Dynamics of girls' motor skills in a three-year research cycle

Dynamika sprawności motorycznej dziewcząt w trzyletnim cyklu badań

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Key words: motor skills, physical activity, general fitness tests, the period of adolescence.

Słowa kluczowe: sprawność motoryczna, aktywność fizyczna, test sprawności ogólnej, okres dojrzewania.

Abstract

Aim of the research: To evaluate the motor performance of girls from Swietokrzyskie Voivodship in a 3-year cycle of research, taking into account any additional physical activity.
Material and methods: The study period covered the years 2008 to 2010. The study included 31 girls from birth vintage 1997 from Secondary School No. 11 in Kielce. To assess motor skills the Krzysztof Zuchora Physical Fitness Index was used. In order to obtain information about taking up additional physical activity a questionnaire technique was used.
Results: The undertaken studies do not indicate a radical improvement or deterioration in the overall motor performance of girls in the three-year test cycle. Only analysis of individual motor skills gives a better picture of the direction of the motor skills development of tested students. Execution of continuous testing of motor skills of girls at puberty makes it possible to know the progress or regress of individual abilities.
Conlusions: Studies confirm that taking up additional physical activity has a positive influence on the development of human motor skills. Girls at puberty require special interest and encouragement to take up physical activity during physical education classes or other forms of physical activity.

Streszczenie

Cel pracy: Ocena sprawności motorycznej dziewcząt z województwa świętokrzyskiego w latach 2008–2010 z uwzględnieniem podejmowania dodatkowej aktywności fizycznej.
Materiał i metody: Badaniami objęto 31 dziewcząt urodzonych w 1997 r. – uczennic Zespołu Szkół Ogólnokształcących nr 11 w Kielcach. Do oceny sprawności motorycznej wykorzystano Indeks Sprawności Fizycznej Krzysztofa Zuchory. W celu zdobycia informacji o dodatkowej aktywności fizycznej wykorzystano ankietę.
Wyniki: W badaniach nie wykazano radykalnego polepszenia lub pogorszenia ogólnej sprawności motorycznej dziewcząt w cyklu trzyletnim. Dopiero analiza poszczególnych zdolności motorycznych umożliwiła lepsze zobrazowanie ich rozwoju motorycznego. Ciągłe badania dotyczące sprawności motorycznej dziewcząt w okresie dojrzewania pozwalają na poznanie kierunku postępu lub regresu poszczególnych zdolności motorycznych.
Wnioski: Dodatkowa aktywność fizyczna korzystnie wpływa na sprawność motoryczną. Dziewczęta w okresie dojrzewania wymagają szczególnego zainteresowania i powinny być zachęcane do wysiłków fizycznych podczas lekcji wychowania fizycznego lub do podejmowania dodatkowej aktywności fizycznej.

Introduction

Human motor skills are a particular area of interest for many professionals. There are trials to explain multiple aspects, symptoms, conditions and specific developmental processes [1–3]. Human motor skills are defined as all motor activities, the realm of motor activity, in short everything that concerns the movement of man in space as a result of changing the position of the whole body or any of its parts [4]. In Poland, there are two concepts operating in theory and practice: physical fitness and motor efficiency. In 1968, the World Health Organization (WHO) considered that physical fitness is most accurately reflected by the ability to do muscle work effectively. It is a very complex property that depends on gender, age, health status, motor abilities, body build, musculoskeletal fitness, exercise capacity, motor skills, lifestyle, willpower, motivation, mental state, weather, temperature, season, etc. In describing the articulation of the skills and abilities of human movement more relevant is the concept of motor efficiency. Szopa (1997) considered this concept as a component of physical fitness specifying the general phenomena associated with the manifestation and determinants of human motor

skills. Motor efficiency is an important component of health [4].

The ability of motor coping in a variety of life situations is dependent on three main factors: individual activity (practicing, training, lifestyle), individual possibilities, which can be called the 'individual development channel' (they depend on congenital and genetic conditions), factors of biological and socio-cultural environment (which usually have an effect for a long time) [5–7].

