities and sports competitions were very numerous and complex, starting from the simple movement outdoors (running, marching, swimming) to systematically organized activities, that are linked to certain political and religious events or to public sports competitions (wrestlings, racings, fights in the amphitheatre etc.) and to activities that had either a luxury character (dance) or wew involving large material investments (tourism trips).

The roman state initiated, encouraged, popularized and financed many of these sport activities, having the obvious tendency to ensure the population with fun and relaxation; among donors was the emperor; so the funding has become a policy of the state.

The roman state supported or facilitated the sport advertising and especially of public games, either by building sports bases (stadiums, circuses, amphitheatres) along the length of the roman state (and especially in its western part where there was a taste for such events),either by advertising sports through monetary shows, inscriptions, models of action.

Along with the state and taking his model, the private entrepreneurs started to make publicity to physical activities by art (paintings, mosaics, sculptures) of different sport events (especially carts racings and gladiator fights) or producing many artefacts with representations related to various sports (luxury vessels of clay or glass, patterns of clay for cakes or bread, statues of bronze, clay, lead, bone, etc. representing fighters. Such sports and games (especially the popular ones) had reached through the way of art or artifacts all over the Empire, especially in its European and North-African parts.

The current status of researches

For the period we are interested in sports movement in Roman antiquity, we are talking about the Roman Empire that had its beginnings in the late first century BC and it touched its apogee at the end of the fourth century (after that it was dismembered).

In the early first century AD. Empire held in an organized way, only Italy, Hispania, Gaul, Greece, Cilicia, Crete and North Africa. In the first century were conquered Noricum, Dalmatia, Rhaetia, Germany, Britannia, Moesia and Thracia. In the second century were conquered Dacia, Mesopotamia, and Armenia. The Roman Empire reached the apogee of its extent. At the end of

the third century began territorial losses which were never recovered: Dacia, Germany Higher partial = Agri Decumates, Armenia (*Bechert 1999*, passim). However, in these first four centuries the Roman Empire was extent on three continents: Europe (western, central and south-east, from Britannia to the Black Sea and Aegean Sea), North Africa, from Gibraltar to the mouth of the Nile, Asia Minor and the Arabian territories (Syria, Lebanon, Palestine).This territory was divided into provinces which were called after the people who lived there. In I-III centuries, there were 50 provinces; in the fourth century (after 285) were reorganized 101 and then 117 provinces (ECR, p 630-631, *Bechert 1999,* pp. 5-13). During this period, the Roman state was led in a centralized way, in two forms: in I-III centuries, principality (*Cizek 2002*, pp. 237-250) and IV-VI centuries, domination (*Cizek 2002*, pp. 524-642). Octavianus, nephew of Julius Caesar called himself princeps, and the first three centuries have been known since antiquity "principality". Year 27 BC. is widely and traditionally considered the beginning of the Roman Empire.

Principality was an authoritarian monarchy with extended juridical status from republican epoch (*ECR*, p 614-626). Under the principality, they have kept the old republican institutions, but new institutions and adequate bureaucracy appeared. Under domination, the leadership of the state became totalitarian (*ECR*, p 267-276) and only the name of old institutions were preserved, all of them becoming subordinating tools of the dominus.

In general, the roman state, based on a strong and permanent army also emphasized physical training of youth, organizing and always inventing new branches of physical education.

Moreover, forms of physical education, sports, began to be publicized through all forms of propaganda. G.W. Weeber (*Weeber 1994*) declares in his book that the development of physical exercises and sport has become a policy of the Roman state and that representations relating to sport and physical education have been promoted and supported by the State. To an analyse of representations related to sports or field (stadiums, amphitheatres, circuses) or the various artefacts related to art, games etc., his declaration becomes true.

