Physiotherapeutic evaluation of the spine in children attending sports classes of the Primary School in Mielec

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Abstract

Early detection of spine pathologies enables the provision of effective prophylactic and corrective interventions, including physical activity. Physical activity is an essential element of proper development of the human body and improvement of motor skills. Increased physical activity of children of sports classes seems to prevent the developmental anomalies of the spine.

The aim of the present study was the physiotherapeutic evaluation of 10-12-year-old children attending sports classes of the Primary School in Mielec. The study population consisted of 56 healthy children (17 boys and 39 girls) regularly attending physical education classes. The range of physical fitness was assessed using the fingers-floor, Schober’s and Matthias tests.

The findings demonstrated that the parameters of somatic development of pupils were within normal limits. Moreover, BMI was normal. The changes in somatic development were found to affect the level of physical fitness. Increased BMI was associated with deteriorated physical fitness. In the study population, boys had the results closer to normal limits.

Pupils of the general profile class were characterised by qualitatively better physical activity as they spent their free time in a more variegated way. The activities of children from the sports classes were monotonous and lacked diversity. Postural defects, predominantly round backs, were observed in 29% of children from the sports classes.

Key words: spine in children, sports classes

Introduction

Physical activity is an essential element of proper development of the human body and improvement of motor skills. Its appropriate regular doses allow to improve the motor skills as well as body condition and to maintain optimal health status. The regularity of physical exercises is the most effective measure to avoid many diseases. Physical exercises mainly prevent overweight and obesity. Moreover, physical activity reduces the risk of hypertension, atherosclerosis, metabolic diseases and degenerative diseases of the skeleto-articular system.

Exercises improve the general fitness of the body, which boosts the immunity and enhances the adaptive responses of the body to the changing conditions of the external environment. Improved efficiency of the locomotor system is crucial for prevention of bone fractures and other injuries.

Over the course of ongoing civilisation changes, the motor activity of man is found to be reduced, which leads to impaired homeostasis. For this reason, it is essential to teach children and teenagers the health promoting habits, which enable optimal functioning of the body in the environment.

Physical fitness is variably moulded during the individual stages of the developmental age, which is characterised by individual variability and depends on specific parameters of the physical development. Early detection of pathologies allows quick and effective prophylactic and corrective interventions.

The morphological and functional development of the locomotor system, activities and lifestyle form the appropriate shapes and locations of the individual body elements, i.e. the body posture, defined as a free erect position assumed in everyday life [1].

Moulding of the erect body position is affected by the development of the skeleto-ligamentous system, muscles, innervation, balance and proprioceptive sensations as well as habits, lifestyle and the type of work performed.

The aim of the study was the physiotherapeutic evaluation of the spine in 10-12 year-old children from sports classes of the Primary School in Mielec.
Material and methods
The study encompassed 56 children (17 boys and 39 girls) aged 10-12 years from the Primary School in Mielec. Three 5th grade classes of a general, volleyball and swimming profile were investigated. The general profile class consisted of 7 boys and 7 girls, the volleyball profile class – 22 girls while the swimming profile class – 10 boys and 8 girls. The questionnaire findings demonstrated that 50 children (89%) were from towns and 6 children (11%) lived in the country. The physiotherapeutic tests were performed in healthy children without any contraindications for going in for sports. The tests were carried out on 14-16th April, 2015.

The mean heights of boys and girls in the individual classes were as follows:
- general: boys 150 cm; girls 149 cm,
- volleyball: boys - no data, girls 153 cm,
- swimming: boys 154 cm; girls 151 cm.

The physical development of children was assessed based on measurements of their height and body weight. The height was measured using an anthropometer to an accuracy of 0.5cm; the body weight was measured on a medical scale to an accuracy of 100g.

The nutritional status of children was evaluated with BMI calculated according to the formula:

\[ \text{BMI} = \frac{\text{masa}}{\text{wzrost}^2} \]

We wzorze – weight, height

The lumbar spine mobility was measured with the Schober’s test.

The Schober’s test
The patient stands erect; the spinous process on L5 and the point 10 cm above in a straight line are marked. With the patient leaning forward and backward, the distance between the points is determined using a measuring tape. The normal results are as follows: on leaning forward, the distance ≤ 15 cm while on leaning backward ≤ 7-9 cm; too small spine mobility is likely to evidence degenerative changes and inflammations [2].