Aim

The aim of the study was to analyze the 3-year dynamics of motor skills of girls born in 1997. The studies were also supposed to answer the following questions: How do specific motor skills of girl students change over 3 years? How does additional physical activity affect the development of specific motor skills?

Material and methods

The study covered the period 2008-2010 and included 31 girls born in 1997 – students of Comprehensive School Complex No. 11 in Kielce. The first study took place on 19.05.2008, the second on 11.05.2009 and the third on 19.04.2010. The above study was approved by the headmaster of the school and parents.

Physical fitness was assessed with the Physical Fitness Index by Zuchory [8]. All motor trials were explained and demonstrated by the examiner. The index consists of six trials evaluating specific motor skills: speed, jumping ability, endurance, flexibility and the arms and abdomen muscle strength. The results of the individual tests were converted into points according to the standards in terms of age. Each trial was evaluated on a 6-point scale: minimum – 1 point, satisfactory – 2 points, good – 3 points, very good – 4 points, high – 5 points, outstanding – 6 points. Total points represent the average fitness in the appropriate age category. The results allowed us to analyze the dynamics of the motor skills of the test girls.

Statistical analysis

The analysis was made with the help of the statistical package PQStat v. 1.4.2.324 and software R. The dynamics of girls' motor skills in a 3-year-cycle were assessed by Friedman test and Dunn post hoc test. There were two levels of significance adopted: $p < 0.05$ and $p < 0.01$. In the study also appears the conditional significance: $0.10 > p > 0.05$ [9].

Results

For flexibility there was very significant and systematic progression in successive years ($p = 0.0063$) (Table 1, Figure 1). In jumping ability also a systematic and statistically significant improvement was observed in the successive years of the study ($p = 0.0004$). A particularly significant difference became apparent between 2008 and 2010 ($p = 0.0105$) (Table 1, Figure 2). Speed results also differ very significantly depending on the year of the study ($p < 0.0001$). In successive years, there was systematic progression of speed. A particularly significant difference was observed between 2008 and 2009 ($p = 0.0056$) and 2008 and 2010 ($p = 0.0003$). The results of 2009 and 2010 did not differ significantly (Table 1, Figure 3). In the case of endurance, significant progress was also found in the successive years of the study ($p = 0.0021$). There was a significant improvement in endurance between 2008 and 2009, and a small, insignificant decline between 2009 and 2010 (Table 1, Figure 4). Differences between 2008 and 2009 ($p = 0.0564$) and 2008 and 2010 ($p = 0.0787$) were not significant ($p > 0.05$), but a more liberal treatment of the post hoc test ($p = 0.10$) allows one to treat it as conditionally significant. For arm strength, there were no significant changes in the successive years ($p = 0.8805$) (Table 1, Figure 5). For the strength of the abdominal muscles, there are significant differences depending on the year ($p = 0.0240$). However, comparisons between the successive years do not show even conditional significance ($p < 0.10$) (Table 1, Figure 6).

Then it was considered how additional physical activity affects particular motor skills of the tested girls. Analysis concerned only the results from 2010. For flexibility, there was no significant difference ($p = 0.0707$) depending on additional physical activity (Table 2, Figure 7). The test probability, however, is close to the objective criterion ($p = 0.05$), but in a more liberal assumption ($p = 0.10$) differences can be regarded as conditionally significant. Jumping results significantly differ depending on the additional physical activity, and are higher in more active girls ($p = 0.0065$) (Table 2, Figure 8). In the case of speed, endurance and strength of abdominal muscles there were no significant differences between additionally active girls and less active (Table 2, Figures 9–11). However, in the strength of the arms, test probability ($p = 0.0927$) is higher than assumed, but with a more liberal assumption ($p = 0.10$) it may be considered as conditionally significant (Table 2, Figure 12).