Stadiums for running contests, circuses, amphitheatres and other similar structures were built in an overwhelming proportion. They were financed by the state (by the emperor) (*ECR*, p 731-732, 189-190). Amphitheatre number increased tenfold (*ECR*, p 53-54). No less was supported constructions of theatres for the literary performances, rhetoric, theatre itself (comedies, tragedies) (*ECR*, p 750-751). Public performances (*ECR*, p 730-731) have become widely used. The fact that they were promoted on one hand by special constructions and on

the other hand by various representations on artefacts, even by typical artefacts, led to their knowledge by large parts of the society. As all public performances demanded special trainings (trainings for leaders and animals, special schools for gladiators, schools for fighters) things have become very popular. Moreover, certain special fights were represented by some nations with their weapons. For example, between gladiators, a special place belonged to Thracian warriors, samnites, etc. Today, some representations of games or fights represents artistic patrimonies of humanity: the circus scene in the Palace of Septimius Geta in Rome, mosaic representing a stadium baths of Caracalla in Rome, mosaic of Plazza Armerina from Sicily.

A higher form of culture was the bath, which became mandatory on Romans, developing as well the health culture and other fields related to it: rhetoric, reading, gym exercises etc.

Roman Empire has developed a real strategy of shows and sports entertainments. . During the same year were forty- five days of public celebrations (*Cizek 2002*, p 271), seventy- two festive days, sixty days of public games (circus, station, amphitheatre).

Physical education (gymnastics, wrestling, riding, athletics), public games, dance and tourism in the Roman Empire

Sources of the paper

We analysed two large groups of sources: literary sources, epigraphic and numismatic on the one hand and archaeological sources on the other hand.

Many representations made of bronze (statues, chandeliers) present gladiators, gymnasts, acrobats, athletes, fighters, dancers.

There are a few representations (graphitized drawings) on the bricks with gladiators.

There are more pieces connected with brain games and gambling; bricks with the game drawn (backgammon), dice and discs made of bone, clay or glass for the movement on the board.

What do the roman written sources reveal?

The information we have gathered about the sports movement in the Roman Empire allowed us to establish six groups of activities, each of them having characteristic subgroups. We know that there is no other division of these activities, so we hope that our initiative to do so.

In literary sources, we find information about places where activities took place; various activities are defined, such as the game, nominating certain physical activities (walking, running, swimming, boxing, fights in the amphitheatre). In the epigraphic sources, we find poor data, like names of athletes or sports activities performed by a certain person.

The numismatic sources are those that are mediating the games at the Empire level, the organizers, the places where are taking place (circus, stadium, theatre) or parts of competitions (Premiers).

A detailed study of literary sources reveals information about:

- the places where physical exercises and sports took place; the most data we have are about the Field of Mars (Rome and the banks of the Tiber); here were held celebrations in honour of the god and practiced many races (*Lascu 1965*, 394-395 , ECR 473).

- the construction of the palaestras as parts of the baths we have information from Vitruvius (V, 11, p 223-226, 256-257), quadrilateral plan with a long side; a lateral pavilion is for oil massage and for boxing exercises.

- the stadium - the stadium was a construction for athletic competitions; a construction with quadrilateral plan and a round extremity , gates at the opposite extremity with a lateral disposal (*Tudor 1976*, 95, *ECR*, p 732).

- the circus - the circus was the place for horse racings and carts (ludi circenses); quadrilateral construction rounded at the extremities, with stands along sides; along the stands were sandy tracks; in the middle was a higher which had protection pillars in places where carts were turning; racings included usually seven tours (*Lascu 1965*, p.405 ff, *Larousse DCR*, pp. 67-68, *Tudor 1976*, p 92-94).

- the amfiteatrum – an amphitheatre is a construction designed for combined performances (individual fights, group fights, gladiators fights, hunting wild animals, naval battle).The number of amphitheatres is very high and they are grouped mainly in West Europe. The biggest and most complex remains amphitheatre called Colosseum from Rome (cf. *SHA* Claudius, note 4, *Tudor 1976*, pp. 84-92; *Lascu 1965*, p 410, *Larousse DCR,* p 22, ECR, p 53 -54).

Literary information related to sports activities

(cf. *Petecel 1980*, passim)

Physical activities

Marcus Porcius Cato (234-148 BC.) in the education of his son gives strong emphasis to heat and cold resistance, swimming, riding and boxing (*Kiriţescu 1964*, p 128).