The efficiency of postural muscles of the trunk and back was measured with the Matthias test.

The Matthias test
The patient stands erect, lifts the straight upper limbs and holds the position as long as possible. Under the physiological conditions, the patient with the upper limbs lifted leans the entire trunk backwards. When the postural muscles are weakened, the spine curvatures increase (thoracic kyphosis and lumbar lordosis).

According to Matthias, there are two degrees of postural weakening:
- 1st degree – when the patient straightens up normally and after 30 seconds the spine curvature increases;
- 2nd degree – with the upper limbs lifted, the patient moves forward, which is accompanied by increased lumbar lordosis and thoracic kyphosis [3].

The mobility of the spine and hip joints was checked using the fingers-floor test.

The fingers-floor test
The patient leans forward with the knee joint straight. The physiotherapist measures the distance between the distal phalanx of the third finger and the floor [4].

The test determines the movement of the spine and hip joints. The normal mobility of hip joints partially compensates the spine rigidity.

A large distance between the fingertips and the floor is not a specific test and the results depend on lumbar spine mobility, shortening of the sciatic-femoral muscles, the presence of the Lasegue’s sign and functions of the hip joints.

The fingers-floor test can assess the spine shape (harmoniousness of kyphotization, fixed kyphosis).

Another tool used in the study was the authors’ questionnaire completed by children’s parents. The questionnaire consisted of single-choice questions and two open questions. The questions regarded the child’s age, place of residence, gender, health status (whether the child was examined for posture defects, has a posture defect; if so, what kind of and who diagnosed it), free time activities.

Results
BMI
The mean parameters of weight, height and BMI of boys and girls were within the range of 25-50 centile, which corresponded to narrow medical norms.

In the general profile class, the mean body weight of boys was 43 kg and of girls 39 kg. In the
volleyball profile class consisting only of girls, the mean body weight was 42 kg. In the swimming profile class, the boys weighed more than the boys from the general profile class; the difference was statistically significant. The gilts with the highest weight were in the volleyball profile class and those with the lowest weight attended the general profile class; however, the differences were not statistically significant.

In the general profile class, the mean height of boys was 150 cm and of girls 159 cm; in the volleyball profile class, the mean height of girls was 153 cm. In the swimming profile class, the mean height of boys was 154 cm and of girls 151 cm. The general class boys were shorter than the swimming class boys. The highest girls were found in the volleyball profile class; the shortest girls attended the general profile class (Fig. 1, 2).

BMI of general class boys was lower (19) than that of swimming class boys (21). The difference was statistically significant. The highest BMI characterized the girls from the swimming profile class (18) while the lowest BMI values were found in girls from the general and swimming profile classes (17). The difference was not statistically significant.

The fingers-floor test

The boys from the general profile class had better results of the fingers-floor test (4.71) compared to the boys from the swimming profile class (10.05). The girls from the swimming profile class had Belter results (0.5) than those from the general profile class (10.71).

The Schober’s test

The mean spine flexion forward was found to be: in the general profile class 15.07 – boys and 15.28 – girls, in the volleyball profile class 15.29 and in the swimming profile class 15.45 – boys and 14.81 – girls (Fig. 3, 4).
The spine flexion backward in boys from the general profile class was similar (8.57) to that in boys from the swimming profile class (8.5). Among girls, the best results were observed in the volleyball profile class and the worst ones in the swimming profile class (8.84 and 8.18, respectively).

Only 30% of children (39) underwent posture tests; 16 of them were diagnosed with posture defects (41%). Six children had scoliosis (4 - sports classes, 3 - round back (general profile class), 1 - concave back, 1 - round concave back, 2 - flat back, 3 - others. Six children diagnosed with the posture defects attended corrective gymnastics classes.

The forms of free time activities were comparable in all classes. Computers and sports-recreation classes were most popular (Fig.7).

The children eagerly attended the physical education classes. Only 5% of children from the general profile class were reluctant.

The parents of children from the sports class and the general profile class were satisfied with the amount of physical activities in school (73%); 27% of parents of general class children believed that the amount of physical exercises was insufficient.