In order to determine the overall motor efficiency of tested girls, the points of each trial were summed and compared with Zuchora standards. Overall efficiency was determined separately for each year of study. Overall motor efficiency of girls was lowest in 2008 (Figure 13). The best test efficiency was achieved in 2009, as 35% of the students were characterized by high overall motor efficiency, and 6% by outstanding. In 2010, the overall motor efficiency of the girls varied. More than half of the students (55%) achieved very good motor efficiency, 23% high, and 6% outstanding (Figure 13).

Table 1. The dynamics of motor efficiency of girls in a 3-year research cycle

Motor abilities	Year	Minimum	Maximum	*X*	*S*	Medium	Lower quartile	Upper quartile	Test Friedmana/ Dunna (*p*)	
Flexibility	2008	3	6	4.81	1.14	6	4	6		
	2009	3	6	5.03	1.08	6	4	6		0.0063
	2010	3	6	5.16	0.97	6	4	6		
Jumping	2008	1	5	2.39	1.23	5	1	3	a	
	2009	1	5	2.68	1.05	5	2	3	ab	0.0004
	2010	1	6	3.03	1.25	6	2	4	b	
Speed	2008	3	6	5.00	0.73	6	5	5	a	
	2009	5	6	5.71	0.46	6	5	6	b	0.0001
	2010	5	6	5.87	0.34	6	6	6	b	
Endurance	2008	1	6	4.06	1.48	6	3	5		
	2009	1	6	4.65	1.14	6	4	5		0.0021
	2010	2	6	4.61	1.20	6	4	6		
Shoulder strength	2008	1	6	3.39	1.28	6	2	4		
	2009	2	6	3.39	1.05	6	3	4		0.8805
	2010	2	6	3.42	1.20	6	2	4		
Abdominal muscle strength	2008	1	3	2.16	0.69	3	2	3		0.0240

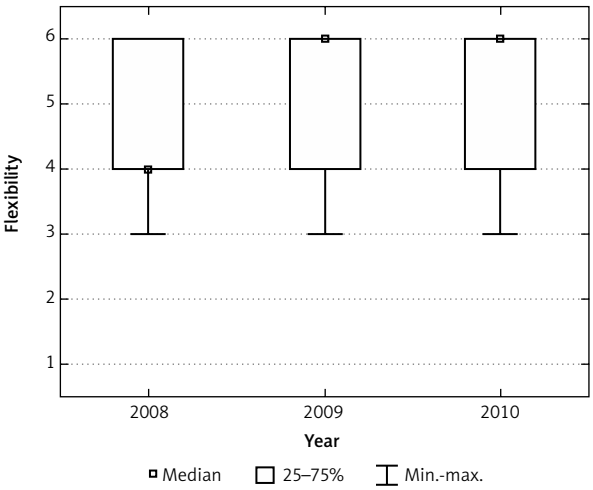

Figure 1. Flexibility results in the successive years

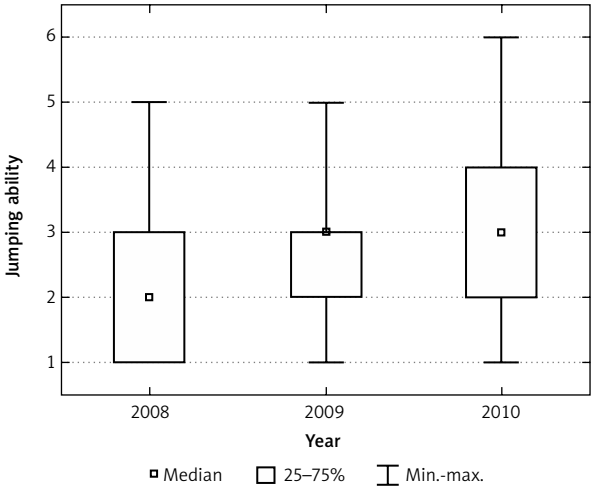

Figure 2. Jumping ability results in the successive years

Discussion

In various stages of ontogenesis human physical abilities manifest themselves in motor activities, illustrate the exercise capacity and condition life resourcefulness. Transformation of human motor skills proceeds from helplessness of neonates and infants, through more efficient and purposeful movements of a baby, fully formed, although rather schematic adult

