ISSN 2084-6002

Opole University of Technology
University of Balearic Islands
State Higher Vocational School
in Raciborz

Journal of Physical Education & Health

Social perspective

Volume 6
Issue 9
2017

ISSN 2084-6002

Opole University of Technology
University of Balearic Islands
State Higher Vocational School
in Raciborz

Journal of Physical Education & Health

Social perspective

Volume 6
Issue 9
2017

Published by: Opole University of Technology
in association with: University of Balearic Islands
State Higher Vocational School in Raciborz

Editorial Office Address:

Politechnika Opolska
Wydział Wychowania Fizycznego i Fizjoterapii
ul. Prószkowska 76
45-758 Opole
budynek nr 9 p. 23

www.jpe-health.pwsz.raciborz.edu.pl

jpe_health@onet.eu

Administrative editor: Katarzyna Kasowska, Piotr Mucha
Technical editor: Janusz Krajewski, Paweł Sujak
Correction: Rachael Sumner

ISSN 2084-6002

Contents

Original Papers

Information

Journal of Physical Education & Health, 2017, vol. 6 (9), 5-11

DEPENDENCIES OF SPEED ABILITIES AND PHYSICAL DEVELOPMENT OF CHILDREN AT THE AGE OF 6 – 7 YEARS

Ivan Čillík, Tomáš Willwéber

Matej Bel University, Department of Physical Education and Sport, Slovak Republic

Abstract

In this article, we present the results of selected parameters of the running speed of young school children. The aim of this research is to determine the dependence of parameters of speed abilities and physical development of 6 – 7 year old children. The sample consisted of 67 probands (42 boys and 25 girls) with a decimal average age of 6.72 ±0.3 year. We used the test 4 x 10m shuttle run with changes of direction for diagnostics of running speeds. We used the test of lower-limbs frequency in 6s to find out the parameters of movement frequency. We established basic somatic parameters: body height, body weight, BMI. All obtained results were compared with each other and evaluated using correlation analysis. We stated that in somatic parameters high statistical dependence was recorded ($p < 0.01$), which we consider as a natural developmental indicator. In the group of girls, we recorded a slightly shorter contact time with the pad; however, a significantly longer flight time with single stride cycles. In intrasexual comparison, we recorded statistical significant difference in flight time and in stride frequency ($p < 0.05$). Boys achieved a higher stride frequency and a shorter flight phase, so they also achieved a higher number of step cycles. In the group of boys, we recorded statistical dependence ($p < 0.01$) between a running speed with changes of direction and stride frequency.

Key words: *younger school age, shuttle run, movement frequency, somatic parameters, correlation analysis*

Introduction

Movement speed is the ability to respond as quickly as possible to a stimulus or to perform a motion as quickly as possible with minimal resistance [10]. Authors state that the long-term influence of speed abilities of human movement is a very complex issue, because speed abilities are genetically conditioned up to 80 % [8].

Speed abilities belong to expresions of movements that should be developed as soon as possible. Refering to children´s preparation, development of speed abilities along with coordinating skills belong to an area that should have a high priority [9].

Authors [5] consider speed abilities in children as a basis and primarize them together with dexterity over all other abilities. Furthermore, they state that we must not in any case put emphasis on special speed development in children using special exercises, but develop the speed through general training.

Authors [1] consider the age between six and eight years in girls and between seven and nine years in boys to be the first critical period in the development of speed abilities. Authors [7] state that speed abilities, unlike strength abilities, depend on age rather than gender and they are the most genetically determined.

Authors [4] state that by the age of 10 it is recommended that children develop, in particular, the frequency of movement, as the best conditions for frequency development and movement coordination are created in this given period. [6] They add that significant sensitivity for speed frequency begins between the 6th and 7th year.

Methods

Children of a younger school age participated in this research. The sample monitored consisted

of 67 probands (42 boys and 25 girls) at the age of 6.72 ±0.3 years.

Procedures

For diagnostics, we used the test 4 x 10m shuttle run to measure running speed with changes of direction [3]. Author [2] recommends using this test for diagnosing a selection of talents in given age category.

The frequency of lower limbs was diagnosed using the test of lower-limbs frequency [13]. The time for performing the test was 6s, due to the age of the probands. We used the device FiTRO tapping check (FiTRONiC, Bratislava, Slovak Republic) for measurement. The device consists of two contact switches firmly attached to the floor, connected via a communication interface to a computer. The role of the tested subject is to do as many alternate touches with a lower limb on the contact mats as possible in 6 s. The system measures the frequency and the number of individual touches, as well as contact time with a mat and flight time in milliseconds. The better of two attempts is counted.

We established basic somatic indicators: body height, body weight, BMI.

Statistical analysis

The statistical significance of differences between genders in the parameters of physical abilities was determined using a T-test for independent samples. The data were processed using correlation analysis to determine relationships between individual parameters. Statistical significance was evaluated at the level of significance $p < 0.05$ and $p < 0.01$.

Results

Basic indicators of physical development are comparable to measurements of the school population [3].

Arithmetic averages and values of variability point to high homogeneity in intersexual comparison (Table 1).

Table 1. Characteristics of age indicators, somatic parameters in the group of boys and girls

		Decimal age [years]	Body height [cm]	Body weight [kg]	BMI [i]
Boys (n = 42)	M	6.77	124.56	24.81	15.88
	SD	0.3	5.69	4.13	1.7
	X_{max}	7.3	137	40.4	21.5
	X_{min}	6.25	112	19.8	13.2
Girls (n = 25)	M	6.64	122.08	23.09	15.92
	SD	0.28	5.38	3.67	1.3
	X_{max}	7.15	134	32.4	19.5
	X_{min}	6.27	113	18.2	13.3

Based on the results of physical development, we state that boys are about 0.13 years older, 2.48 cm taller and 1.72 kg heavier when compared with the girls; however, they have a lower BMI index of about 0.04. Although we recorded differences in intersexual comparison, in parameters of age and physical development these differences were not statistically significant.

Table 2. Characteristic of parameters of speed abilities in the group of boys and girls

		SR 4 x 10m [s]	Step cycles [n]	Contact time [ms]	Flight time [ms]	Stride frequency [Hz]
Boys (n = 42)	M	14.27	34.8	136.17	207.27	6.04
	SD	0.92	7.32	25.79	52.26	1.26
	X_{max}	16.4	54	209	323	9.13
	X_{min}	12.2	23	93	101	4.32
Girls (n = 25)	M	14.61	31.12	136.08	243.48	5.32
	SD	1.36	7.42	27.43	65.09	1.35
	X_{max}	19.3	54	217	356	9.5
	X_{min}	12.1	22	92	118	3.9
P-value		0.046*	0.053	0.989	0.016*	0.032*

Note: M – mean value; SD – standard deviation; * – statistical significance $p < 0.05$

When comparing the parameters of speed abilities in terms of intersexual comparison, we conclude that boys reach better average results in speed parameters (Table 2). In the group of girls, we recorded a slightly shorter (-0.09 ms) contact time with the pad; however, a significantly longer flight time (+36.22 ms), with single stride cycles. Boys reached a higher stripe frequency and a shorter flight phase, so they also achieved a higher number of stride cycles. In intersexual comparison, we recorded statistical dependence ($p < 0.05$) in flight time and in stride frequency.

Boys use the stride frequency while running more significantly. It enables them to achieve a better performance in the 4 x 10m shuttle run in comparison to the girls.

Table 3. Correlation matrix of significant correlates between the variables in the group of 6 and 7 year-old boys.

BOYS	*Age*	*Body height*	*Body weight*	*BMI*	*4 x 10m*	*No (n)*	*Tc (ms)*	*Tf (ms)*	*F (Hz)*
Age	_								
Body height	≤.05	_							
Body weight	n.s.	≤.01	_						
BMI	n.s.	≤.05	≤.01	_					
4 x 10 m	n.s.	≤.05	n.s.	n.s.	_				
No (n)	n.s.	n.s.	n.s.	n.s.	≤.01	_			
Tc (ms)	n.s.	n.s.	n.s.	n.s.	≤.05	≤.01	_		
Tf (ms)	n.s.	n.s.	n.s.	n.s.	≤.01	≤.01	≤.05	_	
F (Hz)	n.s.	n.s.	n.s.	n.s.	≤.01	≤.01	≤.01	≤.01	_

Note: BMI – body mass index; No – Number of stride cycles; Tc –contact time; Tf – flight time; F – stride frequency; n.s. – statistically insignificant

A significant statistical dependence in somatic indicators in the group of boys was found between body height and body weight, as well as between body weight and body mass index, which we consider to be a natural developmental indicator (Table 3).

In the group of boys, we noted significant dependencies in the parameters of frequency of speed. In the group of boys, we found significant dependencies ($r = 0.985$, $p < 0.01$) between the movement frequency and the number of performed stride cycles. Equally high dependence ($r = 0.912$, $p < 0.01$) was found between the flight time and the number of performed cycles, which means that the shorter the duration of the flight, the greater the number of stride cycles.

Statistically significant dependencies were also noted between the parameters of speed frequency and running speed with changes of direction, which proves a close relationship between these abilities in the group of boys. Negative statistical dependence was observed in the parameters of physical development and speed abilities between body height and 4 x 10m shuttle run ($p < 0.05$), which confirms that higher body height is a disadvantage at this age in running with changes of direction. On the contrary, body height does not affect the speed frequency of lower limbs.

In the group of girls as well as in the boys´ group, a significant statistical dependence between body height and body weight was found from somatic indicators, as well as between body height and body weight index, which we evaluate as a natural developmental indicator (Table 4).

Table 4. Correlation matrix of significant correlates between the variables in the group of 6 and 7 – year-old girls.

GIRLS	*Age*	*Body height*	*Body weight*	*BMI*	*4 x 10m*	*No (n)*	*Tc (ms)*	*Tf (ms)*	*F (Hz)*
Age	_								
Body height	≤.01	_							
Body weight	≤.01	≤.01	_						
BMI	n.s.	n.s.	≤.01	_					
4 x 10 m	n.s.	n.s.	n.s.	n.s.	_				
No (n)	n.s.	n.s.	n.s.	n.s.	n.s.	_			
Tc (ms)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	_		
Tf (ms)	n.s.	n.s.	n.s.	n.s.	n.s.	≤.01	n.s.	_	
F (Hz)	n.s.	n.s.	n.s.	n.s.	n.s.	≤.01	n.s.	≤.01	_

Note: BMI – body mass index; No – number of stride cycles; Tc – contact time; Tf – flight time; F – stride frequency; n.s. – statistically insignificant

In the group of girls, we found significant dependencies ($r = 0.986$, $p < 0.01$) between the movement frequency and the number of performed stride cycles.

However, we did not record statistically significant dependencies between the parameters of speed frequency and parameters of running speed with changes of direction, as in the group of boys. We note that the speed frequency of lower limbs and running speed with changes of direction are two relatively independent factors in girls.

Discussion and conclusions

On the basis of the obtained results, we note that in the group of boys there is a more significant correlation dependence between the parameters of speed abilities. From the interdependencies between the frequency and the number of performed cycles, it is clear that the increase of frequency significantly contributes to a greater number of stride cycles in boys as well as in girls.

The relationship between the 4 x 10m shuttle run and the frequency of lower limbs in

the boys' group (Figure 1) achieves a significant strength of relationship (r = 0.467, p < 0.01). In the girls' group, the relationship between the 4 x 10m shuttle run and the movement frequency (Figure 2) does not reach a statistically significant correlation (r = 0.244). This means that the girls' better performance in a 4 x 10m shuttle run was not conditioned by increasing the frequency of the stride, but rather by lengthening the running stride.

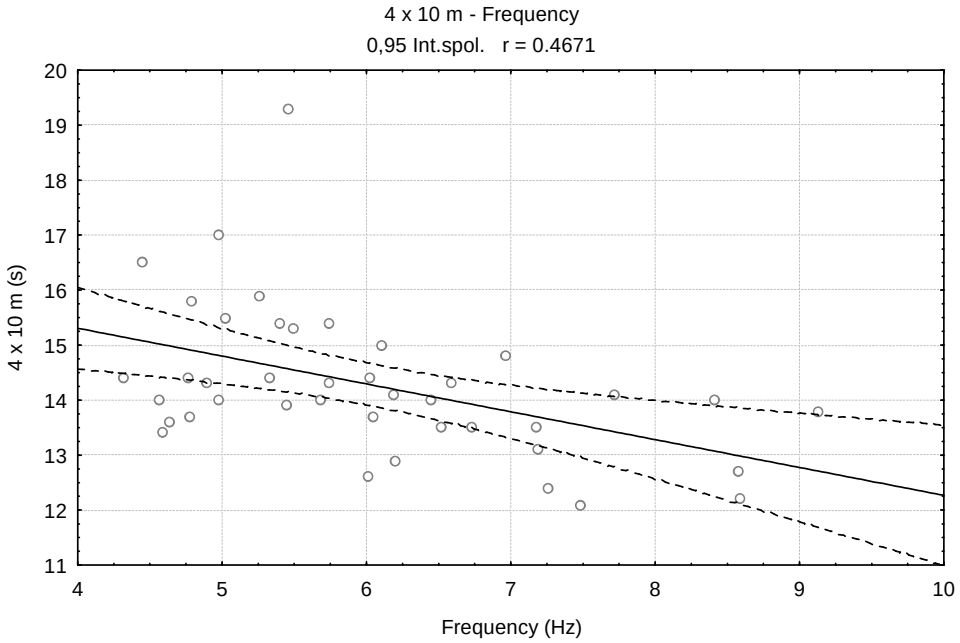


Figure 1. Analysis of relationships between the 4 x 10m shuttle run and stride frequency in the group of boys.

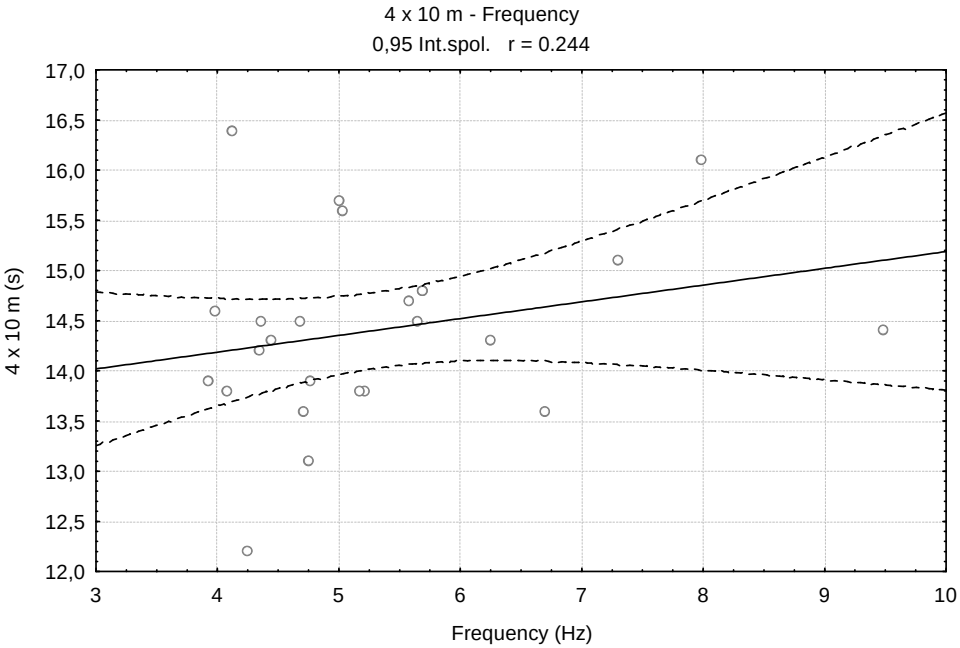


Figure 2. Analysis of relationships between the 4 x 10m shuttle run and stride frequency in the group of girls.

Authors [3; 12] note a statistically significant difference in intersexual comparison in favor of boys in the test of 4x10 m shuttle run.

In our groups, we found that the difference also results from the different implementation of running in boys which is focused on the stride rate, while girls´ running is focused on the stride length. [12] did not record statistically significant dependence between the 4 x 10m shuttle run and BMI in the group of boys. The authors also note significant dependencies of body height and body weight with speed and strength abilities, except for the 4 x 10m shuttle run.

This was not confirmed in our group of girls and in the group of boys we recorded statistical dependence ($r = 0.333$, $p \leq 0.05$) only between body height and the 4 x 10m shuttle run.

We recorded a statistical dependence in the somatic parameters, which we evaluate as a natural developmental indicator.

When comparing the parameters of speed abilities in intersexual comparison, we note that boys achieve on average better results in the shuttle run with changes of direction (4 x 10m). In the group of girls we recorded a slightly shorter contact time with the pad, but significantly longer flight time in individual step cycles. Boys achieve a higher stride frequency and shorter flight phase and that is the reason why they have a greater number of stride cycles.

In the group of boys we recorded a statistical dependence ($p < 0.01$) between the parameters of speed with changes of direction and frequency of lower limbs. In the group of girls we did not record any statistical dependence between the parameters of speed with changes of direction and frequency.

In the group of boys we recorded significant dependences in the parameters of frequency rate. We also recorded statistically significant dependences between the parameters of frequency rate and running speed with changes of direction, which proves a close relationship between these abilities in the group of boys. Higher body height is shown more as a disadvantage in running with changes of direction.

Our measurements confirmed that mainly boys use frequency abilities in running while girls lengthen their stride at the expense of frequency, so they prefer using take-off power. Implementation of boys´ running seems to be more natural and appropriate, considering the age and level of the children´s assumptions.

BIBLIOGRAPHY/REFERENCES

1. Balyi, I., & Hamilton, A. (2004). Long-Term Athlete Development: Trainability in Childhood and Adolescence. Windows of Opportunity. Optimal Trainability. Victoria: National Coaching Institute British Columbia & Advanced Training and Performance Ltd.
2. Brown, J. (2001). Sports talent: How to identify and develop outstanding athletes. Champaign, IL: Human Kinetics.
3. Čillík, I., Kollár, R., Kremnický, J., Pivovarníček, P., Tokárová, M., Ďurják, O., et al. (2014). General physical performance and physical development of the first grade pupils attending primary schools in Banská Bystrica. Hradec Králové: Gaudeamus.
4. Kaplan, A., & Válková, N. (2009). Atletika pro děti a jejich rodiče, učitele a trenéry. [Athletics for children and their parents, teachers and coaches. In Czech.] Praha: Olympia.
5. Kučera, M., Kolář, P., Dylevský, I., Bouška, I., Hátlová, B., Janda, J., et al. (2011). Dítě, sport a zdraví. [Child, sport and health. In Czech.] Praha: Galén.
6. Laczo, E., Buzgó, G., Cihová, I., Cvečka, J., Kalinková, M., & Rupčík, Ľ. (2014). Rozvoj a diagnostika pohybových schopností detí a mládeže. [Development and diagnostics of physical abilities of children and youth. In Slovak.] Bratislava: NŠC a FTVŠ UK v Bratislave.
7. Měkota, K., & Novosad, J. (2007). Motorické schopnosti. [Motor skills. In Czech.] Olomouc: Univerzita Palackého v Olomouci.
8. Perič, T., & Dovalil, J. (2010). Sportovní trénink. [Sports training. In Czech.] Praha: Grada.
9. Perič, T., Levitová, A., & Petr, M. (2012). Sportovní příprava dětí. [Sports preparation of children. In Czech.] Praha: Grada Publishing a.s.
10. Thomas, K. T., Lee A. M., & Thomas J. R. (2008). Physical education methods for elementary teachers. 3rd ed., New ed. Champaign, IL: Human Kinetics.