Discussion

The spine development is affected not only by genetic and environmental factors but also by the types of daily activities (physical work, sports, games, sitting and horizontal positions, leisure activities, and sleeping). The intensity, duration and alterations of resting and active periods determine a lifestyle. Lifestyles are moulded by the individual’s temperament, sensitivity, needs, preferences, personal habits, predispositions and skills. Moreover, the lifestyle is influenced by ethnic-cultural conditions, social habits, attitudes and evaluations [1,5].

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**Fig. 7.** Forms of free time activities in the individual 5th grade classes (sports and general)

Na rycinie – computers, tv, books, social meetings, sports-recreation activities

The most popular sports-recreation activities were bicycle riding and handball (Fig. 8).

**Fig. 8.** Forms of leisure activities in the study population

Na rycinie – volleyball, handball, basketball, football, swimming, bicycle riding, gymnastics, gym, walks, dancing, roller/skateboards, others

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In the early stages of human development, physical activity was considerably determined by the
need to obtain food and to protect against dangers; hence, it depended on biogeographic conditions. Nowadays, physical activity depends on socio-economic conditions, including a regular job, its nature and intensity as well as possibilities of rest. The conditions of leisure and work decide about excessive or insufficient activities. The diversity of motor activities is enormous and should be assessed individually [1].

The observations of teenagers going in for sports usually regard the selected populations and are affected by additional factors (e.g. diets, hygiene, etc.). Therefore, it is difficult to determine whether the changes observed are conditioned by the physical activities or some other factors. Additionally, genetic predispositions are essential in sports and trainings serve to reveal them, to improve the technical skills, to develop somatic, psychomotor characteristics and to enhance motivation.

The observations of individuals who do not regularly exercise provide more information on the impact of everyday activities, type of work and lifestyle. According to the study findings regarding the body structures of town and country children, the differences observed are affected by the type of activities and postures during work. The proportions between the width of hips and shoulders are visibly different in children living in the country, which is likely to be associated with stronger loads on the hip girdle that becomes relatively wider, compared to children living in towns. Children from villages cover several kilometres going to school and during farm work, which is not observed in towns. Moreover, the inclination of the sternum, flattening of the thorax and the trunk shape differ as well [1]. Likewise, the knee positioning, foot arch and articular range of motion are different. Posture-related habits and physical activity significantly affect the development of the locomotor system [1].

It is well known that physical activities have healthful effects on the human body and that optimal doses of exercises improve the body fitness and enhance the immunity. Individuals who exercise regularly use oxygen more economically during work, which is characterised by lower increases in the heart rate [1]. The work efficiency of the body depends on the body structure, weight, age, use of substances and nutrition.

Physical activity has considerable effects on the development of the skeletal system and body proportions, which concerns individual bones and proportions between them. Intensive physical efforts increase the muscular mass and the cortical bone mass without changing the bone thickness. Therefore, sportsmen are characterised by higher bone densities.

Physical fitness of children varies in the individual stages of their development. Individual variability is crucial, which depends on the individual parameters of the physical development. The level of physical fitness in people of the same age depends on their body weight, nutritional status and height. The general physical fitness is assessed using special reliable tests.

In our study, the individual parameters of somatic development were determined using weight and height measurements as well as BMI. Three tests were applied: Matthias, Schober’s and fingers-floor.

The study was carried out in 56 children (70% of girls and 30% of boys) aged 10-12 years from the Primary School No. 6 in Mielec (Subcarpathian province).

The physical development was evaluated based on height and weight measurements. The results were presented in figures as means divided into the individual classes of various profiles (general, volleyball and swimming).

BMI is an easy and quite accurate index of underweight and overweight as well as risks of diseases associated with them. The fat content in females of normal weight is higher, as compared to men. The adipose tissue is responsible for fertility and sexual maturation [6].

The body fat percentage is a more accurate index but it is difficult to measure it without specialist devices.

In clinical practice, BMI measurements are not recommended in children below the age of 14 years; instead, centile charts and suitable interpretation of data are used, the differences in centile channels of height and weight are mainly considered.

BMI > 99th centile means higher body mass indices (less than 1% of the population). The wide normal limits are between 15th and 85th centile, thus BMI > 99th centile suggests extreme obesity.