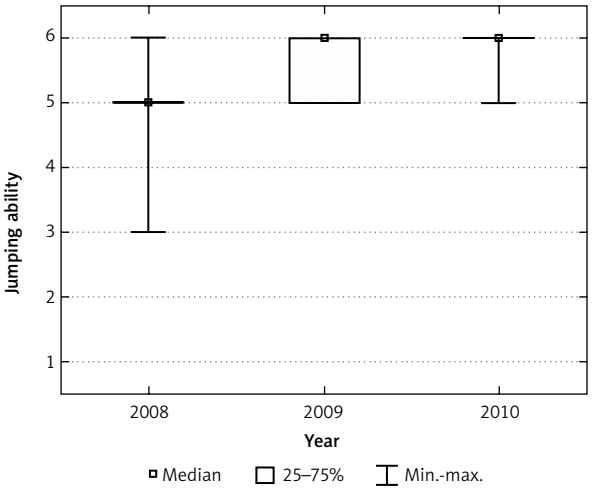

Figure 3. Speed results in the successive years

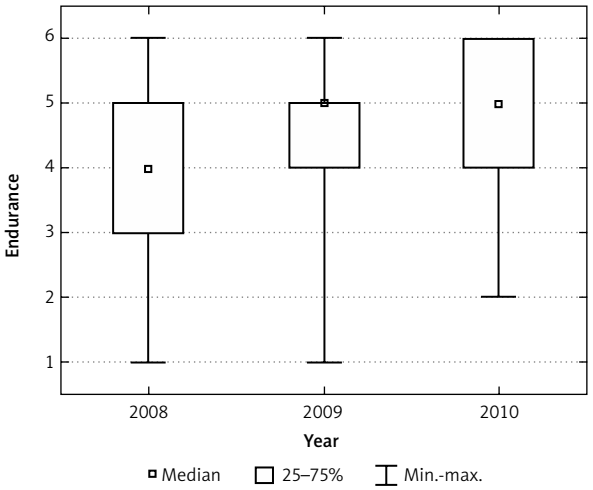

Figure 4. Endurance results in the successive years

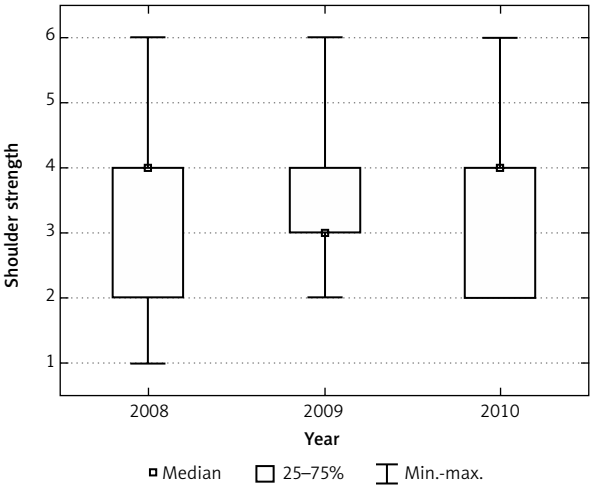

Figure 5. Shoulder strength results in the successive years

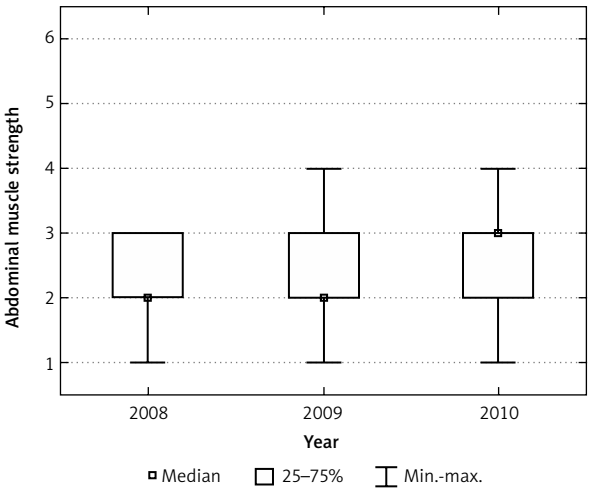

Figure 6. Abdominal muscle strength results in the successive years

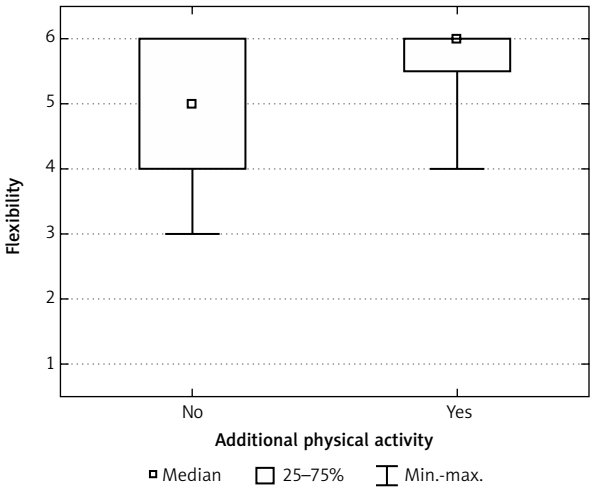

Figure 7. Results of flexibility, depending on additional physical activity

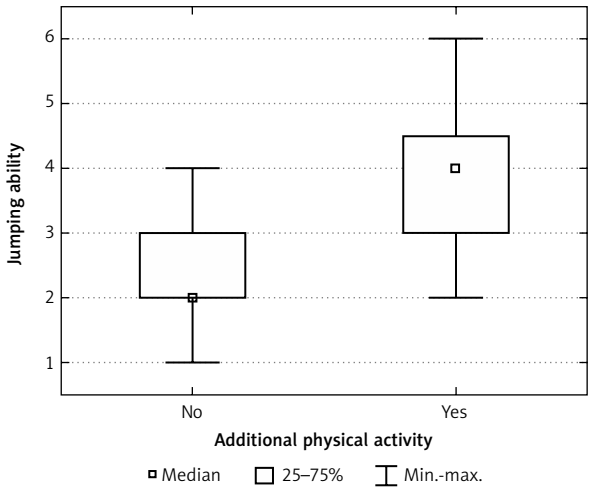

Figure 8. Results of jumping ability depending on additional physical activity

Table 2. Motor efficiency of girls in 2010, depending on participation in additional physical activity

Motor abilities	Extra physical activity	Minimum	Maximum	*X*	*S*	Medium	Lower quartile	Upper quartile	Mann-Whitney *U* test (*p*)
Flexibility	No	3	6	4.89	0.99	5	4	6	0.0707
	Yes	4	6	5.58	0.79	6	5.5	6	
Jumping ability	No	1	4	2.53	1.02	2	2	3	0.0065
	Yes	2	6	3.83	1.19	4	3	4.5	
Speed	No	5	6	5.79	0.42	6	6	6	0.3460
	Yes	6	6	6.00	0.00	6	6	6	
Endurance	No	2	6	4.37	1.16	4	4	5	0.1196
	Yes	2	6	5.00	1.21	5	4.5	6	
Shoulder strength	No	2	6	3.16	1.34	3	2	4	0.0927
	Yes	3	6	3.83	0.83	4	3	4	
Abdominal muscle strength	Yes	1	4	2.68	0.82	3	2	3	0.5894