Vergilius (70-19 BC.) in his opera named Eneida (VIII, verses 62-165) is mentioning riding, spear throwing at target, runnings, wrestlings, all being considered necessary to strengthening the body (*Lascu 1965*, p 353-396).

First century

Titus Livius (73 a.Chr.-17 p. Chr.). De Urbe Condita, cap. XII: about bulls' games, contests of athletes, lions and panthers hunting;

Ovidius (43 a.Chr.-18 p. Chr.): Ars Amandi I 135 about the carts racings beauty one hundred and forty seven about bets; about fights.

Horatius (65 a.Chr.-9 p. Chr.): Ode I, vers 4-12; the importance of sport and especially of swimming; he names a series of sports activities: riding, swimming, disc throwing, spear throwing, running, marching (*Lascu 1965*, p 394).

Cicero (106-43 BC.) mentions swimming as an important physical activity (*Lascu 1965*, p 395).

Seneca (2 a.Chr.-65 AD.), Ep. Luc 7 about punishing criminals as gladiators in the amphitheatre, he manifests love for athletics; about the importance of trainings (*Grimal 1960*, p 397).

Martialis (43, 104), epigrams X, 41: about the expenses with the shows, XIV, 47 about ball games, XI.1, 3 about bets, IV, 67 about awards and salaries of carts leaders, XI, 6 about the periods when the game of dice was forbidden, XII, 20.1 Domitianus Emperor forgave a defeated gladiator, XI, 1, X, 50 about the spectators worship of victorious cart leaders.

Quintilianus (35-95 AD.), a known educator, in his opera named Ars oratorica proposed an educational system that in which physical exercises had an important role "one hour of exercise enhances understanding, rejuvenates and refreshes" (*Kirițescu 1964* , p 137; *Rusu 2008*, p 63); Quintilianus (first century), Oratorical Art VI, 3, 63 about the circus behaviour, I, XI, 15-10 about dance.

Second century

Iuvenalis (55-130 AD.), III, 30 about the murder of a defeated gladiator; X, 36 about racings arbitrators; X, 75 about imperial policy "bread and games"; VII, 113-114 about hunting in the amphitheatre.

Cornelius Tacitus (55-120 AD.) underlines the importance and the value of physical exercises (*Rusu 2008*, p 63).

Petronius (first century), 27: about playing with the ball in palaestras.

Fronto (second century), Principiae Historiae 4, 11: about the shows.

Epictetus (50-125 AD.) wrote a manual for athletes (study of the conditions, lifestyle, and training).

Suetonius (AD 75-160.), Vita duodeci, im Caesarum: Lives of 12 Caesars, Aug. 6, introduced new sports; Claudius 21: how to dress for the circus ; Nero - personally led the cart for a race; Caesar 10: ordered to senators to finance the games; Claudius 21: about circus constructions; Augustus 43: plans the way of seating in the stands in the amphitheatre; Domitianus 4:about the number of rounds at the circus; Titus 6-7:about the number of killed animals; Claudius 21: gladiators salute to the emperor; Claudius 34: concern to occupy a good place in the amphitheatre.

Plinius the Younger (62-114 AD.), Letters IV, 22: Senate has forbidden to Vienna (Gallia) to organize "Greek" games.

Galenus (second century): about exercises with the ball, gymnastics hygiene.

Lucianus (second century): about dance.

Pausanias (second century), in the description of Greece V, 89: about pentathlon, wrestling /fighting, cart racings, pancratium, running with arms.

Third century

Dio Cassius (163-235), Roman History, LIV,10: the importance of sports performances to the society; LII, 30 circus games; battles offered by Traianus; LIV 17 the emperor behaviour at the shows; LII, 30 the maintain of valuable athletes; awards for victorie.

Tertullianus (115/160-240/250), De spectacula; describes the circus, the stadium, the amphitheatre, mostlywith their negative parts.

Dio Cassius LXII, 15 mentions an organizer of games under Nero: Tigelinus, prefect of the praetorium.

Philostratos (end of the third century – start of the fourth century), author of a treaty "De arte gymnastica" including fights, pancratium, boxing, trainings, the mental state of athletes, victory through reason.

SHA, Commodus 17: the emperor had an athlete as a trainer.