BMI between 97th-99th centile denotes higher body mass indices, suggesting obesity less than 3% of the population). BMI between 95th-97th centile (less than 5% of the population) means significant overweight, while BMI between 85th-95th centile (less than 15% of the population) is interpreted as overweight. BMI between 75th-85th centile, 50th
depends mainly on suitably dosed physical activity, which is crucial for the physical development of children and teenagers. The evaluation of physical fitness of a child enables measurements of lumbar spine mobility. The findings reported by Bejer et al. and some other authors have demonstrated that the parameters of weight, height and BMI of the majority of children and teenagers are normal [8,9,10]. The recent studies have revealed increased incidences of obesity and overweight in children and teenagers in Poland and worldwide [11,12,13]. As a result, the level of physical fitness decreased, which is likely to lead to numerous health problems in future, e.g. hypertension, diabetes mellitus or atherosclerosis [10].

In our study, the nutritional status of children was assessed by comparing BMIs with centile chart norms according to age and gender [14]. Many authors consider BMI extremely useful for evaluation of under- and overweight [15,16]. In our study, the level of physical fitness and motor skills was assessed in the Schober’s test, which enables measurements of lumbar spine mobility. Moreover, the findings can be used to determine the existing dysfunctions and other health-related problems. An accurate diagnosis of problems can help to administer early therapeutic, prophylactic and educational measures.

The physical education classes are crucial for teaching the developmental age children motor skills. The evaluation of physical fitness of a child is extremely useful already at the beginning of cooperation between teachers with children [17]. Early orientation of children by choosing suitable physical activities allows to improve effectively their physical conditions and to maintain appropriate body weights, hence, their proper development [18]. Proper psychosomatic development of children depends mainly on suitably dosed physical activities during classes. Insufficient physical activity and the inadequately adjusted environment, e.g. furniture not tailored to the children’s heights, can lead to posture changes, which deteriorates the physical fitness of the body [19].

Physical activity of children suitably adjusted to their preferences enhances self-esteem and is an important element of school education [20]. Unlike specific somatic parameters, physical efficiency can be acquired, i.e. is susceptible to changes resulting from the use of various training techniques. Improved fitness and efficiency contribute to the improvement of health condition and prevent the health-related risks [21].

In our study, the Schober’s test results demonstrated the spine mobility of the study children to be within normal limits. The boys from the general and swimming profile classes had comparable results whereas the girls from the swimming profile class had worse results compared to the girls from the general and volleyball profile classes. According to the available literature data, children of younger school ages are characterised by extreme needs and willingness to exercise, which has favourable effects on the development of motor skills [22].

The findings reported by Woynarowska and other authors suggest sexual dysmorphism in motor activity, which is higher in boys since the early childhood [23,24].

Moreover, comparing the physical fitness of boys and girls, the differences in the rate of somatic development can be crucial. Younger girls are characterised by higher increases in body weight and height, as compared to boys. Girls mature earlier; thus, their final parameters of somatic development are achieved quicker [25].

The above is confirmed by our findings; the girls were higher than the boys, had better results in the fingers-floor test and the Schober’s test assessing the flexion forward than the boys of the same ages. Otherwise, the body weight parameters were found to be higher in boys compared to girls. According to Popławska et al., the physical efficiency of children and teenagers has recently decreased [26]. The data reported by some other authors are consistent with the above finding [8,21]. In increasingly high numbers of cases, the time spent by children in motor activities does not even reach a minimum, which often leads to decreased physical efficiency, obesity and health problems [27]. The international studies on health behavio-
urs in school repeated every 4 years have revealed an increasingly low percentage of children who spent at least one hour for motor exercises. The Polish data have demonstrated that the required minimum was reached only by 41.2% of boys and 29.4% of girls aged 11-15 years [28].

Kostecka et al. have emphasized that improper diets significantly affect the physical condition [13].

According to Denisiuk and Milcerowa, the physical efficiency increases with age, which is affected by the process of maturation and increased body dimensions [29].

**Conclusions**

1. The incidence of posture defects is higher in children from sports classes compared to children from the general profile class.

2. The free time activities amongst the general class children are diverse, leading to comprehensive motor development, as compared to the sports class children whose exercises are monotonous and lack diversity.

3. The results of spine tests indicate abnormalities in 29% of children. In the general profile class, round backs predominate.

**References:**


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