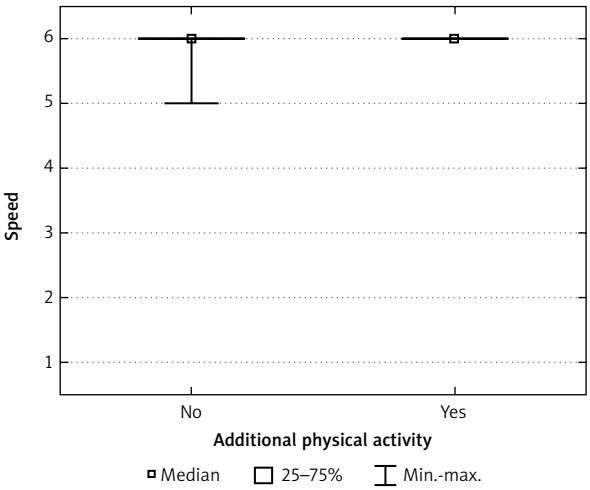

Figure 9. Results of speed depending on additional physical activity

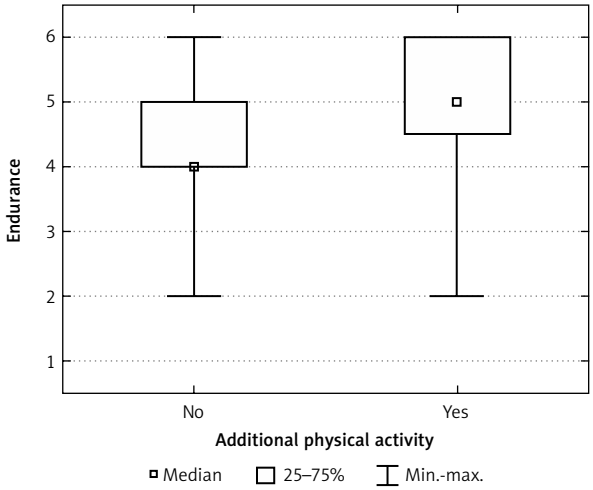

Figure 10. Results of endurance depending on additional physical activity

activities until the inevitable reverse motor involutionary motor poverty in old age. Childhood and adolescence are periods of intense constitutional changes that are the developing organism's response to endogenous and exogenous stimuli. The reaction of the functional characteristics of the human organism to changes in the external environment is the fastest, so the research on motor development of children and young people not only does not lose its importance, but is becoming more and more popular [10]. During puberty, especially in girls, one can observe a decrease in motivation and interest in movement, which clearly affects the motor abilities. The movements are awkward, there is a lack of harmony, their perfection and rhythm are smaller. Changes in body building and less interest in motor activity contribute to lower performance in almost all tests of motor efficiency. For fear of ridicule, girls start to avoid participation in physical education and abstain from physical activity. At the same time their ambitions and desires to be liked are intensified in that period much more than motor abilities [11]. Therefore, it is very important to provide maturing youth with adequate amounts of movement. Physical activity is a targeted form of movement generated by the operation of the skeletal muscles, which increases the metabolism over resting energy expenditure [12, 13]. It is a biological need of every human being to ensure physical, mental and social health. This should be linked not only to the need for maintaining health, but also the maintenance of

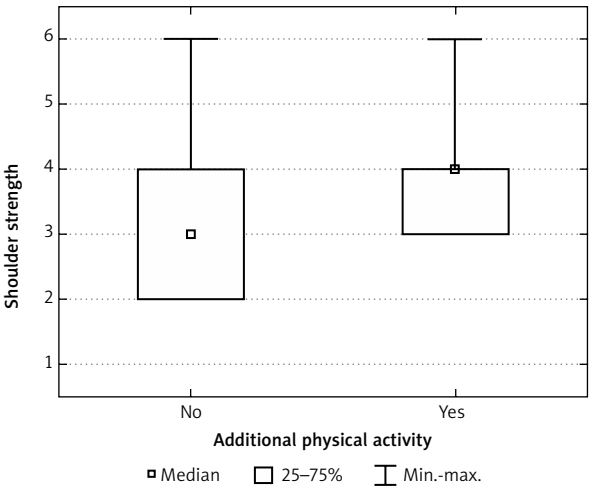

Figure 11. Results of shoulder strength depending on additional physical activity