Epigraphic information

CIL X, 1074 Pompei: Aulus Claudius Flaccus organized a parade with thirty pairs of athletes, in the second year of his duumvirate.

Monuments

Pompeii: on a house door is represented an athlete who holds a palm branch in his hand after the victory; those who occupied second and third place are represented on the extremity doors (*Etienne 1970*, pp. 343-344).

Pompeii: house with mural decoration; in the back of the stage are some athletes (*Etienne 1970*, p 351).

Without going into core sports, the data provided by literary sources give very important information: about the contest places (stadium, circus, theatre), methods of construction, the organization of the stands, how the places are being occupied .There are mentioned a number of physical exercises, data about organizing performances, the behaviour during the shows etc. Unfortunately, most of them refers exclusively to Rome rather than the provinces of the empire.

Literary sources allow us to compose a list of Olympic champions during the I-III century AD. (cf. *Petecel 1980*, passim).

Polyctorfights between children OL 192 12 BC.
Nikostratosfights, pancratium, OL 204 37 AD.
Artemidorus of Trallesfights, pancratium, OL 212 69
Demonstrated of Sinope isthmic games– -
Polites of Keramosstage, running, OL 212 69
Hermogenes of Xantosstage, biathlon, running with arms OL 215 81
Sarapion of Alexandria pugilism OL 21789
Helenius of Roma gladiator sec. I
Gerenos of Naucratos fights OL 247 209
Modrogenes of Magnesia stage OL 249 217
Sarapamon of Alexandria pugilism OL 264 227
Gorgos of Eleearunnings with weapons sec. II-III.

As we can see, the majority that are registered here have names with Greek resonance and they come from places like Greece, Southern Italy or Egypt. Area where Olympic champions are spread at this stage of knowledge is quite low. They won at sports like athletics (running, throwing, wrestling's, and boxing) or like complex sports such as biathlon, pentathlon and pancratium.

Proper games in literary sources (smart games)

Suetonius (17-160 AD.) speaks about Iudus telus (knucklebone game that everybody were playing, including emperors Augustus, Nero and Claudius);

Horatius (65 a.Chr.-8 AD.) Intelligence and luck games are forbidden at certain times (*Lascu 1965*, p 391-393).

Sports competitions; professional sports on inscriptions

CIL X, 1074; Aulus Claudius Fispcus, duumvirate quinquenalis in Pompeii organized a parade during the first duumvirate, with troops of pugilists and isolated pugilists; in the second duumvirate it has marched a band of pugilists at the parade.

Sports competitions; public games in literary texts

Res gestae divi Augusti, 22, 3: twenty six times, either in the circus or in the forum we have offered shows with t animals fights ; 22, 2 "I organized the games in my name for four times and for twenty three times on behalf of other magistrates; I organized the secular games (ludus seculares) and for the first time, games of Mars"; 22, 1" I offered three times gladiatorial games in my name and five times on behalf of my sons and my grandchildren "(*Zugravu 2004*, p 99).

SHA Hadrianus, 19: "organized for the people games with gladiators, that he attend himself ".

SHA Commodus, 11: under Nero, games were held for 4-6 days, and the carts racings, wrestling with beasts, gladiator fights.

Dio Cassius, LXI, 17: „Nero led the cart in the circus and fell off from the car ".

Dio Cassius, LXIII, 14: the emperor (Lucius Verus) loved carts racings and he sympathized with the greens.

Representations related to sports in numismatic sources

T. Deidius (113-112 BC.) Rome, denarius, the reverse shows gladiators in battle with shields and whips (*Münzkabinett Gotha 1980*, p 31, no. 29, page 51 taf. 29).