11. Olex-Zarychta, D. (2010). Functional lateralization of human limbs and the conditions in respect of motor coordination.14–19, 54–71, Katowice: AWF.
12. Podstawski, R., & Boryslawski, K. (2012). Relationships between selected anthropometric features and motor abilities of children aged 7-9. Clinical Kinesiology, 66(4): 82–90.
13. Zemková, E., Chren, M., & Štefániková, G. (2013). Rýchlosť frekvencie pohybov dolných končatín u jedincov rôzneho veku a výkonnosti. [Speed frequency of lower limb movements in individuals of different age and performance. In Slovak.] In Čepková, A., & Horvát, M. (Eds.). Od výskumu k praxi v športe 2013 (pp.347–352). Bratislava: Slovenská technická univerzita.

Correspondence

Tomáš Willwéber
Department of Physical Education and Sport, Faculty of Arts, Matej Bel University
Banská Bystrica, Slovak republic
Phone: +421908912877
E-mail: tomas.willweber@umb.sk

Journal of Physical Education & Health, 2017, vol. 6 (9), 13-18

PHYSICAL ACTIVITY OF PRIMARY SCHOOL STUDENTS

Agnieszka Zdzienicka – Chyła[1], Anna Stelmach[2], Wojciech Pasiak[3]

[1] Department of Rehabilitation, Physiotherapy and Balneotherapy at Lublin Medical University, Physiotherapy Department at University Children's Hospital in Lublin,
[2] Department of Rehabilitation, Physiotherapy and Balneotherapy at Lublin Medical University,
[3] Vascular Surgery and Angiology Clinic at Lublin Medical University

Abstract

A significant decrease in physical activity and a growing incidence of obesity are becoming problems of contemporary times, the economic and social costs of which we are bound to face. The systemic actions undertaken are aimed at creating space for physical activity and shaping health-oriented attitudes among children and young people. Promotion of health-oriented attitudes among children is one of the ways of preventing illnesses associated with lifestyle, and are also a significant factor influencing the condition of society and future generations.

This study forms a preliminary evaluation of attitudes among primary school students in Lublin towards physical activity – its preferred forms and frequency. Moreover, the study presents a preliminary and general analysis of pain within the locomotor system in children.

A survey in the form of a questionnaire was conducted in a primary school in Lublin among children at various stages of education. The questionnaire contained data about the children's age and gender. Other questions concerned preferred forms of physical activity, its frequency and attitudes of schoolchildren to physical activity.

The results obtained indicate that the majority (99%) of the children definitely like to undertake physical activity in various forms and they regard it as fun and an interesting way of spending free time. A significant share (51%) of the respondents reply that they undertake physical activity every day (apart from activities organized at school). However, the number of affirmative answers to the question about pain is worrying.

The results obtained demonstrate quite a high level of physical activity among schoolchildren. However, the alarming results concerning incidences of pain (47%) point to the need for further in-depth research on this area.

Key words: *physical activity, pain, health-oriented attitudes*

Introduction

Widespread illnesses associated with lifestyle, resulting from incorrect diet, obesity and limited physical activity, pose an increasing challenge to health care services. A growing number of children and young people seek rehabilitation treatment due to pain, e.g. of the spine [6]. Decreased physical fitness is also observed in a situation where sports facilities have become more common and accessible in our country and schools have better sports equipment. Promotion of health-oriented attitudes among children is one of the ways of combatting illnesses associated with lifestyle and an important factor influencing the condition of society and future generations. It is emphasized that body posture is formed on both a morphological and functional basis, and effective operation of the muscular (and nervous) system significantly contributes to its development [2].

Aim

The objective of the study was to preliminarily examine the attitudes of primary school students from Lublin towards the extent and forms of physical activity, additionally supplemented with information concerning pain. How often and with what motivations do children take physical

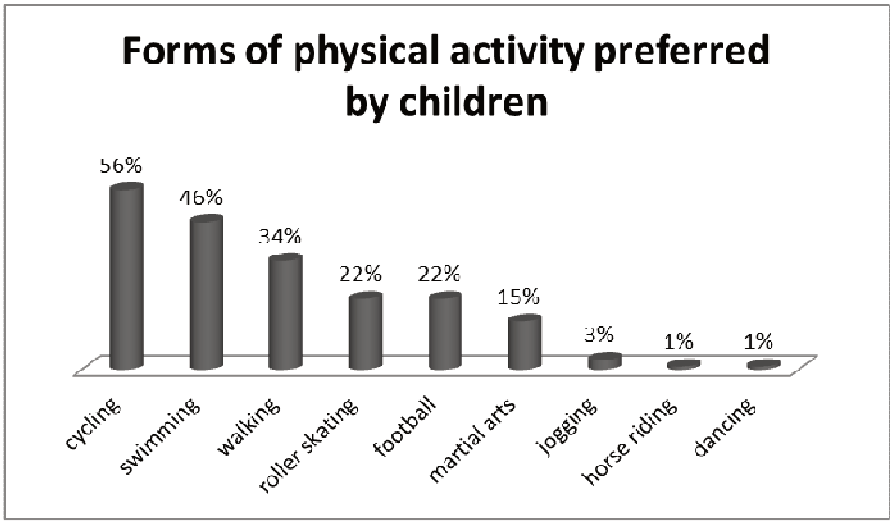
activity in the study group? How often do children in the study group experience pain? A question about pain was introduced due to the fact that both lack of physical activity and intensive practising of sports are indicated as causes of spinal conditions in children and youth [1].

Material and methods

The survey was conducted in a primary school in Lublin among children at various stages of school education. 140 questionnaires (own authorship) were used, of which 127 questionnaires, correctly filled in, were taken into account in the study. The age of the children completing the questionnaires was 6-12. Parents of all children received the questionnaire by e-mail before the survey at school and gave their consent for the children's participation in the survey. In the questionnaire it was noted that in responses concerning the frequency of physical activity, no school activities should be taken into account. Children were required to indicate activities which lasted at least 20 min, taking into account difficulties with accurate definitions of time in this age group. Children were clearly instructed to focus on a purposeful physical activity and not to regard e.g. going to a nearby shop as a walk. During the survey the children were informed that the question concerning pain did not refer to pain connected with a fall or a strike, but should be understood as pain in the back or the limbs not caused by any injury.

Results

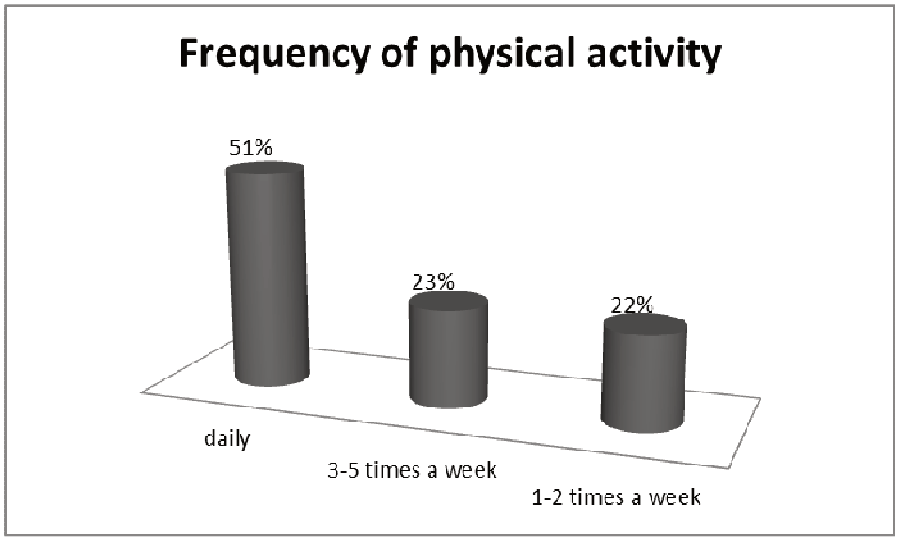
Most of the respondents replied that they liked physical activity (99% positive responses). Forms of physical activity preferred by children are presented in Graph 1.



Graph 1. Forms of physical activity preferred by children

Most children indicated cycling (56%) as their favourite form of physical activity, almost half of them (46%) mentioned swimming as a preferred form of activity as well. Other forms of activity readily undertaken by children are: walking (34%), roller skating (22%), football (22%) and martial arts (15%). The least frequently mentioned sports activities are: jogging (3%), horse riding and dancing (1% each).

In reply to the question about frequency of physical activity (excluding sports classes at school), most children (51%) answered that they undertook physical activity every day, and a similar shares of the respondents (22% and 23%) indicated that they engaged in physical activity 1-2 and 3-5 times a week respectively. The results are presented in Graph 2.



Graph 2. Frequency of physical activity

With respect to division into age groups, children aged 10-12 are the most physically active group among the respondents, while children aged 6-8 are on average are less physically active. The frequency of physical activity in various age groups is presented in Table 1 and Table 2.

Table 1. Frequency of physical activity in various age groups

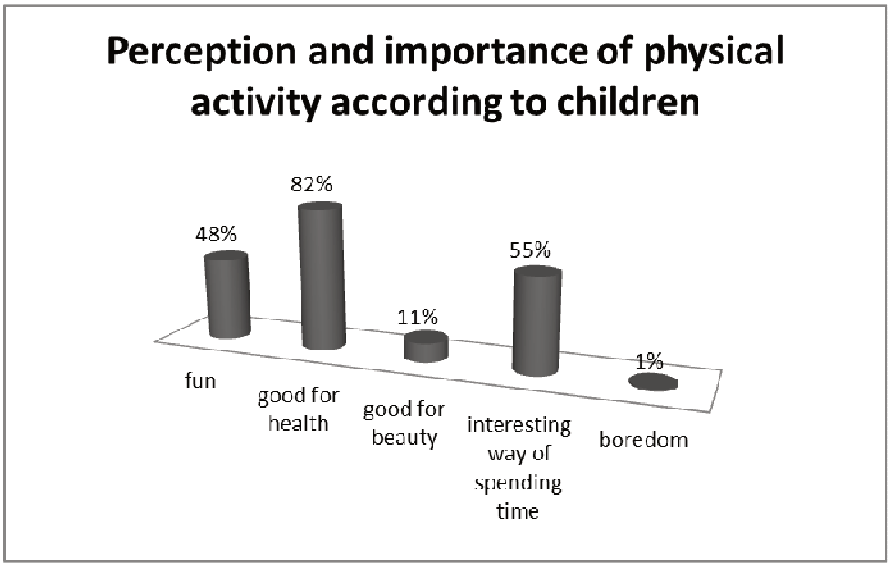
Age	Daily	3-5 times a week	1-2 times a week
6-year old	50,0%	0,0%	50,0%
7-year old	42,5%	17,5%	40,0%
8-year old	38,9%	11,1%	50,0%
9-year old	26,5%	42,0%	31,5%
10-year old	60,0%	35,0%	5,0%
11-year old	62,0%	18,8%	18,8%
12-year old	50,0%	25,0%	25,0%

Table 2. The average and the most frequent values presenting frequency of physical activity among children

Age	Average	Median	Standard deviation
6-year old	4,6	4	2,29
7-year old	4,47	4	2,4
8-year old	4,3	4	2,39
9-year old	4,68	4	2,24
10-year old	5,14	7	2,23
11-year old	5,11	7	2,26
12-year old	5,11	7	2,41

The respondents aged 6-9 undertake physical activity 4 times a week on average. Children aged 10-12 undertake physical activity 5 times a week on average, while the most frequently given answer in this group is 7 times a week.

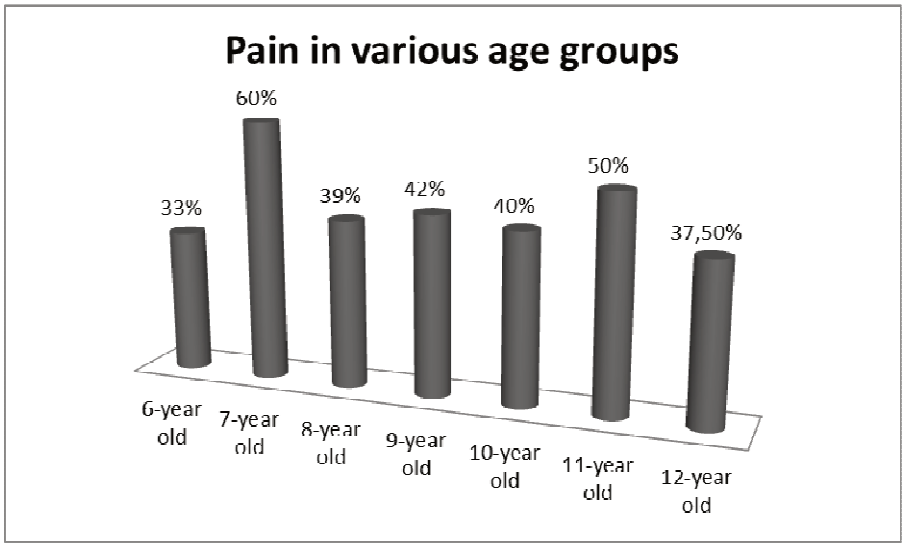
An important aspect of undertaking physical activity is motivation and perception of physical activity by children. Graph 3 presents the main reasons for engagement in physical activity and the perception of its role in the surveyed group.



Graph 3. Perception and importance of physical activity according to children

The largest group of respondents (82%) reply that physical activity is good for health; over half of them (55%) claim that physical activity is an interesting way of spending time and almost a half (48%) think it is good fun.

Attitudes towards physical activity and its frequency indicated by the children are quite high. However, the children also answered questions concerning pain within the locomotor system (not directly connected with an injury). The results are presented in the graph below.



Graph 4. Pain in various age groups

In general, pain is reported by 47% of the children in the surveyed group. In terms of age analysis, it is noteworthy that such complaints are reported by 60% of 7-year-olds, while in other age groups by ca. 40% of the respondents. Occurrence of pain was preliminarily assessed in this study but this aspect appears to be very worrying and requires in-depth research.

Discussion

Despite the research results indicating that the least physically active children undertake physical activity once or twice a week and this group constitutes 22%, a study conducted among schoolchildren in 400 small towns reveals other tendencies. The research carried out within the Polish Project 400 Towns demonstrates that 24% of the respondents aged 6–9 and 10–13 preferred to spend their free time in front of TV, while only 16% opted for physical activity outdoors.[9] The research conducted by HBSC (Health Behaviour in School-Aged Children) reveals that everyday physical activity (at least 60 minutes) is undertaken by 27.3% of schoolchildren aged 11–12 [11]. Such problems as excess weight and obesity, as well as decreased physical fitness, are described as new health concerns, so improvement of quality and effectiveness of health education are the priority [10].

With respect to pain in children, the main issue discussed in literature is back pain. Until recently, back pain was regarded as a problem of adults and it was indicated that such ailments begin around the age of 30. However, it turns out that a considerable share of the younger population also suffer from back pain of various etiology. According to literature, around 10% of schoolchildren suffer from pain of the lumbosacral spine.[7] Back pain is experienced by about 10% of children periodically and by 13% chronically [5]. It is emphasized in literature that both lack of physical activity or physical activity which is too intense are significant risk factors in back pain [1]. A study carried out in Biała Podlaska district among children aged 10-13 demonstrates that 39.4% children are affected by back pain, especially of the lumbar spine [4].

Literature increasingly refers to a coexisting condition which is faulty posture. This is a significant problem not only in the population of young people, but also among children. A study carried out in Radom in a group of 264 children aged 6-12 revealed postural defects in 93.2% of the participants. [3] It is emphasized in literature that there are no strictly specified criteria for a correct posture at various stages of a child's life, which contributes to greater incidence [10].

It should be emphasized that the issue of faulty posture must be considered in a broader perspective, due to the fact that there is a strong correlation between faulty posture and hearing. Moreover, eyesight disorders have a negative impact on body posture. [8] The research on pain carried out in 2013 demonstrated that joint hypermobility was not a factor predisposing children aged 9-13 to back pain [6].

Conclusion

Even though the question concerning pain had a general character in the discussed study, a considerable share (47%) of positive answers is worrying and requires further research into this problem. Pain discussed here is a very broad notion, so it is necessary to specify what is a share of growth-related pain, which pain has a short-term or a chronic character. It is also essential to extend the research to include mental factors which can contribute to incidences of pain, to examine parents' awareness of these ailments and possible measures undertaken.

BIBLIOGRAPHY

1. Dobosiewcz K.: Niespeczyficzny ból kręgosłupa u dzieci i młodzieży – uwarunkowania biomechaniczne, neurofizjologiczne oraz psychospołeczne. Neurol Dziec. 2006; 15(30): 51-57.
2. Górecki A., Kiwerski J., Kowalski I.M., Marczyński W., Nowotny J., Rybicka M., et al.: Profilaktyka wad postawy u dzieci i młodzieży w środowisku nauczania i wychowania – rekomendacje ekspertów. Pol Ann Med. 2009;16(1): 168-177.