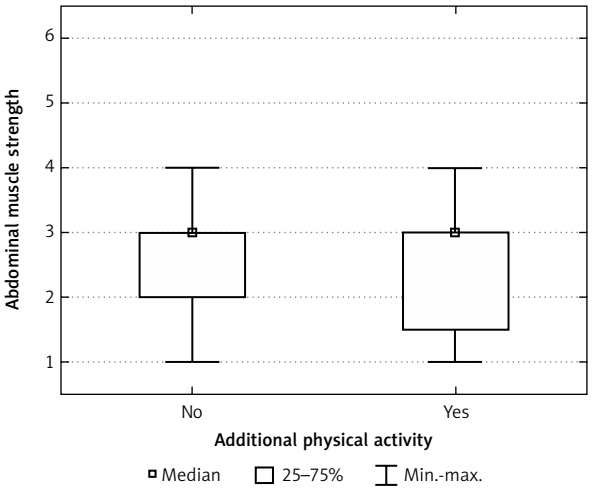

Figure 12. Results of abdominal muscle strength depending on additional physical activity

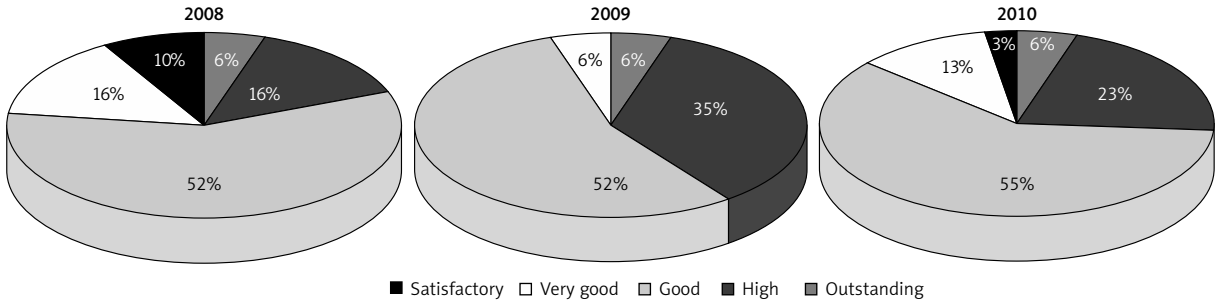

Figure 13. Qualitative assessment of the overall motor efficiency of girls

optimal physical efficiency [13]. It comprises all the activities in their free time, that is physical exercise, sports, professional work and daily tasks that require effort. The optimum would be the physical activity of children and youth which meets the motor needs and stimulates physical development, causes maintenance and improvement of the desired motor efficiency. It is recognized that in order to ensure the necessary physical activity every child should spend on movement at least 3–4 h per day [14]. Compulsory physical education in school is not enough to compensate for deficiencies in motor development. Therefore, children and young people should undertake extra physical activity as often as possible. The literature contains many publications devoted to the study of the physical and motor development of children and youth. There are often standards defined for harmonious development. Unfortunately, in recent years there has been a worrying phenomenon in the field of motor fitness and health. The observed development anomalies concern approximately 30% of the population of children and youth [15, 16]. Research by Saczuk and Wasiluk [17] confirms that the overall physical fitness has not improved over the 20 years analyzed. They show that intergenerational progress of the development of somatic characteristics is accompanied by adverse effects of physical fitness. Therefore, continued research is needed to show development trends and provide a more complete picture of physical realm. These observations may help to discover new trends in science in physical education. Osinski [18] thinks that the control of physical fitness should serve as a diagnosis, awakening consciousness of the need to develop a positive attitude toward the body and facilitate the design of future work. Disorders of motor development may be a signal to verify the learning process of movement. Early changes will result in proper motor efficiency development.

