

THE IMPACT OF REGULAR PHYSICAL ACTIVITY ON GLOBAL MOVEMENT PATTERNS AND BODY POSTURE OF CHILDREN AND ADOLESCENT

^{1,3}*Irmina Blicharska*, ²*Anna Brzęk*, ³*Michał Rżany*, ¹*Jacek Durmała*, ⁴*Agata Walaszczyk*

¹ Department of Medical Rehabilitation, Medical University of Silesia, Poland

² Institute of Kinesiology, Chair of Physiotherapy, Medical University of Silesia, Poland

³ The Student Scientific Set near the Kinezjology Institute, Chair of Physiotherapy, Silesian University of Medicine in Katowice

⁴ Silesian Goliath Karate Club in Katowice

Abstract

Introduction Psychomotor development involves a achieving body movements control through co-ordination of the nerve centers, nerves and muscles function. The progress of the development and forming motor ability cause increase of functional capabilities of the human body. For the appropriate performance of all daily activities adequate neuromuscular control, stability, flexibility and coordination are necessary. It is important make correct movement that incorrect movement patterns don't generate and fixed. Each pattern should be accompanied by the correct body posture.

The aim of study was assessment movement patterns in children and adolescent who take the regular physical activity- trained martial arts determine the most often occur compensations and deficits of body posture

Material and methods The study group consist of children and adolescent of both sexes, aged 9-18 years whose divided into two subgroup. Group A-basic group consist of 35 children and adolescent who train karate since 2-5 years. Group B- control consist of 35 subjects - high school students who don't take regular physical activity.

Research tools The body posture evaluated by scoring Kasperczyk's Scale and the measurement of thoracic kyphosis and lumbar lordosis using the Plurimeter V-Rippsteina. Global movement patterns and the most often compensations was based on FMS Test consisted of 7 motor tasks.

Results In examination of body posture using by scoring Kasperczyk's Scale, group B obtained more points. That means, children and adolescent who don't take regular activity have poorer body posture. The analysis of functional tests showed occurrence of numerous compensations in both study groups but better results obtained older examined. More pronounced compensation noticed in younger children. In the group of men who do not train, there were obtained worse

results of the test, especially in the movement tasks that require adequate stabilization and neuromuscular coordination. But there were no statistically significant differences between groups ($t=1,35$, $p<0,189$). In group A noticed decrease value of thoracic kyphosis- 54%, in FMS Test 67% can't perform test so. Deep Squat .

Conclusions

1. Regular physical activity effect positive on body posture
2. Decrease of thoracic kyphosis in children who train karate may be a result of antykyphosis exercises and strengthening of erector spine muscle which are often used during training.
3. The low level of lumbopelvic stabilization in children and adolescent may be due to a sedentary lifestyle and lack of appropriate oriented physical education.

Introduction

Nowadays, owing to developing anthropometrics, the idea concerning human motor abilities has changed significantly. Every single move is the result of biological factors with psychosocial ones. The external motion aspect together with its potential features (predisposition, motion abilities) are both essential. Every human's move is conditioned by the control process. Movement control is strictly related to the nature of movement – it is subordination of the muscular system (controlled) to the nervous system (controlling)^[1,2] .

Motor skills, which influence the increase of the functional capabilities of the human body are formed in the process of ontogenesis. In order to be able to execute every daily-life activity, not only is a neuromuscular control required, but also a proper stabilization, flexibility, mobility and coordination. The proper movement execution is essential, so that individual movement patterns are not distorted. Every individual movement pattern should be accompanied by good posture^[3,4].

Scientific works on physical activity and its influence on human posture point out that regular physical activity can improve agility and functioning of the body^[5]. There are many tests that serve as diagnostic tool to assess the human body; however, few of them allow to assess the occurring compensations and weak links that are the cause of the injuries. Inefficient individual movement pattern creates independent compensation, which creates an unnatural joint motion that may lead to injuries. It also influences the order or muscle activation, which reduces the effectiveness of movement. The aim of the study was to assess the quality of children's and youth's

individual movement patterns who trained martial arts regularly; and the most common compensations and irregularity within the body posture^[6,7].