Titus (79-81) Rome sestertius, on the observe is the representation of the amphitheatre of Rome (Colosseum) (*Münzkabinett Gotha 1980*, p 40, taf. 56, no. 114);

Traianus (86-118) Rome, sestertius of 104-114, BMC 853; reverse; the representation of the circus maximus, with colonnades and quadriga (*Bauten Roms auf und Münzen Medaillen*, p 38, no. 70);

Septimius Severus (192-209); Rome, denarius from 203-208, BMC 432; reverse ship moved by oars, lower register; above carts racings; under various wild animals (*Bauten Roms auf und Münzen Medaillen*, p 39, no. 71);

Tertullianus and Christian reaction against performances and sports competitions

Tertullianus, first Christian author of the Latin language in Africa; fundamentalist; militant opera against declined morals, against pagans, against Jews, against heretics, against kind Christians (*Larousse DCR*, p 195-196). In his work about the shows, he makes a harsh criticism against them, against the organizers and spectators. On this occasion, he provides important data about all these components:

The organization of games (VII, 2-3, 4): the organization of the games in Rome and in the provinces; the series of the statues, the parade of the images, triumphal carts , sacred carts ,closed carts drawn by elephants , thrones, crowns, rituals and sacrifices; in the provinces there are organized with a little less effort.

The circus: wall that crosses it, satues columns, altars (VIII, 1).

XVIII, 1 - what happens on the stadium: fists, feet, aggression; all forms of human facial disfiguremen; racings, runnings, spear throwings, jumpings;

XXX, 5: beatings with fists and fights (not a few, but many).

XVIII, 3: the specific gesture of the fighter was character of the snake: strong in tightening, coiled to keep connected, slippery to escape.

XXVIII, 4: you sigh after the scenes, after the circus landmarks, after the dust and sand.

Amphitheatre

XII, 7, XX, 4: amphitheatre is the temple of all demons; archways, solar screen.

Way of running the circus

XV, 1: horse, carts drawn by four horses, carts drawn by two horses, coachmen dressed in colours.

IX, 5: the praetor rotates the urn with stones chosen by chances.

XXII, 2: carts leaders, actors, gymnasts, wrestlers in the arena.

XXIII, 2: the leader that is causing the outbreak.

Audience

XVI, 1: at the circus the unleashes yelling it really reigns; the unleashed crowd comes shouting, filled with frenzy.

XXV, 2: exaggerated trimmings of the women and men characterize the show.

Athletes

XXII, 2: they are so loved ... the men lay at their feet their souls, and women (and even men) their bodies.

Dance: dance can be grouped as public entertainment and dance as a part of pantomime.

Literary sources

Seneca (2-65 AD.); mentions the dance (*Lascu 1965*, p 395-396).

Horatius (65 a.Chr.-9 AD.) mentions dance as a form of decadence (*Lascu 1965*, p 396).

Suetonius (75-160): Emperor Caligula was a great dancer (*Lascu 1965*, p 391).

Tacitus (55-120 AD.) mentions several dance styles (*Lascu 1965*, p 398).

Dio Cassius, LX, 7, Note 4: under Nero, children who had been called to learn the pyric dance have played it only once (warrior dance, dance with swords and fake a fight).

SHA, Hadrianus, 19: the emperor organized for the people warrior dance performances, being a witness himself.

Special studies regarding different Roman sports

amphitheatre amphitheatre, in DACL I.2, 1024, col. 1618-1682
athleta 1877 atleta, in DAGR I.1, 1877, p. 515-521
athleta 1924 athleta, in DACL II.2, 1924, col. 3105-3111
gladiator gladiator, in DA II.2, 1896, p. 1562-1599
gladiator 1924 gladiator, in DACL VI.1, 1924, col. 1275-1283

Tourism

Tourism was never considered between physical exercises and sports from antiquity. Probably also because in modern sports entered later. General paper works about ancient civilization (*Lascu 1965*, p 354-387) but, mostly related to travelling and transportation from antiquity ,have managed, systematically analysing the sources, to identify different types of journeys: business journeys, diplomatic journeys, inspections on the one hand and, on the other hand, pleasure journeys (of education, tourism itself and pilgrimage).

- **villegiatura**: Horatius (63 a.Chr.-9 AD.), journey from Rome to Brindisi (approximative 250 km) indicating the roads, hotels, restaurants, historical localities.

- journeys of the provincials from Gaul and Africa to Italy and Aquileia (*Chevalier 1988*, p 13).

- **historical tourism**

- visiting the colossus from the Mnemon (*Chevalier 1988*, p 299-309).