3. Janiszewska R., Tuzinek S., Nowak S., Rytyńska A., Biniaszewski T. : Nieprawidłowości postawy ciała u dzieci 6-12 letnich – uczniów szkół podstawowych z Radomia – badania pilotażowe. Probl Hig Epidemiol 2009, 90(3):342-346.
4. Kędra A., Czaprowski D. : Częstość występowania bólu kręgosłupa a sposób spędzania wolnego czasu dzieci i młodzieży. Med Og Nauk Zdr 2013; 19(2):183-187.
5. Paprocka J., Jamroz E., Głuszkiewicz E., Klimczak A., Kluczewska E., Marszał E. „ Zespoły bólowe kręgosłupa u dzieci." Wiadomości Lekarskie 2008; 7-9:183-189.
6. Pawłowska P., Czaprowski D., Aleksandra Kolwicz A., Leszczewska J.: Dolegliwości bólowe kręgosłupa u dzieci– ocena związku z hipermobilnością stawową i elastycznością wybranych mięśni kompleksu lędźwiowo miedniczno-biodrowego. Nowa Pediatria. 2013;2:39-43.
7. Sienkiewicz D., Kułak W., Gościk E., Okurowska-Zawada B., Paszko-Patej G.: Bóle kręgosłupa w wieku dziecięcym – kolejne wyzwanie dla współczesnej medycyny. Neurol Dziec. 2011;41:129-133.
8. Sitarz K., Senderek T., Kirenko J., Olszewski J., Taczała J.: Ocena rozwoju sensomotorycznego dziesięciolatków z wadami postawy. Fizjoter Pol. 2007;3(4):232-240.
9. Stankiewicz M., Pieszko M., Śliwińska A., Małgorzewicz S., Wierucki Ł.: Występowanie nadwagi i otyłości oraz wiedza i zachowania zdrowotne dzieci i młodzieży małych miast i wsi – wyniki badania Polskiego Projektu 400 Miast. Endokrynol. Otył. Zab. Przem. Mat 2010;6(2):59-66.
10. Woynarowska B., Oblacińska A.: Stan zdrowia dzieci i młodzieży w Polsce. Najważniejsze problemy zdrowotne. Studia Biuro Analiz Sejmowych. 2014;2(38) s. 41–64.
11. Woźniak-Holecka J., Karolina Sobczyk K.: Organizacja szkolnej edukacji zdrowotnej dotyczącej otyłości u dzieci. Medycyna Środowiskowa. 2013; 16(4): 64-70

Correspondence

Agnieszka Zdzienicka-Chyła
Ul. Gościnna 11/15, 20-532 Lublin
Phone: +48508350283
E-mail: agnieszka.zdzienicka@interia.pl

Journal of Physical Education & Health, 2016, vol. 6 (9), 19-25

THE RELATIONSHIP BETWEEN PHYSICAL FITNESS AND ACADEMIC PERFORMANCE IN ADOLESCENTS FROM THE BALEARIC ISLANDS

Bestard V.[1], Cantallops J.[1], Vidal-Conti J.[1]

[1] Physical Activity and Sports Sciences Research Group. University of the Balearic Islands. Spain

Abstract

The aim of this study is to see if there are significant relationships between different variables of physical condition and academic performance.

Most literature shows that a relationship does exist, mainly emphasizing maximal oxygen consumption and academic performance. With regard to the other variables, more differences can be found.

A total of 79 students participated in the study from the island of Majorca (Spain), ranging in age from 12.5 to 14.5 years. Students passed fitness tests, which were compared with their academic results.

The results show a significant positive relationship between BMI and hand grip strength and significant negative relationships between BMI and note and between BMI and maximal oxygen consumption. No significant relationships have been found, however, between maximal oxygen consumption and note.

Assessment of the importance of physical condition and therefore physical education in academic performance is of interest in order to implement the necessary hours of Physical Education. Furthermore, this subject should be characterised further in terms of its relation to the issue of health.

Key words: *physical fitness, physical activity, academic performance, adolescents.*

Introduction

Obesity and the problem of weight gain in young people is one of the real problems that societies are currently suffering around the world. In the last 37 years, according to the World Health Organization (WHO), data concerning obesity have doubled. In the year 2014, 1,900 million people over the age of 18 (39% of the population) were overweight, of whom 600 million (13% of the population) suffered from obesity [20]. At state level, in Spain 52.7% of people were above the weight considered normal in 2014 according to the National Institute of Statistics (INE). In the case of the Balearic Islands and in the youth and juvenile population the prevalence of child and juvenile obesity in the Balearic Islands is 9.3% (95% CI: 7.7-11.0). One in five students from the Balearic Islands is overweight (19.3% CI: 17.3-21.7). The frequency of low weight is less than 1%. The frequency of being overweight and obesity is similar in men and women [1]. Related to the concepts of being overweight and obesity, sedentary lifestyle is one of the main causes of these two problems. In Spain, 4/10 people are sedentary in their free time. This figure is higher amongst Spanish women (49.8%), than men (38.8%) [18].

In this way, it can be seen that levels of regular physical activity are quite low. In addition, due to levels of low physical activity, obesity and being overweight are present in today's society, which can lead to various health problems that also affect the economy in terms of the increase of possible illnesses related to sedentary lifestyle. "Noncommunicable diseases such as coronary heart disease or type II diabetes mellitus cause costs for the health system to

increase" [13]. The WHO indicates the following diseases (not transmissible) and those that most affect the planet: cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes. It also claims that these diseases are mainly due to sedentary and unhealthy lifestyles, poor nutrition, alcoholism, and smoking. Specifically, physical inactivity is associated with being overweight and obesity, which are for example underlying causes of heart disease and diabetes mellitus type II, [13].

Performing moderate or vigorous physical activity more than once a week has a positive effect on health by decreasing type II diabetes. However, all studies show a negative relationship between physical activity and the risk of diabetes type II [7]. Other investigations [9] show that physical activity has a positive relationship with mental health. Specifically, physical activity is positively related to a decrease in stress, an increase in mood, an improvement in self-awareness and decreases in the levels of anxiety and depression.

The assessment of the physical condition, insofar as it is related to the habits and levels of physical activity in a population, allows us to obtain information about the state of health and the quality of life of this population [10].

The original conception of the evaluation of physical condition in schools has changed radically over the last 20 years. While physical condition was initially focused on performance, it was subsequently related to health [4]. This relationship between physical condition and health has been employed relatively recently, but it is currently a much exploited and very necessary field with regard to establishing the current health status of the general population.

Having observed and verified the relationship between having a good physical condition, performing physical activity on a regular basis and having good health, we then focus on analyzing whether the level of physical condition is related to the qualifications of students in educational centers.

A recent study found a relationship between academic performance and physical condition. In the case of boys, a significant relationship was observed between all the tests of physical condition passed by students (explosive force of lower train, agility, speed, and flexibility) and the subject of Mathematics, but no relation to the subject of Spanish Language and Literature. The capacity presenting a significant relationship lasting for 3 years of the study is cardiovascular capacity, in both sexes [3]. Other studies have also emerged that show the significant relationship between cardiovascular capacity and academic performance, but the latter cannot claim to be related to other physical abilities [5, 14].

The significant relationship between cardiovascular resistance and academic performance has been corroborated by different studies [6] and also adds other relationships such as poor academic peformance amongst underweight people as opposed to people with normal weight.

A study recently carried out in Spain shows a significant relationship between academic performance and physical condition, only in terms of the body mass index and the waist circumference, both negatively related. That is to say, the greater the BMI or waist perimeter, the lower the academic performance and vice versa. These same authors, on the other hand, do not observe a significant relationship between cardiovascular capacity and flexibility [12].

Another interesting finding is the significant relationship between academic performance and flexibility, speed test and resistance test. Regarding the tests of flexibility and speed, there is a greater relationship with academic performance in women, while the resistance test is higher in men [15].

There is evidence that it supports the effectiveness of interventions that improve aspects of physical condition to enhance school performance among school-age children who are overweight or obese [16]. These authors, on the other hand, also affirm that the interventions that take place at the level of physical condition in students who are overweight or suffer from obesity suppose an important support for these on the academic stage. However, other factors such as culture and socioeconomic level can also have an influence. In the same way, other studies argue that schoolchildren with obesity have lower academic performance compared to others [14]. On the other hand, there are studies

that show the BMI values do not have a significant relationship with almost any of the subjects [17].

Related to this latest idea, the aim of this study is to establish the relationship between academic performance and physical condition in adolescent students at an educational center of the island of Majorca.

Materials and methods

Participants

The present study was carried out with a sample of 79 participants (46 boys and 33 girls) from Majorca (Spain). All the students who took part in the study were in the 2nd grade of secondary education.

Before performing the tests, the students were informed that their data would be used for the study and that they would be totally anonymous. In the same way, the educational center also gave its consent and provided the data with reference to the academic results.

The inclusion criteria in the study stipulated that participants should not be suffering any form of pathology or have been injured in such a way as to inhibit performance in the tests in an optimal way. In this way, the participants had to be students of 2nd grade, present during the session designated for performance of the tests, without impediments which would prevent appropriate performance.

Procedure

The collection of data was carried out in April 2017, at the final stage of the second school quarter 2016-2017. The test site was the indoor sports center located next to the center itself, which enabled the execution of all the tests.

Instruments

The variables analyzed were as follows: level of physical condition (strength of manual pressing (N), VO2màx (ml/kg/min), (BMI)), academic performance (0-10 points) and sex.

The physical tests chosen were carried out during one session: manual dynamometry, Course-Navette and BMI (weight and height, requested orally).

All participants had a single attempt at The Course-Navette test, whereas the best of two possible attempts was recorded for the test of manual presses force. In addition, before the completion of the tests, the protocol was explained to each participant.

Regarding academic performance, the arithmetic averages (of the second quarter) were used for all subjects studied in the 2nd grade. The average note was obtained, thus obtaining a single figure, which encompasses all the subjects.

Statistical analysis

For the extraction of data, several types of analysis have been used in order to accumulate all the data and make good use of them. The program used was IBM SPSS Statistics 23. In the first place, a descriptive analysis of the different variables has been carried out, using frequencies, percentages, and standard deviations.

Average comparisons have also been made, in the cases of the different BMI ranks and the academic notes (T-student).

Finally, a type of inferential analysis has been performed, which has allowed establishing of meaning between the different variables analyzed, in order to determine if there is a relationship between them (Pearson's correlation coefficient).

Results

The results shown below were obtained from the frequencies, percentages, and averages established for each of the 4 variables analyzed.

Table 1. Frequencies and percentages of the 4 variables analyzed

	All	Boys		Girls			
	X (SD)	X (SD)		X (SD)		t	Sig (p)
Strength	25,87 (6.28)	28.65	(6.20)	22.00	(3.90)	5.42	0.016
BMI	20,87 (3.35)	20.55	(3.50)	21.32	(3.20)	-1.01	0.422
VO2 Max	43,32 (7.22)	46.55	(6.90)	38.82	(4.80)	5.50	0.045
Academic mark	6,04 (1.64)	5.61	(1.60)	6.63	(1.50)	-2.83	0.436

As can be seen, the majority of participants who have participated in the study were boys, with a difference of almost 20% between both sexes.

On the other hand, it is remarkable that girls receive better grades in academic performance, exceeding boys with 1.02 points on the arithmetic average.

It is also interesting to note that, with both boys and girls, the BMI is within healthy limits and that the arithmetic averages of this variable are within the norm. Below is a table that classifies according to the health scale of the BMI for each gender.

Table 2. BMI frequencies by sex

	All	Boys	Girls
BMI	N (%)	N (%)	N (%)
Underweight	22 (27.80)	14 (30.40)	8 (24.20)
Normal weight	47 (59.50)	27 (58.70)	20 (60.60)
Overweight	8 (10.10)	4 (12.10)	4 (12.10)
Obese	2 (2.50)	1 (2.20)	1 (3.00)

Underweight participants score an academic mark mean of 6.16; normal weight score 6.02; overweight score 5.92; and obese score 5.50.

Table 3 shows the correlations that have been observed between the variables (BMI, VO2Màx, strength, and marks) for which some meanings can be extracted.

Table 3. Correlation between variables strength, BMI, VO2 Max, and marks.*p<0.05 **p<0.001

	Strength	BMI	VO2 Max	Mark
Strength	1	0.387**	0.133	-0.232*
BMI		1	-0.432**	-0.078
VO2 Max			1	-0.117
Mark				1

As can be seen, it should be noted that there is a significant positive relationship ($p < 0.01$), among those students who have presented higher levels of strength and those with a higher BMI.

The other result to note is that there has been a significant negative relationship ($p < 0.01$), between BMI and maximum oxygen consumption. That is, those students who have obtained a better result in the test that recorded the consumption of oxygen are those that had lower levels of BMI.

In Figure 1, it can be observed that there is a tendency for those subjects with a low body mass index to achieve higher oxygen consumption levels. Likewise, a significant relationship ($p < 0.05$), negative, is observed between "mark" and "strength" variables, where those with lower values of force obtain a better academic qualification.

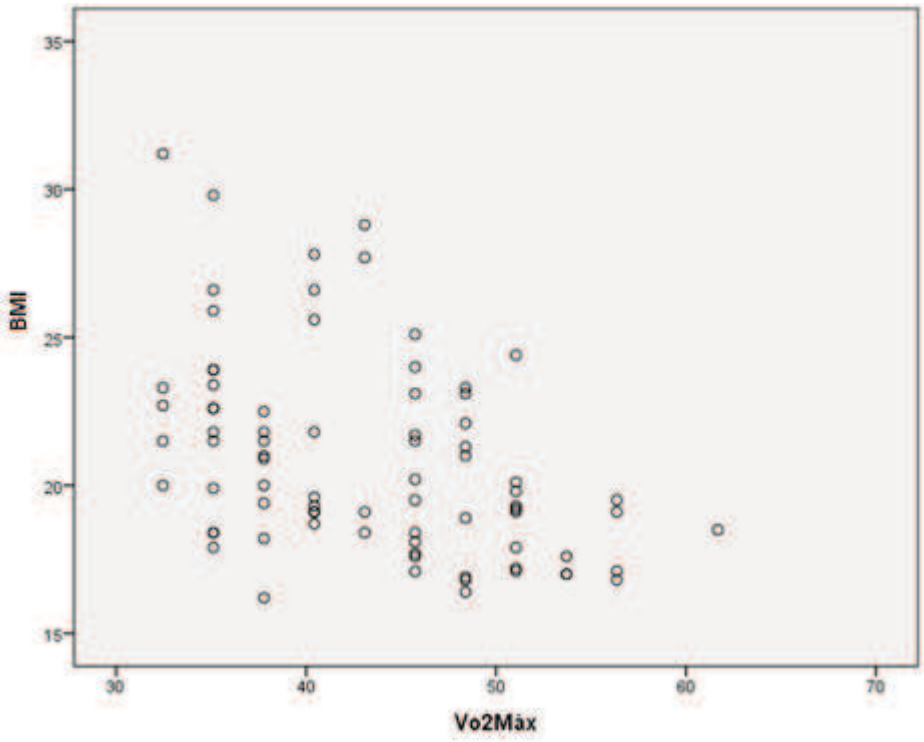


Figure 1. BMI and VO2 Max Maximum Dispersion

Discussion

The aim of the present study was to analyze the marks obtained by students from the 2nd grade of secondary education from Majorca, and to determine if their physical condition had a significant relation. Next, the concordances and disagreements with other studies related to the case will be presented, in order to establish whether they compare with other lines of investigation.

It was noted that people with normal weight in this study accounted for 59.5% while in another study the figure was 79.7% [1]. This difference, however, could be due again, to the diversity of population studied in both cases. In relation to the physical condition; it can be observed that boys have higher values in the test of the force of manual pressing and also a greater consumption of oxygen, which enters the parameters of normality, due to the development of both sexes.

Differences between boys and girls begin to be appreciated after adolescence, around age 14 when boys develop their strength more quickly. Men have more strength than women (36-44%)

since they have more muscle tissue than women (25-29%), and men's ability to develop muscles is almost twice as high as that of women [2].

In relation to the VO2 Max, there is no significant difference between boys and girls before puberty. It is after this that differences begin to present. Girls present between 30-35% lower levels of VO2 Max. In the present study, however, these differences are smaller as the boys show a maximum consumption of 46.55 oxygen and girls 38.82 [11].

Focusing on academic record, we emphasize that the results show that girls (6.63) have an overall arithmetic mean in comparison with boys (5.61). Related to this, the European Commission [8], in a document of gender comparison, writes that generically boys gain higher qualifications in scientific subjects while girls get better results in the field of humanities.

Based on the results obtained in the correlation between strength and BMI, one might think that it is better to have low BMI levels, since this may mean having lower levels of manual strength and therefore obtaining better qualifications.

However, these results disagree with another study [19] carried out in seniors. The work affirms that those people with higher levels of hand grip strength have better cognitive capacity. However, these studies prove difficult to compare because of the age difference.

Regarding the relationship between BMI and marks, no significant relationships were found according to another study [17]. On the other hand, a significant negative relationship was found between BMI and waist perimeter with academic performance [12].

A study has also indicates that underweight people get worse qualifications than people who are within normal weight parameters (18.5-25). These statements are in line with those in the present study, since those who were underweight (6.16) got better grades than people with normal weight (6.02) [6].

A recent study claims that obese schoolchildren have lower academic performance compared to others; according to our study, overweight students get an average of 5.5, followed by people with obesity (5.92) [14].

Finally, no significant relationship was found between maximum oxygen consumption and the academic grades achieved. These results are in line with those presented in another study carried out in Spain last year [12].

As for weaknesses of this study, it should be said that the sample used is scarce if we want to extrapolate from it results for the whole population, which is an important aspect to keep in mind. Although the results of the study are not powerful enough as regards the amount of data obtained, for the total population studied, the need to continue studying the relationship between physical condition and health/academic performance is assessed.

BIBLIOGRAPHY

1. Artigues, G., Cabeza, E., Henríquez, P., Mendez, M., Pujol, A. & Villalonga, B. (2007). Prevalença de l'obesitat infantil i juvenil a les Illes Balears. (EPOIB) Govern de les Illes Balears.
2. Barraza, J. (2013). La fuerza en niños y adolescentes. Educación Física y Deportes. Revista Digital, 179.
3. Carral, C., Ay, C. & Espi, S. (2016). Relación entre la condición física y rendimiento académico en matemáticas y lenguaje en estudiantes españoles de educación secundaria: Un estudio longitudinal. Cultura Ciencia Deporte, 11(12), 7–16.
4. Castro, J., César, G., David, J. & España, V. (2014). Condición física y riesgo cardiovascular futuro en niños adolescentes argentinos: una introducción a la bateria ALPHA. Archivos Argentinos de Pediatría, 112(2). 132-140.
5. Cesar, A. & Oliveira, C. De. (2016). Association between health-related physical fitness and academic performance in adolescents. Rev Bras Cineantropom Hum, 18(4), 441–449.
6. Chen, L.J., Fox, K.R., Ku, P.W. & Taun, C.Y. (2013). Fitness change and subsequent academic performance in adolescents. Journal of School Health, 83(9), 631–638.
7. Demakakos, P., Hamer, M., Stamatakis, E. & Steptoe, A. (2010). Low-intensity physical activity is associated with reduced risk of incident type 2 diabetes in older adults: evidence from the English Longitudinal Study of Ageing. Diabetologia, 53:1877–1885.