Materials and methods

Study groups

There were two groups of children and youth of both sexes taking part in the study. The main group – A consisted of 25 subjects varying in age from $14,8 \pm 2,12$ who trained karate for 2 – 5 years. They declared to attend trainings systematically – at least twice a week. The control group – B, on the other hand, consisted of 30 middle school students varying in age from $15,03 \pm 0,77$ who did not train regularly or systematically, aside from physical education classes

Research tools

The participants' posture was assessed using Kasperczyk's method, which involves visual assessment or setting particular elements of posture. The assessment includes observations of the sagittal plane and the frontal plane from back and front of the body. The score pattern is strictly specified. 0 is awarded for perfect condition. The following points are deviations of the assessed element, up to 3 – 5 points are awarded in case of occurrence of permanent changes of a structural character. The scale takes into account all possible irregularities in relation to the particular element and gives the possibility to highlight their size; whether they are big, advanced, or whether there are slight aberrations. On the basis of the summed up points the posture of the participant can be assessed as either very good, good, bad, or very bad^[8,9].

The measurement of thoracic kyphosis and lumbar lordosis was done using V-Rippstein Plurimeter following Dobosiewicz's methodology and standards^[10].

The quality of global movement patterns was evaluated with the use of a standardized Functional Movement Screen (FMS) test. FMS consists of a set of seven motor tasks, which are used for screening diagnostics of functional state. The analysis of the individual components of the test allows to identify the so-called weak link in the biokinematic chain. Indicates critical spots predestined to injuries, which should be subjected to a process of improvement, or should focus the training in a way in which an injury would not occur. Execution of the tasks is assessed according to a scale where 0 points are awarded when pain occurs during movement; 1 point is awarded when the participant is unable to meet the movement pattern; 2 points are awarded in case of meeting the movement pattern, but with the use of compensation; 3 points are awarded for flawless execution of the movement pattern. These tests allow to evaluate the parameters such as neuromuscular coordination, joint mobility, global and local stabilities. Only the proper functioning of particular

elements will allow for fully accurate task completion. The total number of points indicates the movement of an accurate movement pattern; it is then when the risk of overloads and injuries is minimal; or numerous compensations and asymmetries occur; or even the risk of an injury occurs – when the sum of points is below 14^[11,12].

Statistical analysis

The gathered data were placed in a single database and developed through Excel programs belonging to the MS Office 2007 and Statistica v. 10. The study estimated mainly the level of the lumbo-pelvic stability complex, the quality of individual movement patterns and the spine's curvature in the sagittal plane; and then it checked how much these parameters obtained from the measurements differ between the groups. The evaluation of correlation of the measurable parameters was performed using R- Pearson's factor. "T" test, on the other hand, was used for the comparative evaluation of the groups. For all the calculations statistically significant values of $p < 0,05$ were used.

Results

Analysis of the results obtained from the measurement of the spine's curvature in the sagittal plane showed that the majority of the subjects training karate had reduced thoracic kyphosis. It was noted in 54% of cases. In the group of middle school students (group B) the majority of the respondents displayed features of a correctly shaped thoracic kyphosis – 62,07%. The most often deviation, however, was its enlargement – in 34,48% of cases. Statistical evaluation of the FMS test showed statistically significant differences between the groups that participated in the test called "Trunk Stability Push-Up" ($t= 3,33$ $p<0,0027$) and the groups that participated in the trunk stability test ($t= -6,43$ $p<0,000001$) in favor of the group which trained karate. Total number of points was also significantly higher in this particular group ($t= -3,17$ $p<0,004$). In a general summary, the "Deep Squat" test. The highest number of compensations appeared during this specific test. Most often it was a trunk flexion and lower limb rotation. Interestingly, the group of middle school students achieved slightly better results in the "Active Straight-Leg Rise" test. The detailed point distribution is presented at Figure 1.