Conclusions

General motor efficiency of the tested girls developed within 3 years mostly at the level of very good and high (especially in 2009 and 2010). In 2009, the girls achieved the best results of motor efficiency. In 2010, a slight regression of efficiency was observed, which could be due to puberty, in which there is a large diversity of physical, motor, mental and social

development manifested by considerable disharmony. Analyzing the results of research on the dynamics of the development of motor skills in girls, neither global efficiency improvement nor deterioration can be recognized unambiguously after 3 years. However, considering the specific abilities analytically there has been some progress, but sometimes also regress. Assessing components of motor efficiency we can say unambiguously that the progression is reflected in flexibility, jumping ability, speed and endurance. Arm muscle strength and abdominal muscle strength did not show significant changes in the successive years. Students undertaking extra physical activity were characterized by significantly higher jumping ability. A slight progression was observed in shoulder muscle strength. Other motor skills showed no significant variation.

References

1. Ślężyński J. Former athletes physical fitness. J Sports Med Phys Fitness 1991; 2: 218-221.
2. Ślężyński J. Physical fitness of men in production age. Int J Phys Educ 1991; 1: 28-34.
3. Ślężyński J. Cechy somatyczne, sprawność fizyczna i gibkość kręgosłupa studentów. AWF, Warszawa 1991.
4. Osiński W. Antropomotoryka. AWF, Poznań 2003.
5. Kasperczyk T. Postawa ciała a wybrane cechy morfologiczne i funkcjonalne u dzieci i młodzieży w wieku 8-15 lat. AWF, Kraków 1988.
6. Kasperczyk T. Ilościowe i jakościowe aspekty aktywności fizycznej człowieka dorosłego. Fizjoter Pol 2001; 1: 74-75.
7. Migasiewicz J. Wybrane przejawy sprawności motorycznej dziewcząt i chłopców w wieku 7-18 lat na tle ich rozwoju morfologicznego. AWF, Wrocław 2006.
8. Zuchora K. Indeks sprawności fizycznej. KAW, Warszawa 1982.
9. Stanisz A. Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. Tom I. Statystyki podstawowe. StatSoft Polska, Kraków 2006.
10. Pośpiech D, Juras B, Raczek J. Sprawność motoryczna uczniów w wieku 10-17 lat z wybranych regionów Japonii i Polski. Antropomotoryka 2008; 4: 17-27.
11. Pułtorak M. Problemy zdrowotne okresu pokwitania u dziewcząt. In: Zdrowie dzieci i młodzieży w aspekcie fizycznym, psychicznym, społecznym i duchowym. Jopkiewicz A, Schejbal J (red.). Kieleckie Towarzystwo Naukowe, Kielce 1998; 73-77.
12. Jopkiewicz A, Suliga E. Biomedyczne podstawy rozwoju i wychowania. Instytut Technologii Eksploatacji – Państwowy Instytut Badawczy, Kielce, Radom 2005; 289-291.
13. Drabik J. Profilaktyka zdrowia – aktywność fizyczna czy aktywność ruchowa. Wychowanie Fizyczne i Zdrowotne 2011; 8-9: 30-33.
14. Pluta B, Posiadała D, Buczkowska J. Ocena poziomu sprawności motorycznej młodzieży poznańskiej w wieku 13-15 lat. Medycyna Sportowa 2006; 22: 277-286.
15. Jopkiewicz A, Lelonek M. Sprawność motoryczna młodzieży szkolnej charakteryzującej się różną aktywnością ruchową. In: Auksologia a promocja zdrowa. Jopkiewicz A (ed.). Kieleckie Towarzystwo Naukowe, Kielce 2007; 163-170.
16. Przewęda R, Dobosz J. Growth and physical fitness of Polish youths. University of Physical Education, Warsaw 2005, 103.
17. Saczuk J, Wasiluk A. Changes in the somatic and fitness variables in girls over two decades. Physical Education and Sport 2011; 55: 31-34.
18. Osiński W. Osiągnięcia czy zdrowie i styl życia – czyli o testowaniu sprawności fizycznej. Wychowanie Fizyczne i Zdrowotne 2009; 5: 4-9.

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