8. European Comission (2009). Diferencias de género en los resultados educativos: medidas adoptadas y situación actual en Europa. Brusselas: EURYDICE.
9. Garatachea, N. & Márquez, G. (2013). Actividad física y salud. Madrid: FUNIBER.
10. Generelo, L., Serrano, J. & Zaragoza, J. (2004). Dimensiones de la condición física saludable: evolución según edad y género. Revista Internacional de Medicina y de Ciencias de la Actividad Física y el Deporte, 4(15), 204-221.
11. López, J. & López, L.M. (2008). Fisiología clínica del ejercicio. Madrid: Panamericana.
12. Olivares, P. R. & García-rubio, J. (2016). Associations between different components of fitness and fatness with academic performance in Chilean youths. PeerJ (https://doi.org/10.7717/peerj.2560).
13. Reiner, M., Niermann, C., Jekauc, D. & Woll, A. (2013). Long-term health benefits of physical activity--a systematic review of longitudinal studies. BMC Public Health, 13(1), 1–9.
14. Sardinha, L. B., Marques, A., Minderico, C., Palmeira, A., Martins, S., Santos, D. A. & Ekelund, U. (2016). Longitudinal relationship between cardiorespiratory fitness and academic achievement. Medicine and Science in Sports and Exercise, 48(5), 839–844.
15. Serrano, V., López, C., Pulido, M. & Zagalaz, R. C. (2015). Estudio comparativo del rendimiento académico y la actividad física en dos institutos de enseñanza secundaria de Andalucía (España). SporTK: Revista Euroamericana de Ciencias Del Deporte, 4(2), 11–1.
16. Shaw, S. R., Gomes, P., Polotskaia, A. & Jankowska, A. M. (2015). The relationship between student health and academic performance: Implications for school psychologists. School Psychology International, 36(2), 115–134.
17. Silva, P., Lott, R., Wickrama, K., Mota, J. & Welk, G. (2011). Associations Between Cardiorespiratory Fitness and Overweight With Academic Performance in 12-Year Old Brazilian Children. International Journal of Sport Nutrition and Exercise Metabolism, 32, 1–22.
18. Suárez, Neira, Pastor & Ichaso (2014). Encuesta Nacional de Salud España 2012/13 (https://www.msssi.gob.es/estadEstudios/estadisticas/encuestaNacional/encuestaNac2011/informesMonograficos/Act_fis_desc_ocio.4.pdf).
19. Taekema, D.G., Ling, C.H. Y., Kurrle, S.E., Cameron, I.D., Meskers, C.G.M., Blauw, G.J., Maier, A.B. (2012). Temporal relationship between handgrip strength and cognitive performance in oldest old people. Age and Ageing, 41(4), 506–512.
20. WHO (2016). Obesidad y sobrepeso (http://www.who.int/mediacentre/factsheets/fs311/es/).

Correspondence

J. Vidal-Conti
Physical Activity and Sports Sciences Research Group. University of the Balearic Islands
Crta. Valldemossa Palma de Mallorca, Spain
Phone: +34971172095
E-mail: josep.vidal@uib.es

Journal of Physical Education & Health, 2016, vol. 6 (9), 27-33

THE DEVELOPMENT OF RESULTS IN 100M AND 400M SPRINT RACES IN ATHLETES AGED FROM 6 TO 100

Janusz Iskra[2], Michał Pietrzak[1], Monika Szczęsna[1], Paweł Gwiazdoń[3]

[1] University of Physical Education, Katowice,

[2] Opole University of Technology, Opole,

[3] Medical University of Silesia, Katowice,
Department of Biopharmacy, School of Pharmacy with the Division of Laboratory Medicine in Sosnowiec

Abstract

The 100 m race is not only a sports discipline but also a way of assessing an athlete's speed abilities. The run over the distance of 400 metres combines both speed and endurance (anaerobic) capacities. The purpose of the study was to evaluate the development of results in men's 100 and 400m sprint races, taking into account the best performance within the age from 6 to 100. By examining the course and the development of the world's leading sprinters' careers, the authors took into consideration their best final results achieved each year. They were assigned to three research protocols that included age, successive years of starts, and the period before and after their personal best.The results are presented with arithmetic means and standard deviations (SD). In the comparative analysis of groups of runners over various distances (100 and 400m), the percentage value (%) of the result in relation to the world record over the given distance was chosen as a common element. The research has shown that the age range from 20 to 31 in the 100m race and 20 to 29 in the 400m run respectively, are the best periods for continuation of a sports career suitable for the shortest and longest sprint distance at the highest world level. The development of speed abilities up to the age of 14 is similar to the scale of their regression after the age of 35. Knowledge concerning the change in sports performance level in relation to age provides the opportunity to predict the periods of peak performance in a given sports discipline. This enables a rational and proper planning of the training process.

Key words: *100m, 400m, ontogenesis, sports career development.*

Introduction

Effort abilities as a result of many years of development and training are of interest to many researchers dealing with issues concerning not only the theory but also the methodology of sports. A sports result is the consequence of many biological, social and training factors affecting the athlete. Sports achievements determine their prestige and social position; they are evidence of success. In recent years, we have witnessed record results in track and field speed disciplines, and the 100 and 400m races are interesting, also in terms of analyzing the development of results and the related course of sports careers.

The 100m race is not only a sports discipline but also a way of assessing an individual's speed. Although at a younger age groups this distance seems too long for speed assessment (Raczek 2010), it works in the field of sports competition for the most talented children.

The 400m run is a discipline combining both speed and endurance (anaerobic) capacities. In this case, both in the youngest and oldest age groups, the difficulty in covering that distance increases. The final result in covering one lap of the athletic stadium is mainly determined by exceptional (anaerobic) propensity that makes it possible to continue to run quickly under conditions of significant "acidification" of muscles (Letzelter 1979, Iskra 2015). The difficulty of

training and competition in the 400m run is evidenced by the fact that this distance was included in the Olympic women's contests only in 1984, i.e. more than 100 years after this discipline had been included in the men's contests. (Wallechinsky and Lucky 2012).

Age is of indisputable importance in defining the model of sports championship. Information concerning the age at which the sports abilities reach their peak, as well as the optimal time to begin an athlete's adventure and specialization in sports are essential in the selection of candidates for particular disciplines and events. Research based on those data can be used to draw practical conclusions, to forecast and evaluate the development of results and speed capabilities in human ontogenesis (Ważny and Sozański 1980; Sozański et al 1999, Tataruch 2014).

Knowledge concerning the change in sports performance level in relation to age provides an opportunity for the prediction of the period of peak performance in a given discipline. This enables proper planning of the training process. Rational training should be a step-by-step process, targeted and continuous, taking into account the personal changes in ontogenesis. Only such proceedings lead to the gradual development and maximization of training effects (Sachnowski 2002, Hohmann et al. 2002).

The accuracy of data presented by statisticians – members of the International Association of Athletics Federations (ATFS) - is helpful in assessing the age for the best results in track and field events. In Butler's extensive publications, one can evaluate the age at which the best results in all athletic events are achieved, by following various championship contests (Buttler 2012, 2015).

Table 1. Periods of sports success in track and field events (according to Płatonow 2004).

Events	First success		The highest performance		Maintaining high results	
	W	M	W	M	W	M
Sprint races	18-20	19-21	20-24	22-26	25-26	27-28

While assessing the importance of age in sports, the optimal age of sports championship is just the beginning of scientific observation. The data collected are the basis for the definition of a specific "sports ontogenesis", i.e. systematic changes in athletes' results and their sports development; in other words in the course of their sports careers defined as a specific curve of growth, stabilization and gradual reduction of sports performance level. The process of sports maturation is a specific stage of human ontogenesis, covering the period from the moment when interest is taken in a particular discipline, through the achievement of best results, to the end of the sports career (Skorowski 1968, Iskra 2005, Sozański et al. 2012).

The purpose of the study

The purpose of the study was to evaluate the development of results in men's 100 and 400m sprint races, taking into account the best results from the 6th to 100th year of age.

Material

The world's best sprinters (aged from 15 to 35) were subjected to detailed analysis. The sports ontogenesis of athletes achieving record-breaking results in the 100m race (9.86 ± 0.07 s) and 400m run (44.06 ± 0.32s) was analyzed. The record results were achieved within the period of 1968 to 2016. The data collected included the best results achieved by the respondents in the given calendar year - from the first to the last start in their sports careers. Additionally, the development of the best results in groups outside the championship competitions (up to the 14th and after the 35th year of age) was presented.

METHODS

While examining the development of the world's leading sprinters' careers, the authors took into account their best final results in each year of their starts. They were assigned to three research protocols that included age, successive years of starts, and periods before and after their personal best. This procedure was used in previous studies (Plewnia 2016, Dziadek 2017). The structure and method of data distribution are presented below:

Protocol 1 – analysis of achieved results taking into account the athlete's age.

Protocol 2 – analysis of achieved results in successive years of training.

Protocol 3 – analysis of achieved results before and after the personal best.

The results are presented taking into consideration arithmetic means and standard deviation (SD). In the comparative analysis of groups of runners over various distances (100 and 400m), the percentage value (%) of the result in relation to the world record over the given distance was chosen as a common element.

The other set of data includes results in all age groups - from the 6th to the 100th year of age. These data are available at www.age-records.125mb.com and www.world.masters.atchletics.com

Results

Looking for changes in the level of results with regard to the age, it is difficult not to refer to the record results achieved by the younger (children up to 14 years) and older (veterans aged over 35) representatives of age groups. Data from the age between 6 and 14 are supplementary to the analysis of sports championship development in the 100 and 400m runs. These results (especially concerning the longest sprint run) do not have much in common with the training methodology in this discipline, which applies to the older age groups (Smith 2005, Iskra 2015). They only inform about the possibilities of the human body at a given stage of ontogenesis. This is due to the lack of information about their later performance in the 400m run. The distance of 400 meters is extremely demanding and the runners have to be prepared for it in a balanced manner, taking into account the young athletes' age and above all their biological development. Premature specialization is not only inadvisable, but can be hazardous to health. Not without significance is the fact that the 400m run appears in the program of competitions only for younger juniors, i.e. young athletes aged under 15 (Butler 2015).

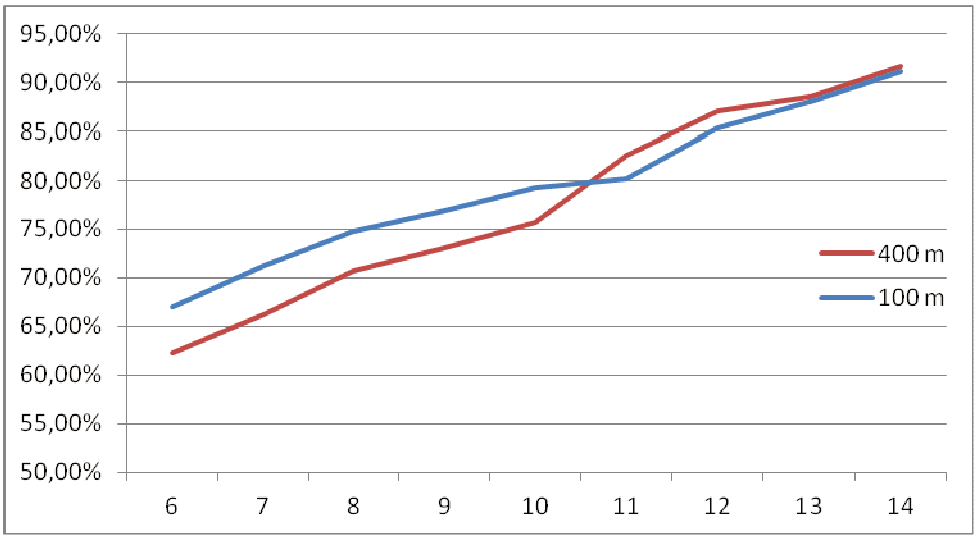


Fig. 1. Changes in running abilities over the distance of 100 and 400m in human ontogenesis up to the 14th year of age compared to the world record (WR=100%)

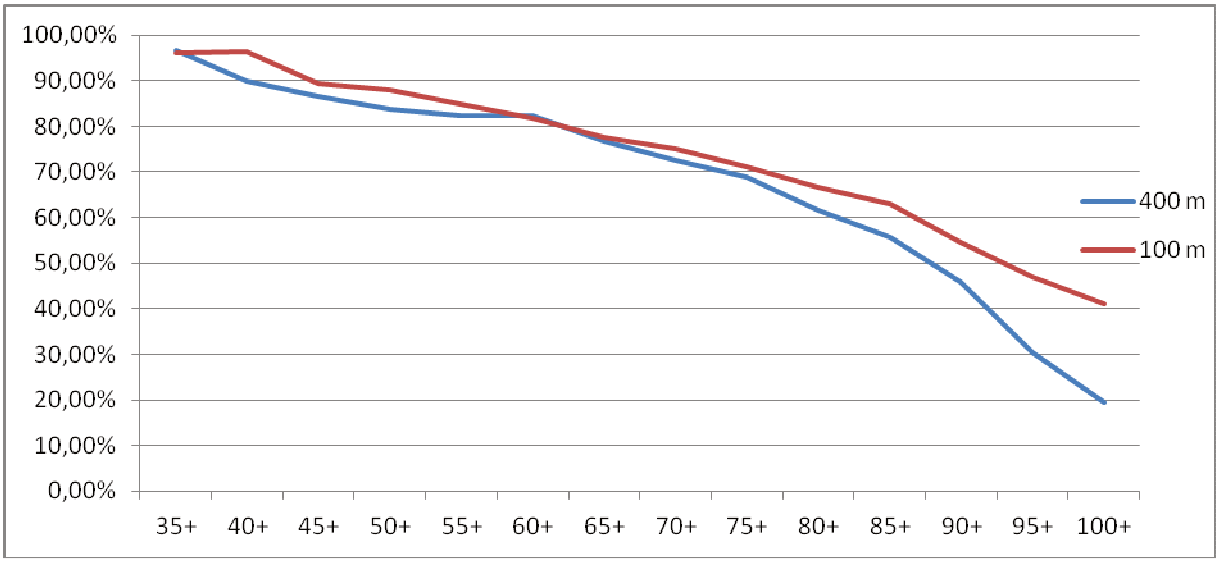


Fig. 2. Changes in running abilities over the distance of 100 and 400m in human ontogenesis after the 35th year of age compared to the world record (WR=100%).

Comparing the increase of results in the period up to the age of 30 with the decrease of sports skills level after the age of 35, almost symmetric relationships must be noticed (Figures 1. and 2.). Both an 11-year-old athlete and a 60-year-old one achieve about 80% of record results. The same can be noted for 6- and 80-year-old athletes (about 62% for 400m and 67% for 100m), 7- and 75-year-old ones (about 68%), 8- and 70-year-old ones (about 73%) as well as 9- and 65-year-old ones (about 77% of the world record). In human ontogenesis, the scale (magnitude) of speed abilities' development up to the age of 14 is similar to the regression scale after the 35th year of age. Figures 1. and 2. also indicate the difference in results regarding distances 100m and 400m at the very early (up to 10 years) and very late (after 75 years) life stages. From the data it follows that the speed and endurance capabilities appear later and decrease relatively early.

An analysis of sports career development of the 50 best sprinters in the history of the 100m race showed that the mean value of the best results achieved by the above mentioned athletes throughout the course of their careers is 9.86 ± 0.07 sec., with a minimum result of 9.58 sec. and a maximum one of 9.93 sec., and concerns the 25th year of age (± 3 years). The age at which the personal best is achieved varies within the wide range between the 20th and 33rd year of athletes' age. In the shortest sprint race, the number of analyzed data (n = 42) increases up to the age of 22, then it remains at a relatively constant level (n = 38-40) within the age from 23 to 25; after that the number of analyzed data constantly decreases. (in the 31st year of the examined sprinters' age n <200).

The analysis of sports' career development of the 50 best sprinters in the history of the 400m run showed that the mean value of the best results achieved by the above mentioned athletes throughout the course of their careers is 44.06 ± 0.32 sec., with the minimum result of 43.03 sec. and the maximum one of 44,36 sec. and concerns the 24th year of age (± 3 years). The age at which the personal best is achieved varies over a wide range between the 18th and 32nd year of the athletes' age.

By studying the sports championship development based on the results achieved in the given year of age of the world's best 400m runners, it can be noted that up to the 23rd year of age the number of analyzed data increases (n = 34). From the age of 24 to 26 on, it remains at a constant level (n = 27), and later on the number of analyzed runs decreases.

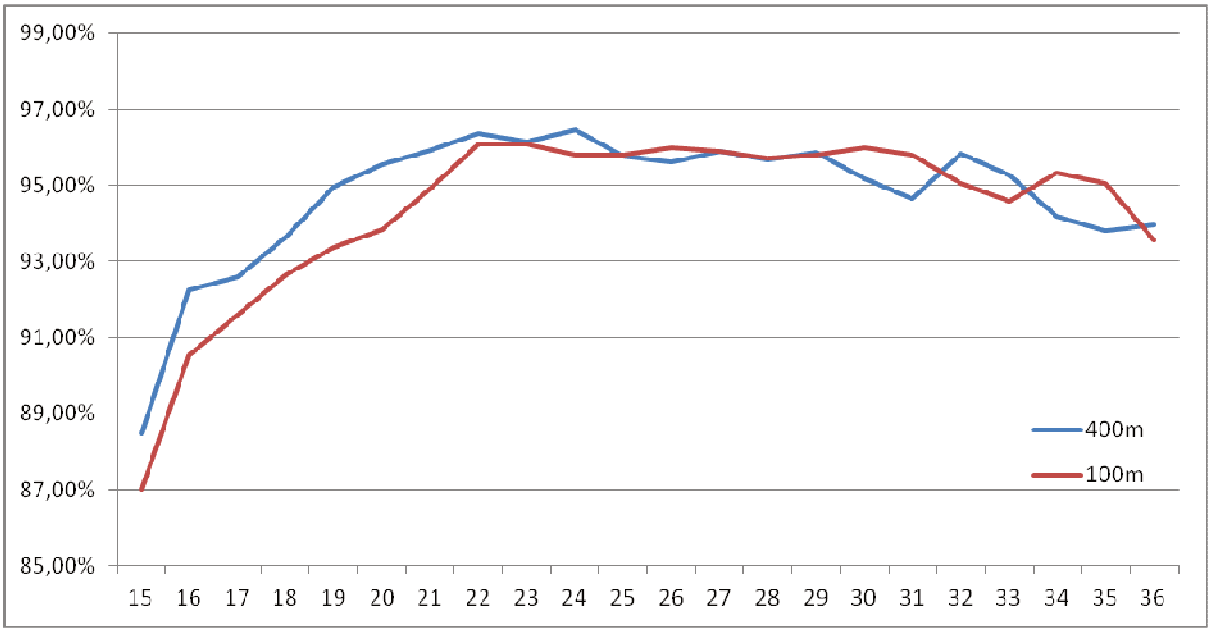


Fig. 3. Sports championship development in men's 100m and 400m run, taking into account the athletes' age in relation to the world record in particular discipline (WR=100%)

By studying the sports championship development based on the results achieved in the following year of age of the world's best 400m runners, it can be noted that the most dynamic results progression of the researched groups takes place up to the age of 22; after that, in the group of 400m runners it stabilizes up to the age of 29 at a relatively equal level (Fig.3.). This may indicate that the age from 20 to 29 is the best period in which the athletes running over the longest sprint distance can achieve record results. On mean, the fastest short distance sprinters maintain the highest level of sports championship up to the 31st year of age. After the 32nd year of age, the level of results regresses systematically in both examined groups of athletes.