- visiting the mosaics from Sicily: Plazza Armerina (*Chevalier 1988*, p 316-318).

- visiting the villas of Cicero (*Chevalier 1988,* p 337-340).

- **visiting natural curiosities**

- volcanoes and special waters (*Chevalier 1988*, p 310-312).

- **information and cultural journeys**

Plutarch (46-120), Aemilius, 6: writes that Aemilius Paulus ordered that his son, accompanied by specialized tax collectors should visit Macedonia and the library of Perses.

Philostratos (170 -?), Vita Apolonii I, 20: Apollonius travelled from Athens to India, and the border post (Syria) was cleared customs (*Gudea 1986*, p 87-125).

- **journeys of scientific interest**

Plinius the Elder, Historia Naturalia V, 9-10 says that in times when Scipio Aemilianus was governor of Africa, Polibius made a boat trip in order to find out the outline of Africa (*Chevalier 1988*, p 345).

- **religious tourism / pilgrimages**

Titus Livius, XXVII, 35, 3 L. Manlius was sent to the Olympic Games (*Chevalier 1988*, p 372).

- pilgrimages to oracles e.g. Oracle of Delphi (*Chevalier 1988*, p 384-385).

- travels of the Apostle Paul (Chevalier 1998.p. 384-385).

- pilgrimages to sacred places, to the the tombs of saints (*Chevalier 1988*, p 392-393).

Reviewing the data offered by the five groups of sources that certifies activities considered as ”sportive” has allowed us a number of legal findings related to the literary certified documentary about sport:

- at present, there are numerous data related to the official development places: stadium, circus and amphitheatre, relatively accurate as technical information; less data exist about the free events (Olympic-type) and those who were held in the large baths of the palaestras.

- there are data about the financing and the organization of the games where the emperor had a great role, followed by all magistrates.

- there was a calendar of public games; some dates were fixed, other had happened during certain events (victories in wars, anniversaries of different characters, born of the throne etc.)

- data are given separately in connection with certain athletes; for example, under Tiberius, was a famous gladiator Castro, due to the scandals he used to cause (Dio Cassius, LVII, 14, note 72), the popularity of sports boxer, gladiators, carts leaders was very large; they were sung by poets.

- there are many data about the rewards they received.

- there is also data about the audience, supporters of fighters or leaders of carts.

Technical and historical perspective of sport based on data provided by archaeology

Based on illustrations that we have studied, it can be completed what is known from written sources:

- first of all, after studying these illustrations and representations, the conclusion is that sport was very popular; the advertising materials circulated over large areas of the Empire, representations were made on very different artefacts from all areas and on monuments of art "(some of them visited as tourist destinations: e.g. Piazza Armerina in Sicily with its mosaics).

- secondly, we can remark how important were the rewards, either honorary reward (consisting of olive or palm branches) or cups of bronze, silver or gold, or even money.

- the various way of the publicity by different forms of art, artefacts, jewellery, gifts.

Conclusions

Luxury terra sigillata vessels, especially those produced in Gaul, during the second and third centuries, were spread throughout the empire, bringing with them nearly every scene of ancient sports. Theirs spreading may be a sign that all or many sports have come to the attention of people in the farthest corners of the empire, especially in its western part.

It is obvious that, after the demonstrations made especially by Weeber, the Roman state, the emperor and those around him, have financially supported, directly or indirectly, sports, building in the same time sporting

facilities (stadiums, circuses, amphitheatres) and they also financed and the games. In this process, they have attracted individual persons (animals' capturers, conveyors to the bases of games, animal maintenance, schools for athletes and for gladiators).

From all sports events in the Roman Empire, certified both in written sources and archaeological, we chose a limited number (as many as were necessary to be able to study the similitude of the process in the Dacian provinces) but enough, we believe, to show the proportion of sports movement in the empire, the variety of sports, the popularity of sports and athletes of certain specialties, the realism that some sports have been described both in written sources and archaeological representations.

It is obvious that the sports movement was financed by the state (by the emperor) for the physical preparation of young people and especially in the interest of imperial dynasties. Maintaining a sporting spirit, be it physically through movement and through intelligence was well distributed policy over three centuries of the empire.

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