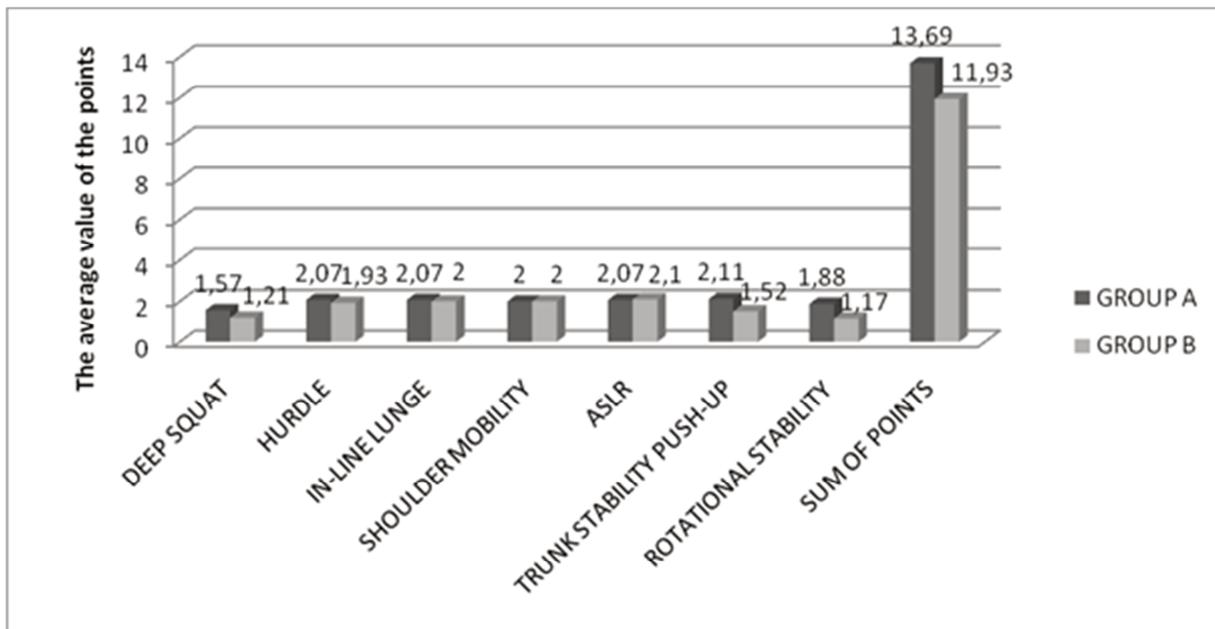


Fig. 1. Average number of points obtained in the FMS test

A statistically significant correlation between the amount of obtained points and the age of the participants was noted. The older respondents turned out to obtain better scores in general ($R=0,605$, $p<0,0001$).

In the assessment of posture, its individual components, there were no significant statistical differences between the set of elements, that is head and shoulders. The better results in overall scoring were achieved by the group that trained systematically ($t = 2,09$ $p< 0,04$). It is interesting that the biggest difference between the two groups was observed in foot arch for the benefit of the students who trained karate ($t= -4,1$ $p<0,0004$). In the group B there appeared a tendency between the values obtained at the FMS test and the sum of points obtained at the evaluation of the body with Kasperczyk's method ($R= -0,63$ $p< 0,00001$). This tendency pinpoints that a person with poor posture is more likely to suffer various injuries and often an incorrect compensations (Figure 2).