Table 2. Significance of differences between the sports performance level at particular stages of sports championship.

Stage (years of career)	100m			400m		
	n	x- SD (s)	ANOVA	n	x-SD (s)	ANOVA
17	12	10,46 ± 0,09	0,05	7	46,29 ± 1,06	-
18	20	10,34 ± 0,16	-	13	45,76 ± 1,38	-
19	34	10,26 ± 0,16	-	20	45,37 ± 0,95	-
20	37	10,21 ± 0,22	0,01	22	45,09 ± 0,83	-
21	41	10,09 ± 0,17	0,01	27	44,76 ± 0,78	-
22	42	9,97 ± 0,21	-	31	44,63 ± 0,74	-
23	39	9,98 ± 0,15	-	34	44,76 ± 0,93	-
24	40	10,01 ± 0,18	-	31	44,59 ± 0,64	0,05
25	38	10,01 ± 0,14	-	26	44,96 ± 0,61	-
26	35	9,98 ± 0,15	-	27	45,02 ± 1,02	-

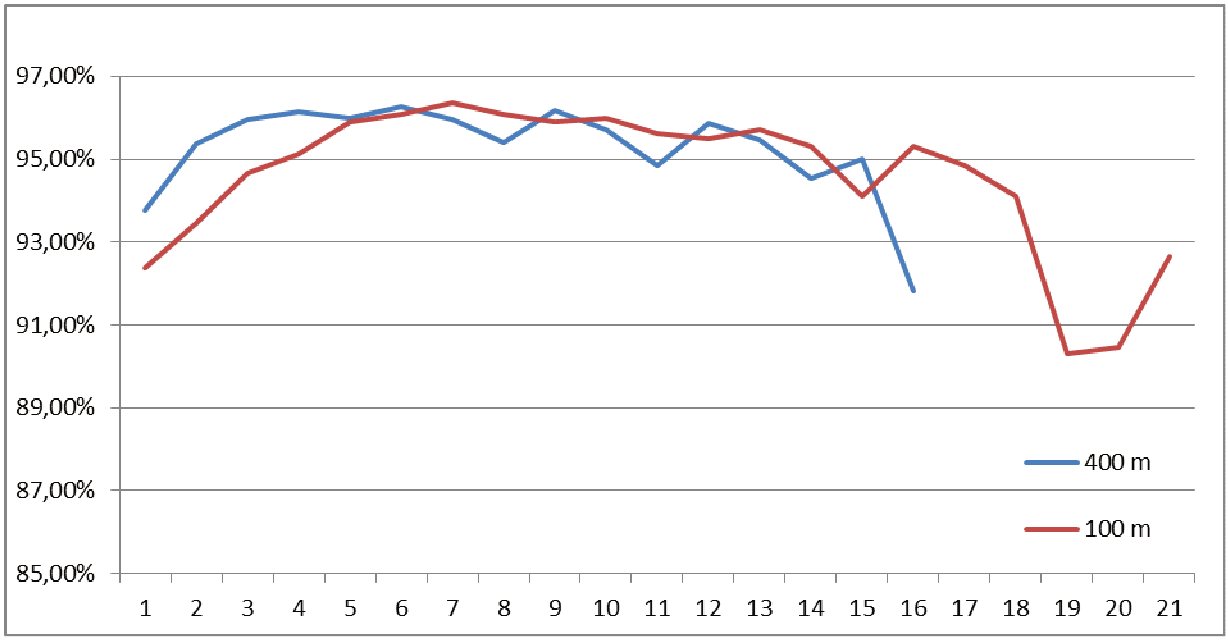


Fig. 4. Sports championship development of the best sprinters in the history of 100m and 400m runs in the consecutive years of their careers in relation to the world record (WR=100%)

The analysis of the consecutive years of the best sprinters' careers indicates that the most dynamic development of results takes place in the first four years of specialized training in the group of 400m runners (from the mean result of 45.89 ± 1.45 sec., for n = 50 on up to 44.75 ± 0.70 sec. (n = 35) and in the first seven years for 100m sprinters (from 10.37 ± 0.21 sec. on up to 9.95 ± 0.12 sec., respectively). After eight years of continuous 100m sprinters' career, there is a mild but steady decrease in the results' level (from 9.97 to 10,17 sec.). In the fifth year of the 400-m runners' career, the sports performance stabilizes at a similar level for another three years. In the later years of the fastest male 400m runners' career, the mean values of the results decrease and increase alternately and the sports performance level shows a general declining trend.

Table 3. The significance of differences between the sports performance level at particular stages of sports championship in the consecutive years of examined athletes' careers.

Stage (years of careers)	100m			400m		
	n	x- SD (s)	ANOVA	n	x-SD (s)	ANOVA
1	50	10,37 ± 0,21	0,01	50	45,81 ± 1,29	0,01
2	45	10,26 ± 0,21	0,01	38	45,15 ± 0,92	0,01
3	42	10,11 ± 0,15	-	39	44,80 ± 0,57	-
4	47	10,06 ± 0,14	0,05	36	44,70 ± 0,64	-
5	42	9,99 ± 0,13	-	37	44,70 ± 0,81	-
6	47	9,97 ± 0,12	-	31	44,70 ± 0,72	-
7	43	9,95 ± 0,24	-	26	44,76 ± 0,74	-

The analysis of the consecutive years of the examined sprinters' careers indicates that the continuous progress within the first three years of participating in sports competitions, i.e. between the first and the third year of sports career development is statistically significant (p≤0,01). In addition, among sprinters specializing in the distance of 100m, the period between the fourth and fifth year of runners' sports career development has an impact at the level of p≤0.05.

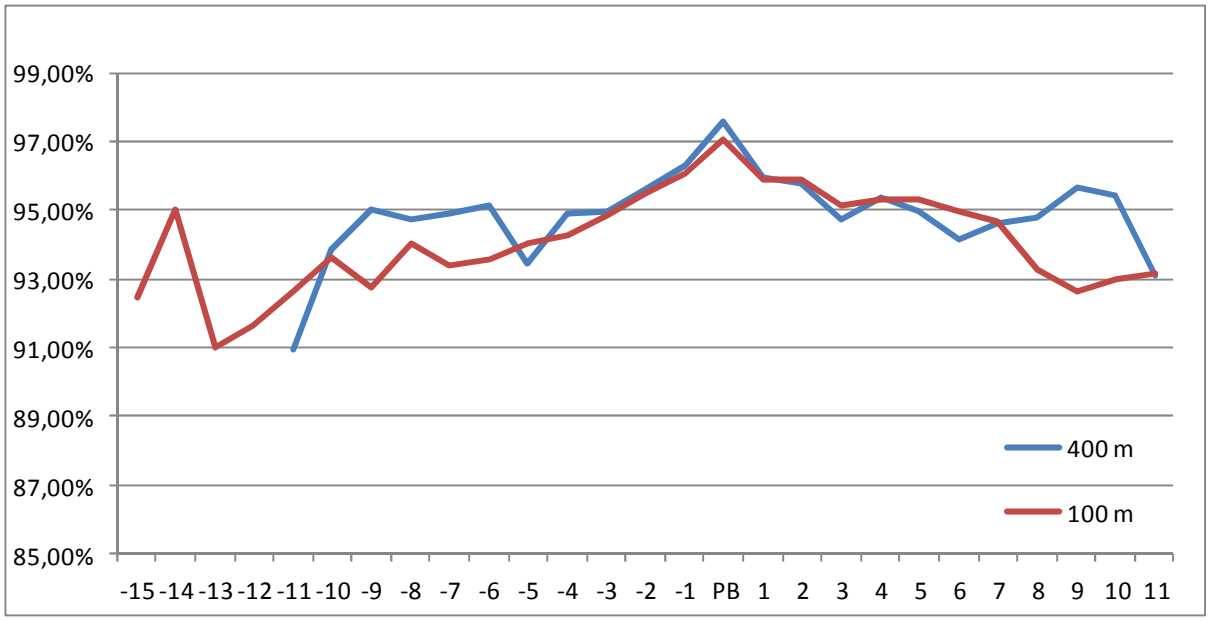


Fig. 5. Sports championship development of the best sprinters in the history of 100m and 400m runs in the previous and following years since achieving the best results in their careers in relation to the world record (WR=100%)

The research results indicate that continuous progression of results concerns the period of five years prior to the personal best ("PB") achieved by the fastest 400m runners and eight years prior to achieving the "PB" by the fastest 100m racers in the history of those events. The permanent regression of results after achieving the "PB" concerns the following three years of careers in both groups of examined sprinters. In the 4th year after the 400m runners discussed achieved their "PB" and in the 4th and 5th year after achieving the best result in the career in the group of 100m sprinters, the mean result improves. This affects the general regression of the results following the establishment of the personal best of the examined athletes.

In analyzing the influence of the years before and after achieving the best results in the careers of examined sprinters, it should be noted that the two years preceding the achievement of the best results in their sports careers have statistically significant impact (p≤0.01) on the runners themselves and their achievement of their "PB" in both groups of runners specializing in distances of 100 and 400m. In addition, the 3rd year before achieving the best result in the careers of examined athletes among the tested 400m runners has a significant impact (p≤0.05) on the runners themselves and the achievement of their "PB".

Table 4. The significance of differences between sports performance levels at particular stages of sports championships in the years before and after achievement of PB amongst the athletes examined.

Stage (years of career)	100m			400m		
	n	x- SD (s)	ANOVA	n	x-SD (s)	ANOVA
-4	40	10,14 ± 0,19	-	21	45,40 ± 1,06	-
-3	41	10,09 ± 0,19	-	29	45,27 ± 0,89	-
-2	46	10,02 ± 0,12	-	31	45,08 ± 0,83	0,05
-1	45	9,95 ± 0,20	0,01	38	44,68 ± 0,61	0,01
PB	50	9,86 ± 0,07	0,01	50	44,06 ± 0,32	0.01
1	37	9,98 ± 0,11	-	37	44,87 ± 0,83	-
2	34	9,99 ± 0,12	-	21	44,85 ± 0,66	0,05
3	34	10,06 ± 0,20	-	17	45,34 ± 0,73	-
4	24	10,05 ± 0,13	-	13	45,02 ± 0,65	-
5	24	10,04 ± 0,10	-	13	45,27 ± 1,02	-

Table 5. Correlation coefficient between the selected parameters and personal best of examined sprinters.

Parameter	**100m**		**400m**	
	r	**p**	**r**	**p**
17th year of age (cadet)	0,48	-	-0,13	-
19th year of age (junior)	-0,13	-	0,35	-
22nd year of age *	0,46	0,01	0,36	0,05
23rd year of age * (youth)	0,65	0,01	0,39	0,05
1st year of career	0,07	-	0,13	-
2nd year of career	0,16	-	0,20	-
5th year of career*	0,56	0,01	0,47	0,01
6th year of career*	0,52	0,01	0,53	0,01
3 years prior to "PB"*	0,46	0,01	0,51	0,01
2 years prior to "PB"*	0,51	0,01	0,63	0,01
1 year prior to "PB"*	0,63	0,01	0,78	0,01
1 year after achieving "PB"*	0,65	0,01	-	-
2 years after achieving "PB"*	0,59	0,01	-	-
3 years after achieving "PB"*	0,49	0,01	-	-

*The statistically significant selected parameters correlating with "PB" of examined sprinters (p≤0.05)

The statistically significant (p≤0.05) results of 400m runners in the periods from the 22nd to the 26th and from the 28th to the 32nd years of age, except for the 30th year of age, correlate with their personal best (PB). In the 24th and 28th years of age, the value of p≤0.01 achieved statistical significance. The statistically significant (p≤0.01) mean values of results achieved by the world's fastest 100m sprinters between their 22nd and 31st year of age correlate with the best results in their sports careers. This confirms the fact that it is the best time to achieve results at

the highest world level. Results in the 24th and 28th years of age correlate statistically with the PB at the level of p≤0.05. The conducted analysis of results in relation to the age of examined sprinters did not show any statistically significant impact of the age of cadet (U18) and junior (U20) on their results in relation to their later record achievements (Table 5).

Studying the correlation between the results achieved by the best sprinters in the consecutive years of their careers in both groups (100 and 400m), there was a statistically significant relation with the best results in the period from the 5th to the 12th year of sports career development (p≤0.01). It is to be noted that in both groups of sprinters, the results achieved by them in the first two years of their careers do not have a statistical impact on the later record results at world level.

All mean results from the period of three years prior to achieving the best results in their career by world-class athletes are statistically significant with their PB (Table 4, p <0.01). In addition, in the group of examined 100m runners, the results from years 1-4 following the establishment of their "PB" correlate significantly with the best results in their careers (p≤0.01).

Discussion

Research on human motor abilities in the context of sports ontogenesis indicates that the peak of speed development as a motor ability is achieved within the age range from 20 to 23, while the peak of endurance and strength development is observed between the 24th and 27th year of age (Krawiec 1989).

In the 1980s, it was a common view that athletic training should be taken up as early as possible. The research of Iskra (2005) showed that the beginning of training and sports specialization too early does not guarantee achievement of becoming a sports champion. Sozański et al. (1993) believe that the late engagement of a child in sports activities is better than taking them up too early.

The high sports performance level of young champions is first of all the result of specialized training already performed in the youngest periods of age. Those athletes who make further progress have usually trained in a different manner based on a comprehensive and targeted preparation (Sozański 2003). Youth sport cannot be aimed at maximizing the performance already in the youngest age groups. Adolescent athletes exploited too early are unable to make further progress; they often suffer from injuries, and eventually give up their training. For years there have also been characteristic constant age ranges, in which the percentage results rates of stagnation frequencies and the giving up of sports activities are the highest, also including track and field runs. At the age of 19-21, this indicator concerns almost 65% of women and 52% of men (Sozański 2013).

The comprehensive analysis of age dynamics (Sachnowski and Iskra 2015), in which the best results in athletics and swimming are achieved, indicates that after a significant increase in the 1980s and 1990s of the age at which championship results were achieved, at the beginning of the 21st century a trend to stabilize this was observed.

This phenomenon can be explained by the commercialization and professionalism of Olympic sports. In the last few decades, along with the extension of sports championship formation, the length of its maintenance has increased even more. According to Płatonow (2004) and Szustin (2001), the above mentioned elements significantly contributed to the prolongation of sports ontogenesis in the context of competition at the highest level.

Until now, the best age to take up the adventure with sport in sprint disciplines was considered to be from 10 to 12 years. The age range from 14 to 16 was considered ideal for beginning a specialization. The age at which record results are achieved ranges from 22 to 26 years (Bompa and Haff 2010). At the same time, according to the data provided by Vaeyens et al. (2009), only less than half (44%) athletes participating in the Olympic Games in Athens in 2004 took part in international junior contests in their sport discipline. Most of them (56%) had such debuts only at senior age. Of the 387 athletes competing in the 28th Olympic Games track and field events, 8% of them began their adventure with sports before the age of 8, 10% within the range of 9-10 years, 17% at the age

from 11 to12, 22% started training at the age of 13-14 and 43% were more than 15 years old.

According to Kampmiller (2000), the optimal age for maximizing athletic performance in the men's 100m race is the age range from 20 to 25. In the men's 400m run, this range is extended and shifted and ranges from 22 to 28 years.

The results of various studies inspired the research team to reflections and analysis of sports career development of the best athletes specializing in the shortest and the longest sprint race (100 and 400m). The analysis of results showed that the greatest dynamics of results development in both groups occurs up to the age of 22 and in the first four years, taking into account the successive years of the 400m runners' sports career and the first seven years for the world's fastest "short" sprinters. The mean value of the 400m runners' results assigned to the athlete's age at the time of their achievement indicates that the best time for the distance of one lap of the athletic stadium is achieved aged 20 to 29. This is confirmed by previous analyses (Płatonow 2015). At this age, the mean of results is less than 45 seconds.

The fastest sprinters specializing in the 100m race maintain the highest sports championship level on average up to the age of 31. The mean of the fastest sprinters' results is equal to or less than 10 seconds and occurs at the age between 22 and 31. This may indicate that this period is the best time to continue the sports career running over the shortest sprint distance. In this period, the mean of results is also statistically significant ($p \leq 0.01$) and correlate with the best results in their sports careers.

The best time for men to start the competition over the distance of 400m is the age from 18-20. After four years of the most dynamic sports career development the age of 24 is the mean (± 3 years) age for achieving the best result in the career of a 400m runner. Track and field athletes can continue their struggles over the distance of one lap of the athletic stadium at the world's level until the age of 29. According to the research, after this time there is a regression in sports results. Considering the mean age of achieving the best records in the careers of the world's 50 best 100m sprinters, and taking into account that the period during which these athletes achieve their personal best is 7 years, and that the constant progression of results is shaped within the first 8 years of sports career, the best time to begin the specialization at the shortest sprint distance is the age of 17-18.

The conducted analysis of results assigned to the age of examined sprinters did not show any statistically significant impact of cadet's (U18) and junior's (U20) age on their results in relation to their later record achievements, which confirms the assumption that beginning training and sports specialization too early does not guarantee the achievement of becoming a sports champion (Iskra 2005).

The research into the correlation between the results achieved by the best sprinters in the history of the two race categories showed that the mean results achieved within the period ranging from the 5th to 12th year of their careers in both groups have a statistically significant impact on athletes' personal best. The mean results from the period of three years before achieving the best result in the careers of athletes at world level in both groups are also statistically significant with their "PB". Additionally, in the group of examined 100m runners, the results achieved during the period of 1-4 years after achieving the "PB" correlate significantly with the best results in their careers. The above statements may be important in organizing the training process at various stages of sports championship.

Conclusions

1. In the 100m race (at the level of 9.86 ± 0.07 sec.), the mean age of achieving record-breaking results is 25 ± 3 years. The mean age of achieving the best results in 400m run (results level: 44.06 ± 0.32 s) is 24 ± 3 years.

2. The greatest dynamics of change (progress) of results in both sprints occurs up to the age of 22. In the 100m race, this concerns the first seven years of a sports career, and in the 400m run, the first four years of specialized training.

3. The best sprinters' results (under 10 seconds) are achieved within the period from the 22nd to the 31st year of age. The mean of results in this period significantly ($p \leq 0.01$)

correlate with the best results in their sports careers.

4. In the 400m race, the age from 20 to 29 is the best time to continue the sports career over this distance at the highest world level. In this period, the mean of results is less than 45 seconds.

5. In both examined groups, the periods of three years prior to achieving the best results, and 4 years after that is the time in which the maximum results in sprints are achieved.

6. Of statistically significant importance ($p \leq 0.01$), in the context of record results, are the first three years of starting in running contests and two years prior to achieving the "PB".

7. The development of speed abilities up to the age of 14 is similar to the scale of their regression after the age of 35. An 11-year-old athlete and a 60-year-old one achieve about 80% of their record results. The same can be noted in the case of 6- and 80-year-old athletes (about 65%), 7- and 75-year-old ones (about 68%), 8- and 70-year-old ones (about 73%) and 9- and 65-year old ones (about 77% of the world record).

BIBLIOGRAPHY

1. Butler M. 2015. IAAF World Championships. Beijing 2015. Statistic Handbook. IAAF/ATFS, Monaco
2. Butler M. 2012. IAAF Olympic Games. London 2012. Statistic Handbook. IAAF/ATFS, Monaco
3. Bompa T.O., Haff G.G. 2010. Periodyzacja. Teoria I metodyka treningu. Biblioteka Trenera, Warszawa.
4. Balyi I., Hamilton A. 1993. Long-term athlete development: train ability in childhood and adolescence. Olympic Coach 16, 4-9.
5. Hohmann A., Lames M., Letzelter M. 2002. Einfuhrung in die Trainingswissenschaft. Wiebelsheim.
6. Iskra J. 2005. Ontogeneza sportowa w lekkoatletycznych konkurencjach szybkościowych. (w:) P. Kowalski (red.): Problemy badawcze w lekkoatletyce. AWF, Wrocław, 43-46.
7. Iskra J., Walaszczyk A., Skucha J. 2015. Trening mistrzowski w biegach sprinterskich. Akademia Wychowania Fizycznego/Polski Związek Lekkiej Atletyki, Katowice/Warszawa.
8. Kampmiller T. 2000, Teoria a didaktika, Uniwerzita Komenskeho, Bratyslawa, s. 81-85
9. Krawiec S. 1989. Analiza sportowych karier czołowych lekkoatletów polskich z lat 1972-1984. Poznań
10. Plewnia D. 2016. Przebieg mistrzostwa sportowego zawodników w rzutach lekkoatletycznych. Praca doktorska. AWF Katowice.
11. Płatonow N. 2015. Sistema a podgotowki sportsmienow o olimpijskom sportie. Olimpijskaja literatura, Kijów
12. Raczek J. 2010, Antropomotoryka. PZWL, Warszawa
13. Sachnowski K.P. 2002. Sowremiennaja strategija mnogoletniej podgotowki sportsmienow. Wychowanie Fizyczne i Sport 1 (46): 176.
14. Skorowski J. 1968. Badania nad rozwojem wyników lekkoatletów. Lekka Atletyka 4: 11-12.
15. Sozański H. 1986. Zróżnicowanie rozwoju sportowego młodocianych zawodników w zależności od rodzaju treningu. AWF, Warszawa.
16. Sozański H. Zaporożanow W. 1993. Kierowanie jako czynnik optymalizacji treningu. Resortowe Centrum Medyczno-Szkoleniowe Kultury Fizycznej i Sportu, Warszawa.
17. Sozański H. 1999. Podstawy teorii treningu sportowego. Warszawa.
18. Sozański H. 2012. Ku poprawie efektywności systemu szkolenia sportowego (w:) Kierunki optymalizacji treningu i systemu szkolenia w sporcie wyczynowym- retrospekcja i perspektywy/ (red. W. Moska, J. Jaszczur-Nowicki). Gdańsk, AWFiS, 19-34.
19. Sozański H., Sadowski J., Czerwiński J. 2013. Podstawy teorii i technologii treningu sportowego Tom I, Warszawa-Biała Podlaska, 114-119.
20. Sozański H., Sadowski J., Czerwiński J. 2015. Podstawy teorii i technologii treningu sportowego Tom II, Warszawa-Biała Podlaska, 448-469.
21. Szustin B.N. 2001. Itogi wystuplienia rosyjskich sportsmienow na Igrach XXVII Olimpiady. Teorja i Praktika Fiziczeskoj Kultury 1: 57-62.
22. Tataruch R. 2014. Somatyczne i treningowe uwarunkowania szkolenia dyskoboli o zróżnicowanym poziomie sportowym. Studia i Monografie. Politechnika Opolska, Opole.
23. Vaeyens R., Güllich A., Warr c. R., Philippaerts R. 2009: Talent identification and promotion programmes of Olympic athletes. J. Appl. Physiol. 56.
24. Walaszczyk A. 1994. Przebieg karier sportowych płotkarzy (110 m), Trening 4, 87-90.

25. Wallechinsky D., Loucky J. 2012. The complete book of the Olympics. Aurum Sport, London.
26. Ważny Z., Sozanski H. 1980. W poszukiwaniu elementów do modelu mistrzostwa sportowego- analiza wybranych parametrów uczestników Igrzysk Olimpijskich w Moskwie, Montrealu i Monachium. Sport Wyczynowy 12, 13-56.

Strony internetowe

www.iaaf.org
www.pzla.pl
www.european-athletics.org
www.alltime-athletics.com
www.age-records.125mb.com
www.world.masters.athletics.com

Correspondence

Janusz Iskra
Opole University of Technology
ul. Kościuszki 84, 40-519 Katowice
Phone: (+48) 506143962
E-mail: j.iskra@awf.katowice.pl

Michał Pietrzak
University of Physical Education
Phone: (+48) 884937319
E-mail: mpietrzakawf@gmail.com

Monika Szczęsna
University of Physical Education
Phone: (+48) 500555734
E-mail: monikaszczesna7@o2.pl

Paweł Gwiazdoń
Medical University of Silesia
Department of Biopharmacy, School of Pharmacy
with the Division of Laboratory Medicine in Sosnowiec
Phone: (+48) 537401437
E-mail: pgwiazdon@wp.pl

Journal of Physical Education & Health, 2016, vol. 6 (9), 39-44

PHYSIOTHERAPY IN PERSONS OVER 80 YEARS OF AGE

Jan Szczegielniak[1,2,3], Katarzyna Bogacz[1,3], Dagmara Matelonek[4]

[1] The Technical University of Opole , Physiotherapy Institute, the Physiotherapy Department

[2] SP ZOZ MSWiA Hospital in Głuchołazach

[3] Vital Medic Hospital in Kluczbork

[4] Medical Centre in Strzelin

Abstract

Persons older than 80 are a significant group of patients in outpatient clinics.The aim of the study was to evaluate the effect of physiotherapeutic treatment of pain experienced by geriatric patients and to evaluate the basic activities in their daily lives before and after the 10 days improvement of the elderly during ambulatory treatment. The study was conducted at the Medical Center in Strzelin. The study group consisted of patients over 80 years of age (18 women and 6 men) with an average age of 86 ± 8, with pain caused by osteoarthritis, sciatica, rheumatoid arthritis, pericarditis and periarthritis. It has been shown that physiotherapeutic treatment in people over 80 significantly reduces feelings of pain and does not affect the improvement of basic activities in everyday life..

Key words: *Physiotherapy treatment, feeling pain, people over 80 years old.*

Introduction

As average life expectancy so has the number of elderly people. The general process of physical aging involves pathological lesions, problems with bodily functions, and morbidity of different systems and organs which lead to walking disorders and problems with personal activities. The situations described have an impact on the quality of elderly people's lives and limit their physical activity. Those people need medical and physiotherapy treatment and it is a challenge for doctors and physiotherapists. It is necessary to select a proper programme of activities for people who belong to the mentioned age group (1). No papers that refer to physiotherapy treatment dedicated to elderly people have been found so far. That is why the effects of physical therapy of people over 80 have been evaluated during outpatient treatment.

Aim

People over 80 are a large group of patients at outpatient clinics. They take part in individual or group activities, massages as well as physiotherapeutic treatment. The aim of this article is to evaluate the influence of physiotherapeutic treatment on pain and basic activities connected with everyday life before and after 10 days of activities selected for elderly people during outpatient treatment.

Reference methods and materials

The examinations were conducted at the Medical Center in Strzelin. The examined group comprised patients over the age of 80 (18 women and 6 men), the average age 86±8. Patients suffered from pain caused by osteoarthritis, sciatica, rheumatoid arthritis, ankylosing spondylitis and periarthritic inflammation. Examinations were carried out by a physiotherapist. The eligibility criteria consists of a referral form for physiotherapy treatment, the patient’s consent for taking part in examinations and obtaining a minimum of 4 points on an AMTS test. For the purposes of examinations patients have been evaluated according to Katza’s (ADL) scale to evaluate the basic activities of their everyday life. Hodgkinson's test (AMTS) was applied, which evaluates the mental

capacity of patients and Borga's 10-scale which evaluates the level of experienced pain (Tab. 1, 2, 3).

Katza's scale (ADL) evaluates 6 basic everyday life activities to determine patients' physical capacity. In examining patients according to this scale, the support of other people has been taken into consideration (Tab. 1).

Tab.1. Katza's scale – ADL (evaluation scale of basic every day life activities).

	INDEPENDENT - YES	INDEPENDENT - NO
1. BATHING	1	0
2. DRESSING/UNDRESSING	1	0
3. USING THE LAVATORY	1	0
4. GETTING OUT OF BED AND MOBILITY IN AN ARMCHAIR	1	0
5. INDEPENDENT EATING	1	0
6. CONTROLLED DISCHARGE OF STOOLS AND PASSING OF URINE	1	0

Score:

5 – 6 – non - disabled people

3 – 4 – moderately disabled people

=< 2 – considerably disabled people

Hodgkinson's test evaluates patients' mental capacity. Through simple questions and orders the awareness of the patients and their memory is controlled. The test described was carried out only once in order to qualify patients for the conducted examinations. The Patient had to obtain 4 or more points to be assured that the received answers evaluated according to Katz's scale and Borg's 10 scales were reliable (Tab. 2).

Tab.2. Mental capacity test according to Hodgkinson (AMTS).

How old are you?
What time is it?
Please repeat and try to remember the address you are going to hear – Gruszkowa Street 42.
What year is it?
What is you address?
When were you born?
What year did the Second World War start?
What is the name of the Polish president?
Please count backwards from 20 to 1.
Please repeat the address that you heard.

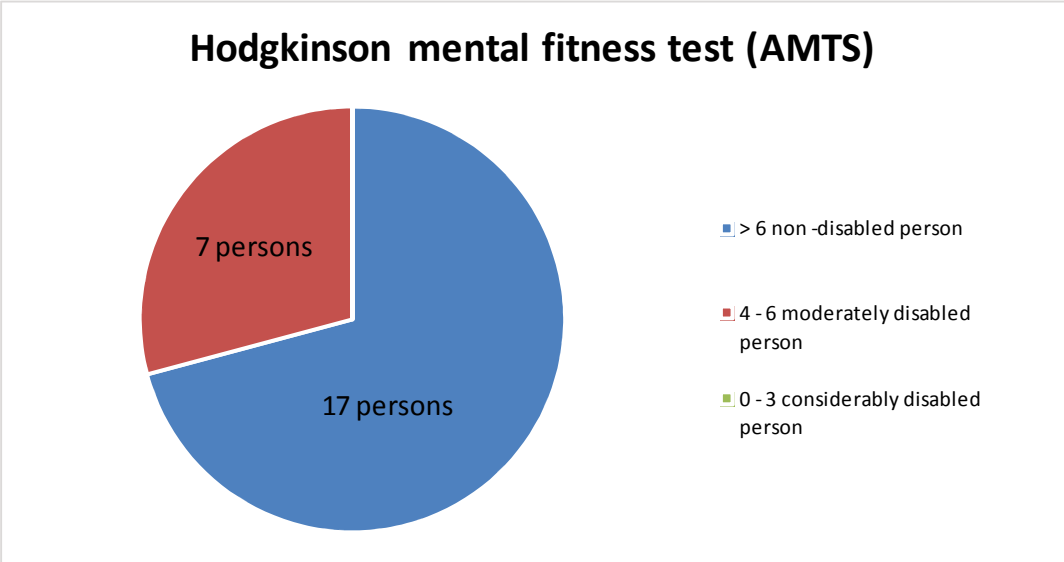
Single correct answer - 1 point, max. 10 points.

>6 – non – disabled person

4-6 – moderately disabled person

0-3 – considerably disabled person

Hodgkinson' s test shows that 17 patients are non – disabled, but 7 patients are moderately disabled (Ryc.1).



Ryc.1. Evaluation of mental capacity, according to Hodgkinson's Test, patients undergoing physiotherapeutic treatment.

Borga's scale is used for subjective measurement of the patients' degree of pain. The scale presented was used in order to obtain information about whether physical treatment lowers pain (Tab. 3).

Tab.3. 10 – Borga's 10 grade scale

BORGA'S SCALE USED FOR SUBJECTIVE MEASUREMENT OF A PATIENT'S DEGREE OF PAIN	
10 GRADE SCALE	
0	no pain
0,5	light pain
1	mild pain
2	annoying pain
3	moderate pain
4	significant pain
5	intense pain
6	
7	severe pain
8	
9	
10	severe pain, unable to perform tasks

Having qualified patients for physiotherapeutic treatment, the length of rehabilitation (10 days) was applied. This consists of physiotherapeutic treatment such as: a laser 1 time per day for about 5 minutes, a magnetic field 1 time per day for about 15 minutes, interferential currents 1 time per day for about 15 minutes, diadynamic currents 1 per day for about 15 minutes, TENS 1 per day for about 15 minutes, sollux 1 per day for about 15 minutes, cryotherapy 1 per day for about 3 minutes and ultrasound 1 per day for about 3

minutes on different parts of the body for example: lumbar spine, knee joint and shoulder girdle.

Physiotherapy treatment was used for 10 days according to the requirement of the National Health Fund.

At the beggining and at the end of the physiotherapeutic treatment programme that lasts 10 days, every patient took a subjective measurement of the degree of pain according to Borga's scale and evaluated the basic activities of their everyday life according to Katz's scale.

All patients finished selected the programme.

The data collected has been statistically analyzed. For each parameter the mean value and standard deviation have been charged. The materiality level within the group has been determined by using the T Student's Test.

Results

During the research, subjective measurement of pain degree according to Borga's scale and basic activities of everyday life according to Katza's scale have been analyzed. The mean value of examined indicators and average value were compared before and after physiotherapeutic treatment.

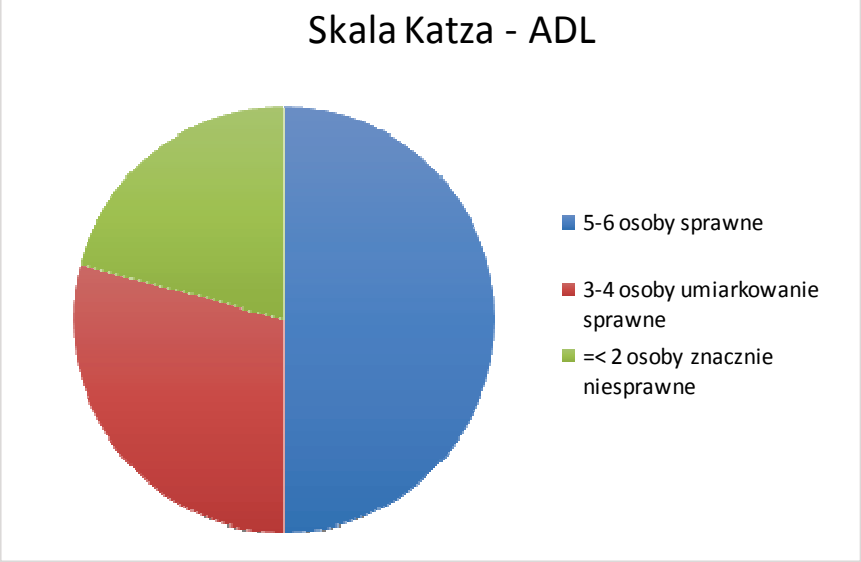
The study showed that the average value of pain experienced before physiotherapeutic treatment in the group of women was 9.5, but after physiotherapy treatment it is 8.5. The level of pain experienced lowered about 10.5% and it is statistically relevant.

In a group of men the level of experienced pain was 10, but after physiotherapeutic treatment 9. The level of experienced pain lowered about 10 % and it is statistically relevant (Tab. 4).

Tab.4. Evaluation of experienced pain before and after physiotherapeutic treatment.

Evaluation of experienced pain			
Before Women - Men		After Women - Men	
9	*10*	*7*	8
9	*10*	*9*	9
9	*10*	*9*	10
9	*10*	*8*	9
9	*10*	*10*	8
9	*10*	*7*	10
9		*8*	
9		*9*	
9		*10*	
10		*7*	
10		*8*	
10		*9*	
10		*10*	
10		*7*	
10		*8*	
10		*9*	
10		*9*	
10		*9*	
9		8	
9		9	
9		8	
10		8	
10		9	
10		9	

Patients' capacity for dealing with everyday life activities before and after physiotherapy has not changed (Ryc. 2).



Ryc.2. Evaluation of dealing with everyday life before and after physiotherapy.

Discussion

The aim of physiotherapy among elderly people is to improve physical capacity in everyday life as well as lower experienced pain. According to the Polish model of comprehensive physiotherapy presented by prof. Wiktor Dega (1) and guidelines that refer to individual rehabilitation of the geriatric, care should be individualized considering the existing distortions (2).

Examinations conducted by Marek Żak refer to the rehabilitation of people over 80 years old considering different types of physical activities with satisfactory results. Physical capacity has been improved significantly (3). Analyzed results of basic every day activities have not improved but the level of experienced pain has decreased according to Borga's scale.

Another form of physiotherapy is occupational therapy. Research conducted by Dr. Adrianna Maria Borowicz shows positive results of physical capacity in the area of basic activities of everyday life. What is more, occupational therapy enables participation in community life, the develop of passions and has influence on mental state, decreasing tension and levels of stress and promoting a healthy lifestyle (4).

The review of research conducted by Agnieszka Borzym shows that highly efficient risk reduction of falls indicates properly selected exercises that have an influence on proper body poise, better balance, strong muscles and better physical capacity in everyday life (5).

Physical treatment exercises have influence on decreasing feelings of anxiety about falling, improved blood flow, ameliorate the symptoms of depression, and improve the quality of sleeping which is reflected in patients' well-being (6).

On the basis of studies it is assumed that physical treatment has a positive influence on reduced levels of experienced pain but it does not affect the physical capacity of elderly people (7).

Results of research conducted by the authors of this article and results presented by other authors are evidence of the need to apply comprehensive physiotherapy to geriatric patients in order to obtain better physical capabilities. The aim of detailed recordings and reviews of the effects of physiotherapy on longevity, which involves physical treatment,

kinesiotherapy and occupational therapy, are necessarily for further examinations of geriatric patients who suffer from pain caused by osteoarthritis, ischias, rheumatoid arthritis, ankylosing spondylitis and periarticular inflammation (1, 7).

Conclusion

1. It has been proved that physiotherapeutic treatment of geriatric patients over 80 years old significantly decreases experienced pain.

2. It has been pointed out that physiotherapy treatment does not have any influence on improvement of basic activities connected with everyday life.

3. Kinesiotherapy and occupational therapy is a favorable form of rehabilitation amongst geriatric patients.

BIBLIOGRAPHY

1. Dega W.: Kształtowanie się modelu rehabilitacji w Polsce. Wydawnictwo Lekarskie PZWL. Warszawa 1983.
2. Derejczyk J., Grodziński T., Jakrzewska-Sawińska A. i wsp.: Standardy świadczeń usług medycznych w specjalności geriatria. „Gerontologia Polska". 2005; 13: 67-83.
3. Żak M.: Rehabilitacja osób po 80 roku życia z zaburzeniami czynności życia codziennego. „Gerontologia Polska". 2005; 13 (3): 200-205.
4. Borowicz A.: Terapia zajęciowa jako forma rehabilitacji osób starszych. „Rehabilitacja w praktyce". 2015; 2: 42-45.
5. Borzym A.: Upadki osób w podeszłym wieku – przyczyny, konsekwencje i zapobieganie. „Psychogeriatria Polska". 2009; 6 (2): 81-88.
6. Gardner MM, Robertson MC, Campbell.: Exercise in preventing falls and fall related injuries in older people: a review of randomized controlled trials. "Br J Sports Med". 2000; 34: 7-17.
7. Pawełczyk W., Bajowska J., Wójtowicz B., Bogacz K., Sirek T., Szczegielniak J.: Ocena zastosowania feedbacku oddechowego w fizjoterapii chorych na POChP. „Fizjoterapia Polska". 2014; 4: 12-18.
8. Galon M., Zaremba-Szopa A., Sosna M.: Przegląd metod fizykoterapeutycznych w chorobie zwyrodnieniowej stawów. „Rehabilitacja w praktyce". 2014; 2: 51-54.
9. Szczegielniak J., Pawełczyk W., Łuniewski J., Wdowiak A. i wsp.: Ocena wydatku energetycznego w teście 6MWT i ISWT. Fizjoterapia Polska 2013; 1: 1-5.
10. Studnicki R., Góral A., Dymek K., Krzemińska K., Bytner A.: Ocena skuteczności zabiegów fizykalnych w redukcji bólu. „Rehabilitacja w praktyce". 2014; 1: 39-42.
11. Katan A., Kaczorowska A.: Ocena funkcjonalnej sprawności fizycznej osób starszych – test seniora. „Rehabilitacja w praktyce". 2015; 6: 52-56.
12. Skopowska A., Ciechanowska K., Szymańska J. i wsp.: Zastosowanie niskich temperatur w wybranych jednostkach chorobowych. „Rehabilitacja w praktyce". 2015; 1: 37-39.
13. Kozak-Szkopek E., Galus K.: Wpływ rehabilitacji ruchowej na sprawność psychofizyczną osób w podeszłym wieku. „Gerontologia Polska". 2009; 17 (2): 79-94.

Correspondence

Dagmara Matelonek
Medical Centre in Strzelin
E-mail: dagmara.matelonek@gmail.com

Journal of Physical Education & Health, 2016, vol. 6 (9), 45-53

GOALS OF PHYSICAL EDUCATION BASED ON OPINIONS OF ACADEMIC TEACHERS FROM SELECTED POLISH UNIVERSITIES

Kamil Wręczycki[2], Cezary Kuśnierz[1], Izabela Zając-Gawlak[3]

[1] Opole University of Technology, Opole.,

[2] MOS Opole

[3] University of Physical Education, Katowice

Abstract

To achieve its aim, any human activity needs to be performed consciously and purposefully. In this way, such an activity strengthens perseverance and contributes to the development of a strategy of action. The selection of the objective is associated with the valuation and hierarchy of goals and in such circumstances the teacher who targets the completion o a variety of tasks needs to determine what is important for them, prioritise, and establish which activities are indispensable in order to proceed to further steps (Strelau, 2000). Physical education forms a process through which students are prepared for an independent, satisfying and life-long participation in movement culture(Crum, 2007). However, the realization of these goals is relative to activities on the part of teachers and adequate education throughout the course of the study program. The objective of this paper is to establish the opinions of academic teachers regarding the hierarchy of the goals of physical education. The survey involved 52 teachers working at three Polish universities: Opole University of Technology, University of Physical Education in Katowice and State Higher Vocational School in Racibórz. The method involved a diagnostic technique, i.e. a survey in the form of a questionnaire. The specific tool applied a survey developed by the European Physical Education Association. On the basis of the replies to the questionnaire we can conclude that all interviewees agree on the principal objective i.e. encouraging students to follow an active and healthy lifestyle. This objective was followed in priority by ensuring students' safety during physical education classes and developing the range of movement skills.

Key words: *goals of physical education, hierarchy, academic teachers..*

Introduction

Physical education forms a process through which young people prepare for an independent, satisfying and life-long participation in the culture of movement (J. Pośpiech 2003 after Crum 2003). The realization of the objectives of physical education is related considerably to the educational priorities followed by academic teachers, since the latter have a decisive role in the perception of physical education amongst their students, i.e. future teachers of this school subject.

It was stated by Bart Crum (J. Pośpiech after B. Crum 2003) that the school should provide students with basic competency as a result of which the latter will develop the ability to:

– adapt the course of activity to particular circumstances,
– appreciate and organize health promoting activities,
– act as a critical sports consumer,
– maintain a distance in relation to media reports.

The realization of the goals of physical education is considerably dependent on teachers themselves. The existing differences in the educational priorities followed by teachers can arise along the career path followed by teachers with a greater length of service, in particular with regard to those educated under the influence of the biotechnology-based theory of physical

education. The reasons for the discrepancies between teaching strategies in accordance with Bart Crum's theories can be associated with the various ideologies followed by teachers of physical education. "The first ideology – characterized by the idea of 'education-through-the-physical' – which claims that the described effects on character and personality development come more or less automatically simply by taking part in movement activities with the ascribed educational potential ". (Crum 2007, p.5).

"The second ideology is 'training-of-the-physical'. The objectives of PE are formulated in terms of training effects and the content is described in terms of exercises that are classified according to desired effects and/or body parts. The main methodological rule of thumb is: keep students busy with frequent repetitions of simple exercises" (Crum 2007, p.6). Political transformations and socio-political factors can play a role in the educational views of teachers as they affect the system of education and vocational training. For this reason, it is important to correctly determine the hierarchy of the objectives followed in physical education and adapt a uniform system of teacher training (Kuśnierz 2015).

Research in the area of physical education undertakes basic issues related to the realization of this school subject. During such studies, one of the objectives is to determine educational activities, the effect of which is a commitment to developing well-educated persons in this area. To give an example, the European vocational associations in this area united in 1990 to form European Physical Education Association, (EUPEA), whose main objective is concerned with the protection and promotion of the Physical Education subject curriculum in school (Hardman, Green 2011). The important role of physical education as a subject that is recognized by the EU is demonstrated by the fact that the year 2004 was called the European Year of Education through Sport, and 2005 was named the United Nations International Year of Sport and Physical Education. Nevertheless, despite the considerable progress visible in many countries, the actual issue is probably associated with the "permanent tension between the unfulfilled humanistic commitments expressed by politicians and compensation strategies generated by non-governmental organizations" (Klein, 2003, p. 424).

In consideration of the fact that each student attends school for at least 12 years and that schools employ professional PE teachers, the school takes responsibility for introduction to movement culture and the acquisition of movement competency (Crum 2007). The teaching of movement and sport should be followed by analogy to the teaching languages and literature. Despite the fact that the latter introduces the young to linguistic culture, the former gives an introduction to movement culture (Crum 2007). However, in order to ensure that this process occurs adequately, it is necessary to start from the source of the issue and determine which of the goals of PE are recognized as most important by the staff responsible for preparing future teachers, i.e. by academic teachers. "As long as the professor of biomechanics teaches a different message about the essence of PE than the pedagogy professor and as long as the games methodology teacher has a different PE perspective than the teacher for gymnastics methodology (just to give some examples), a PETE program will never be able to defeat the power of the apprenticeship of observation" (Crum 2007, p. 10).

The perception of the issue stated by Bart J. Crum can be limited to the statement regarding the differences between the objectives of physical education recognized by academic teachers in charge of theoretical subjects, such as theory of physical education, theory of learning, methodology of physical education and the group of university teachers providing training in the gymnastics hall, swimming pool and athletic stadium.

Objective of the study

This study aims to learn and report on the hierarchy of the objectives of physical education as they are recognized and valued by academic teachers.

Study questions:

- Which of the objectives of physical education are most important in the opinions of academic teachers?

- Are there differences in the hierarchy of goals followed by teachers teaching theoretical and practical courses?
- Does gender form a factor in the hierarchy of the goals?

Material and Methods

The pilot studies involved 52 teachers working at Polish universities: Opole University of Technology, The University of Physical Education in Katowice and State Higher Vocational School in Racibórz. The method involved a diagnostic technique, i.e. a survey in the form of a questionnaire developed by the European Physical Education Association (Repond, 2010). This questionnaire includes 13 goals of physical education representing general and detailed content, and the task of the interviewees was to indicate a hierarchy by marking the most important goal and giving a score to the remaining objectives in accordance with their preferences with regard to the priority. The analysis of the results involved calculation of arithmetic means and the statistical materiality level was established by the application of the Mann-Whitney test.

Results

An adequate selection and effective implementation of the objectives of physical education can provide students with suitable competency that can enable life-long participation in the culture of physical education. The acquisition of the competency will be relative to the effective following teaching and educational activities and fulfillment of their goals. A classification of such goals was provided by the European Physical Education Association, and it involved 13 competencies considered as core to the subject curriculum. They are formulated as follows:

1. ‘To encourage students to follow an active and healthy lifestyle’
2. ‘To develop a feeling of personal well-being’;
3. ‘To spread values among students that are connected to participation in sport: solidarity and fair play’;
4. ‘To ensure students’ safety during classes’;
5. ‘To develop a broad repertoire of students’ competence in movement’;
6. `To show students the cross-curricular links between physical education and other school subjects`
7. ‘To promote among students the social and cultural importance of sports and physical activity’
8. ‘To develop students’ ability to evaluate their own and others’ performance’;
9. ‘To develop group management skills and the ability to organize others’ work’;
10. ‘To appreciate the value of fitness and health’;
11. ‘To develop the capacity to apply and develop skills in specific forms of physical activity’;
12. ‘To foster a sense of citizenship’;
13. ‘To provide opportunities for satisfactory participation in classes to all students, regardless of ability, gender or social and cultural background’.

The analysis of the results based on arithmetic mean demonstrates that among the goals listed above, the teachers recognized objective no. 1 as the most important one (encouraging students to follow an active and healthy lifestyle’). It was followed by two equally important ones (goals 4 and, 5, i.e. ensuring students’ safety during classes and developing a broad repertoire of students’ competence in movement). The goals that are considered as the least relevant to the teaching process include: no. 12: fostering a sense of citizenship and no. 6., i.e. encouraging students to appreciate the cross-curricular links between physical education and other school subjects (Fig. 1).

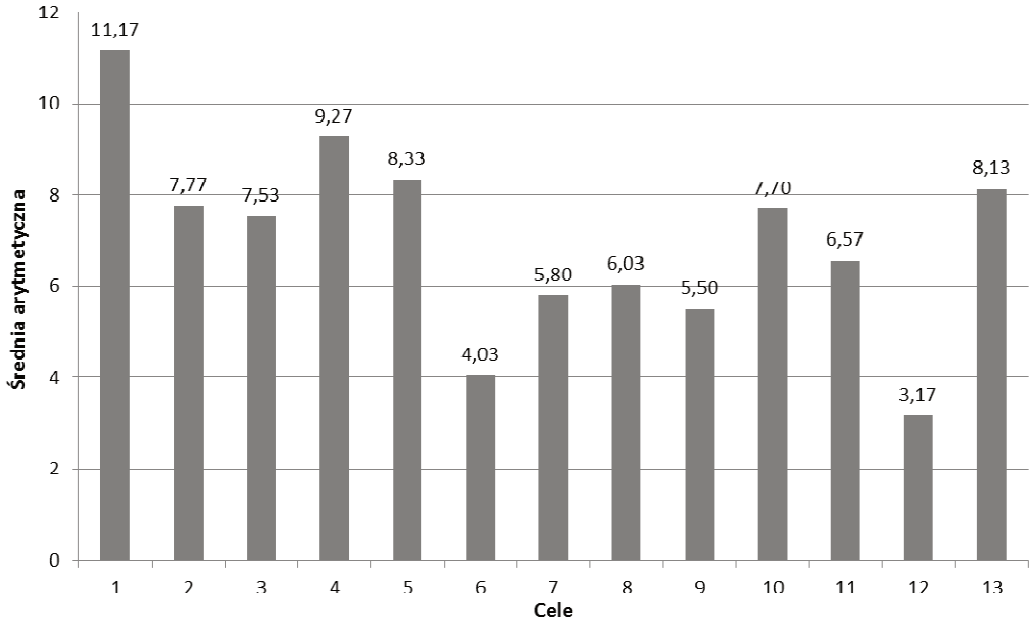


Fig. 1. Differences between EMG recordings of the right and left side of the body in individual movement schemes (I - marching, II - trotting, III - running)

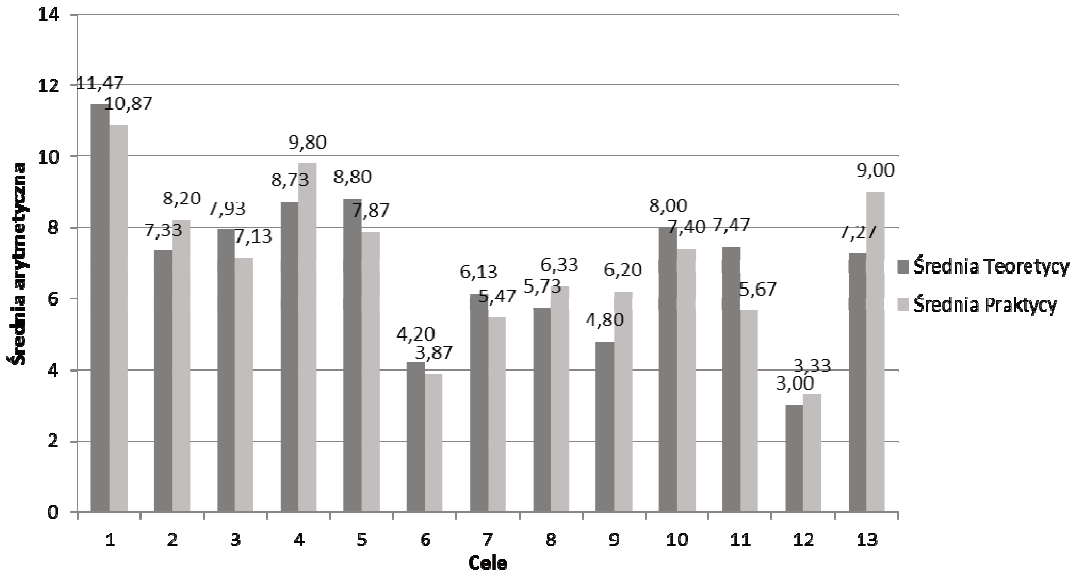


Fig. 2. Hierarchy of goals of physical education, comparison of staff teaching theoretical and practical courses

On the basis of a comparative analysis of the arithmetic mean gained from the interviews involving academic staff teaching theoretical and practical courses, we can immediately note some differences in the hierarchy of goals in the area of physical education observed by the two

groups of academics. Despite the fact that both groups indicated objective no. 1 as the most important one, later choices demonstrate discrepancies between the two groups. The second place among theoreticians is occupied by goal no. 5, i.e. development of a broad repertoire of abilities, whereas the practitioners indicated goal no. 4, which is associated with ensuring student safety during the classes. The objective no. 4 took third place in the opinion of the staff teaching theoretical subjects, whereas for those giving practical courses this position is occupied by providing opportunities for satisfactory participation in classes regardless of ability, gender or social and cultural background (goal np.13), for details see Fig. 2.

The following step involved a comparison of the hierarchy while focusing on the differences depending on the gender of the interviewees. With regard to goal no. 1, i.e. encouraging students to follow an active and healthy lifestyle, a higher arithmetic mean was registered in the female group and similarly a higher score among women was indicated with regard to goals no. 4 (ensuring student safety during class) and no. 2 (developing a feeling of personal well-being). Concurrently, the male interviewees tend to pay more attention to goal no.13 (providing opportunities for satisfactory participation in classes to all students regardless of ability, gender or social and cultural background) and goal no. 8 (developing students' ability to evaluate their own and others' performance), details can be found in Fig. 3.

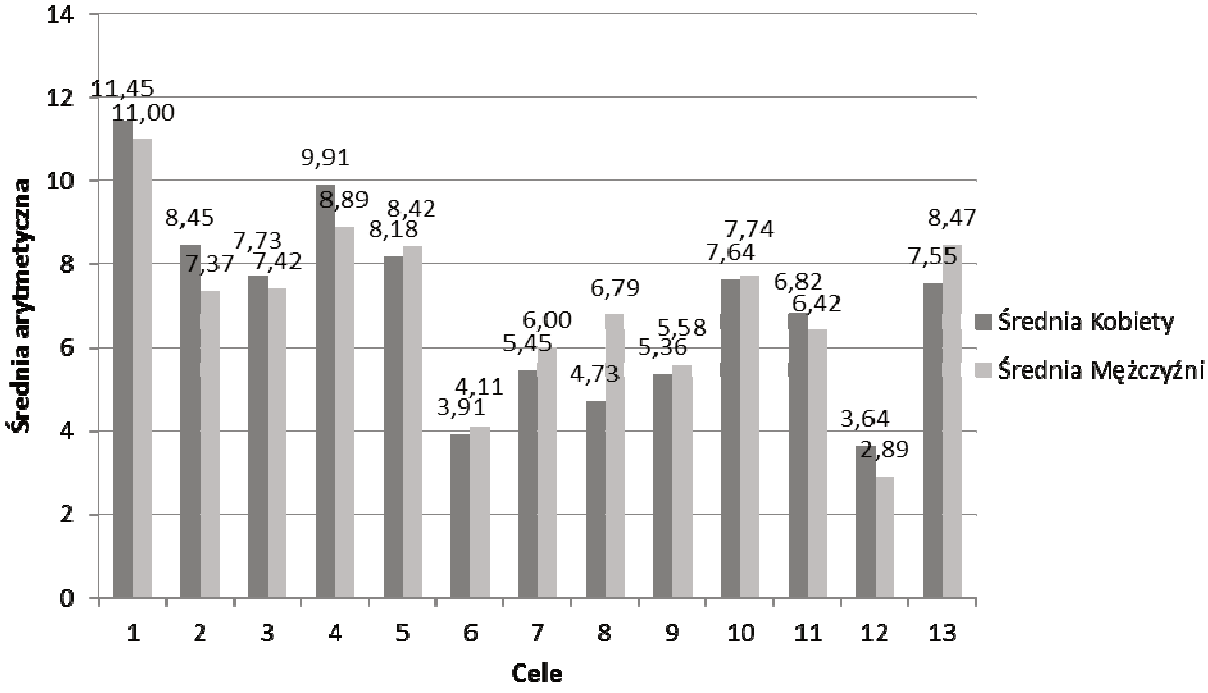


Fig. 3. Hierarchy of goals of physical education on the basis of comparison of male and female academic teachers

By comparing the hierarchy of goals reported by the teachers of the particular universities, we can note that all of them indicated goal no. 1 to be the most important; however, there are some differences with regard to the hierarchy of the remaining goals. For instance, goal no. 4 regarding ensuring safety is more highly valued by teachers from Racibórz and Opole compared to Katowice and a similar situation is noted with regard to goal no. 11. Concurrently, in comparison to the teachers from Racibórz and Opole, the staff from Katowice university tend to give higher priority to goals no. 9 and 11. We can also note that with regard to goals np. 6 and 12, there is a strong consensus among the interviewed academic staff from the

universities participating in the studies (see Fig. 4).

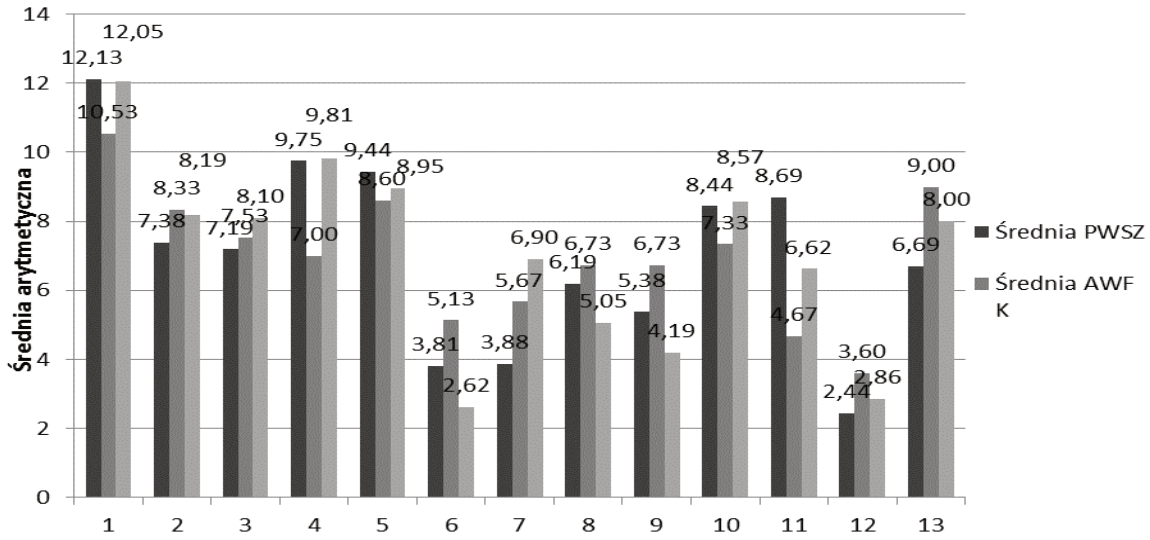


Fig. 4. Hierarchy of goals of physical education – a comparison of teacher opinions from various universities.

A statistical analysis was also performed with the purpose of determining the differences in the hierarchy indicated by the academic staff teaching theoretical and practical courses. The statistically material differences could only be observed with regard to goal no. 9, which was given a higher rank by the staff teaching practical courses and goal no.11, which is more respected by theoreticians (Table 1). On the basis of statistical analysis regarding the gender-related variations, only differences were noted with regard to goal no. 8, which was given a higher rank by male teachers (Table 2).

Table 1. Hierarchy of goals based on classification of staff teaching theoretical and practical courses.

Goal no.	Mann-Whitney U test with regard to variable: theory/practice. Statistically material differences ($p < 0.05$) are marked by bold font				
	Overall rank theoreticians	Overall rank practitioners	U	Z	P
1	854.0	524.0	248.0	1.56	0.11
2	715.5	662.5	280.5	-0.96	0.33
3	868.5	509.5	233.5	1.83	0.06
4	719.0	659.5	284.0	-0.90	0.36
5	777.5	600.5	324.5	0.15	0.87
6	716.0	662.0	281.0	-0.95	0.33
7	783.0	595.0	319.0	0.25	0.79
8	720.0	658.0	285.0	-0.88	0.37
9	657.5	720.5	222.5	**-2.03**	**0.04**
10	835.5	542.5	266.5	1.22	0.22
11	888.5	489.5	213.5	**2.20**	**0.02**
12	738.5	639.5	303.5	-0.54	0.58
13	684.5	693.5	249.5	-1.53	0.12

Table 2. Gender-related hierarchy of goals.

Goal no.	Test U Mann-Whitney U test with regard to variable: theory/practice. Statistically material differences ($p < 0.05$) are marked by bold font				
	Total rank F	Total rank M	U	Z	p
1	610.0	768.0	303.0	0.49	0.62
2	660.5	717.5	252.5	1.42	0.15
3	631.5	746.5	281.5	0.88	0.37
4	654.5	723.5	258.5	1.31	0.18
5	556.0	822.0	303.0	-0.49	0.62
6	499.0	879.0	246.0	-1.54	0.12
7	544.0	834.0	291.0	-0.71	0.47
8	475.5	902.5	222.5	**-1.98**	**0.04**
9	566.0	812.0	313.0	-0.30	0.75
10	513.0	865.0	260.0	-1.28	0.19
11	614.5	763.5	298.5	0.57	0.56
12	616.0	762.0	297.0	0.60	0.54
13	596.5	781.5	316.5	0.24	0.80

Discussion

The goals of physical education play a role in the shape of physical culture and hence a diagnosis with regard to them can be extremely important. The interviewees participating in the survey play professional roles concerned with training future teachers and this was the rationale for the selections made by the respondents. The current study can be considered as an initial pilot study and it can form a starting point for a further analysis of the issue of the hierarchy of goals. The impact of the work of a physical education teacher is relative to the formation of a value system in the area concerned with care for health and fitness as well as consistency in attitudes that are manifested (and not only declared) by teachers and their students (Bronikowski 2005). A solution to this issue should require a consistent approach among teachers to the overall objectives and the tasks of physical education that stem from them. It was stated by Sulisz (2005) that the particularly good effectiveness of the education can be achieved in conditions when a coherent educational system is formed by an education and training environment that is based on shared and respected values. Nevertheless, it seems that the durable outcome of education is not related to the apparent respect for value systems declared by teachers. An educational outcome can only be achieved as a result of an approach involving professional and emotional commitment. Physical education does not only form a teaching process; in contrast, it is principally based on an educational process (Kuśnierz 2015).

The objectives of physical education in accordance with Crum (2007) should be stated in such a manner that the effects they produce should take the form of an introduction to movement culture. As a result, the participants can gain the needed competence to achieve an independent, conscious, durable and satisfying participation in physical culture. The selection made by academic staff with regard to goal no. 1: ‘to encourage students to follow an active and healthy lifestyle’ demonstrates the correct interpretation and approval for the humanist idea of the theory of physical education. This goal was also selected to be the most important one in the studies reported in various European countries (Hardman, Green, 2011) as well as by teachers based in schools in the southern part of Poland (Kuśnierz 2015). Such an outcome can also demonstrate similar tendencies observed among the developmental tendencies in physical education as well as the common educational

priorities followed in many countries in Europe. Further analysis conducted by Crum revealing a varied hierarchy of goals reflected by remaining choices with regard to goals of physical education registered are attributed to a diversity of versions of the theory of physical education followed by PE teachers. The professional experience gained by PE students during their apprenticeships in schools can have a considerable outcome in the form of recognition of the principles observed and followed in this profession. We can predict that through apprenticeships accompanied by observations made by students during physical education classes, many students were able to learn about the principles of the traditional biotechnology approach to physical education. Consequently, this leads to a professional approach among new teachers that mainly reflects the ideas concerned with the general development of exercise and game-playing tasks (Crum 2007). Even if a PETE program succeeds in accomplishing the desired PE teaching perspective, there is a great chance that these changes will appear to be cosmetic once student teachers or new teachers confront the constraints of real work in schools. Because many supervising cooperating teachers, older colleagues, principals, parents and students hold non-teaching perspectives and expectations concerning PE, the old perspectives will be reinforced (Dodds, 1989; Griffin, 1985; O'Sullivan, 1989; Placek, 1983; Tannehill, 1989). Research indicates that the approach to this subject plays the principal role in the prediction of future physical activity (De Bruijn et al., 2006, Kuśnierz, 2005,2006,2008,2009). The positive experience derived from PE classes will have an effect in the form of a stimulus to undertake various types of exercise and practice sport. In contrast, a negative experience can produce a reverse effect, and can discourage students from involvement in sport activities in the future. Knowing the sources of student satisfaction, teachers often tend to meet students' expectations, which positively affects the level of activity during class but has a detrimental effect on the teaching function played by PE classes. Other reports focus on the fact that meeting of the adopted goals by the students is related to the way in which curricula are followed and the achievement of the maximum effect depends on the selection of particular types of physical activity (Kuśnierz, 2015). A model that can be derived from a study by Fisher et al. (2011) is close to a suggestion that a goal of the subject that is close to the students' needs leads to the better realization of the adopted objectives.

Conclusion

The results representing the opinions of academic teachers regarding the hierarchy of goals of physical education have considerable implications both for theory and scientific practice. The hierarchies indicated by the interviewees are in accordance with the values established in the humanist concept of the theory of physical education and the latter emphasizes the role of an active and healthy lifestyle. A comparison of the academic staff teaching theoretical and practical courses demonstrates that statistically material differences are only noted with regard to two goals, which involve the development of group management skills and the ability to organize others' work and developing the capacity to apply and develop skills in specific forms of physical activity. The only gender-related differences could be observed with regard to one objective and this can mean that gender does not have an effect on the hierarchy followed by the academics interviewed. The results of the pilot studies need to be confirmed by studies involving a wider group of interviewees, preferably a study extending to all Polish universities teaching physical education at Master's degree level. It would also be necessary to extend the scope of the investigated variables and perform a wider statistical analysis of the results.

REFENENCES

1. Bronikowski M. : Hierarchy of goals of physical education as assessed by physical education teachers. [in Polish: Hierarchia celów operacyjnych wychowania fizycznego w ocenie nauczycieli wychowania fizycznego.] Zeszyty Naukowe AWF w Poznaniu 2005, Vol. 54 pp.195-197
2. Crum B. How to pave the road to a better future for physical education. Paper presented at the meeting of the physical education teachers at the PWSZ, Racibórz 2007Babu D., Roy S. Left-right asymmetry: cilia stir up new surprises in the node. Open Biol, 2013; 3(5): 130052
3. Crum B. Conventional Thought and Practice in Physical Education: Problems of Teaching and Implications for Change 1993. Quest,45, pp.339-356
4. De Bruijn G-J., Kremers, S.P.J., Lensvelt-Mulders, G., De Vries, H., Van Mechelen, W., &Brug, J. : Modeling individual and physical environmental factors with adolescent physical activity. American Journal of Preventive Medicine, 2006, Vol.30, 507-512.
5. Fisher R., Repond R., Diniz J. : A Physicially Educated Pearson. [In:] K.Hardman & K. Green (EDS.), Contemporary Issues In Physicial Education 2011 69-89. Meyer & Meyer Verlag.
6. Hardman K. & Green K. : Contemporary Issues In Physical Education. Meyer & Meyer Verlag 2011
7. Kuśnierz C. : Hierarchy of goals of physical education students based on the opinions of teachers and students from south-western Poland [in Polish: Hierarchia celów wychowania fizycznego w opiniach nauczycieli i uczniów południowo-zachodniej Polski]. Politechnika Opolska 2015.
8. Kuśnierz C. : Reasons for students' aversion to physical education lessons [in Polish: O przyczynach niechęci młodzieży szkolnej do lekcji wychowania fizycznego], [In:] Dydaktyka wychowania fizycznego w świetle współczesnych potrzeb edukacyjnych, AWF Wrocław 2005, pp. 129-135.
9. Kuśnierz C. : Students attitudes towards physical education lessons [in Polish: Oczekiwania uczniów wobec lekcji wychowania fizycznego], Annales Universitatis Mariae Curie-Skłodowska, Sectio D Medicina, Vol. LX, Suppl. XVI N 4 Lublin 2006, pp. 143-146
10. Kuśnierz C. : Students' views regarding realization of physical education in a secondary school [in Polish: Opinie uczniów o realizacji wychowania fizycznego w szkole ponadgimnazjalnej] (R. Czarnecka, Ed.) Szkoła wobec dylematów i inspiracji w zakresie teorii i metodyki wychowania fizycznego. V Ogólnopolska Konferencja Naukowa, 2008, Łowicz pp. 42-45.
11. Kuśnierz C. : Rural environment students' attitudes toward physical education teachers [in Polish: Oczekiwania uczniów ze środowiska wiejskiego wobec nauczyciela wychowania fizycznego], [In:] Rozprawy Naukowe, (R. Bartoszewicz, T. Koszczyc, A. Nowak, Eds.) AWF Wrocław 2009, pp.282-286.
12. Pośpiech J. : Physical education and school sports in European countries – selcted problems [in Polish: Wychowanie fizyczne i sport szkolny w krajach europejskich – wybrane problemy, [In:] „Studia i monografie", Vol.145, Politechnika Opolska 2003.
13. Repond R. M. : Current trends and future directions of school Health and Physical Education in Europe. Global Forum on Physical Education Pedagogy, Northem Iowa University 2010.
14. Sulisz S. : Students' sport teams as a point of clash between various educational concepts [in Polish: Uczniowskie kluby sportowe jako teren ścierania się różnych koncepcji edukacyjnych] "Kultura Fizyczna " 2005.
15. Strelau J. : Psychology. Academic textbook. [in Polish: Psychologia. Podręcznik akademicki.] Gdańsk 2000.

Correspondence

Cezary Kuśnierz
Opole University of Technology
E-mail: ckusnierz@op.pl

Journal of Physical Education & Health

Social Perspective

PHYSICAL EDUCATION TEACHER

We are planning to issue a volume including materials concerning the **education, improvement of qualifications and the work of physical education teachers in different countries**.

We would like to invite all physical education teachers/scholars to prepare articles on the above mentioned topic, analyzing/exploring/characterizing the situation in your country. This could be a case study regarding the entirety of the above mentioned topic or selected issues within this scope, such as:

1. The profession of a physical education teacher

- qualifications entitled to realize the program of physical education at respective levels of school education; qualifications for the realization of the various physical education programmes at all levels of learning/education
- number of didactic classes per week;
- age of retirement;
- results of research projects, as well as the characteristic foci of publications concerning this profession;

2. Studies preparing for the above mentioned profession

- types of schools educating/training physical education teachers;
- structure of educational programmes (names of subjects, the scope of classes realization of such programmes);
- professional titles of graduates;
- results of research and the characteristics of issues concerning the education of physical education teachers;

3. Improvement of professional qualifications for physical education teachers

- normative settlements regarding this problem;
- programmes and the organizational form of courses for physical education teachers;
- the results of research and the characteristic problems concerning this issue.

4. Other issues within the scope of the above topic specific to your country.

Works should be submitted (only as an attachment to an e-mail)
to the following e-mail address: **jpe_health@onet.eu** – in the form compliant with the requirements of the magazine

(vide: **www.jpe-health.pwsz.raciborz.edu.pl**).

Following a positive review, articles shall be published in following issues.

Jerzy Pośpiech
Editor

INFORMATION FOR THE PAPER AUTHORS

Journal of Physical Education & Health

Social Perspective

is a science periodical published by the following universities: Technical University in Opole (Poland), High State School in Raciborz (Poland) and University of Balearic Islands (Spain)
which discusses the following issues:

- the health of children, adolescents and adults,
- physical activity amongst children, adolescents and adults,
- attitudes towards health amongst children, adolescents and adults,
- knowledge about health amongst children, adolescents and adults,
- initiatives and programmes designed to improve health,
- physical and health education in school curricula and public services,
- the training of teachers of different specialisms,
- developing professional skills amongst teachers and
- the training and employment of teachers.

Journal of Physical Education & Health

Social Perspective

publishes papers only in English:
▪ original papers (anonymously reviewed), ▪ demonstrative papers, ▪ editorial papers,
▪ polemics, ▪ conference and symposium information.

Original or editorial papers (including tables, bibliography, abstract)
may not be more than 30,000 characters including spaces (about 15 pages A4).

Layout of the materials submitted to be published:

1. **page**: title, names and surnames of authors, name and address of the institution represented by authors, postal address, telephone number, e-mail, agreement,
2. **page** and following pages: title, abstract (15 to 20 lines), keywords (to 5), text.

Materials submitted for publication (text – type 12 point, 1,5 of line, tables, and figures (black-white) with numeric data describing them) should be sent only as a Word document with doc. extension as an e-mail attachment.
Text should be sent by the first author from his or her e-mail box.
Layout of the original paper only: abstract, introduction, aim, materials and methods, results, discussion, conclusion, bibliography (up to 30 positions).

Footnotes in the paper referring to the bibliography should be marked with Arabic numerals and square brackets. Bibliography listing should be numbered in alphabetical order.

The submitted paper cannot be printed or submitted for publication in another journal.

A statement confirming this condition should be on the front page of the paper.
Submitting a paper for publication and attaching other data is considered a conscious agreement to printing and publishing electronically, and also on the Internet.

The editorial office reserves the right to shorten papers, correct linguistic mistakes and make any other editorial corrections.

Authors do not receive any royalties for publishing their articles, although authors receive a copy of the journal.

Editorial office address

(Editor-in-Chief: prof. Jerzy Pośpiech)
Politechnika Opolska, WWFiF, ul. Prószkowska 76, budynek nr 9 p. 23, 45-758 Opole, Poland
www.jpe-health.pwsz.raciborz.edu.pl
e-mail: jpe_health@onet.eu


POLITECHNIKA
OPOLSKA


UIB


PWSZ
W RACIBORZU