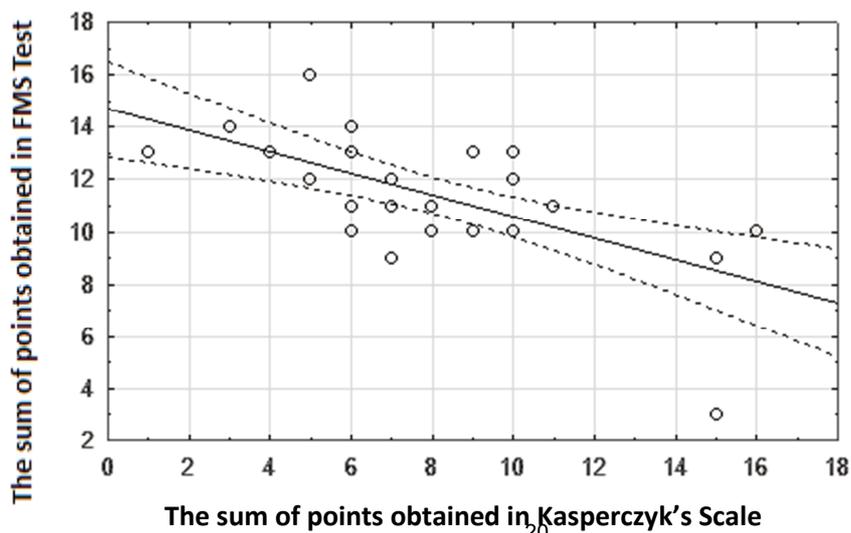


Fig. 2.The correlation between the results obtained in the evaluation using Kasperczyk's method and the FMS test.

Statistical analysis of the functional tests showed the occurrence many compensations in both groups. In basic group observed difficulties evaluated within mobility of the thoracic spine- 68,2 % and ischio-tibial muscle shortening- 70%. In a high school students' group results were slightly different. A large percentage of examined-88,5% had limited mobility of the shoulder girdle. Difficulties also appeared with the maintenance of the body and its segments in the axis during the test called "Hurdle", consisting in crossing the appropriate matching to the growth of the special fence- compensation occurring in 90,2% of group B.

Discussion

Physical activity is a sign of a healthy lifestyle. It has a positive influence on individual systems in the human's body. Effects and benefits of exercise have been reported as early as the time of Hippocrates. The early introduction of exercise in various areas of physiotherapy dominated partial or complete hypokinesia. Studies confirmed that physical activity has a positive influence on the body posture^[4,13]. However, some elements, in this case, exercises and individual movement patterns performed within the framework of martial arts can influence the reduction of thoracic kyphosis, what can be explained by greater amounts of extensive exercises, and strength and endurance shaping exercises, aimed at large muscle groups, including extensor spinae muscles. Proper spine formation in the sagittal plane cushions the axial loads acting on the human's body. A change of the angle of curvature provokes compensations supervening in the whole body. The loss of the axial load distribution through the spine can cause overloading of structures both osteoarticular and muscular^[14]. On the other hand, the sedentary lifestyle and the lack of physical activities in case of youth predispose them to enlargement of thoracic kyphosis. The only solution seems to be finding the golden mean. However, a modification of certain elements of training (exercises) could provide a training person with a better overall posture. It, however, can be widely discussed whether the reason for such situation (57,43% with reduced thoracic kyphosis) is the excess of anti-kyphosis exercises, or other factors resulting from individual predispositions.

Interestingly, the training has contributed greatly to the improvement of stabilization parameters. The test that were to assess the mobility of shoulder girdle came out similar in both groups. Therefore, it can be concluded that the physical activity during physical education is

sufficient to maintain the correctness of these parameters. However, these days more and more attention is devoted to the appropriate level of the lumbo-pelvic stabilization complex, which improper functioning may lead to the occurrence of pain in the future. The FMS test is a valuable measuring (diagnostic) tool that helps to detect the weak link in the functional state. Many authors point to the potential negatives such as the possibility of unlike results for different countries or different age groups. They agree, however, that it helps to identify faulty individual movement patterns or the lack of skill of their execution. Detecting them at an early age will avoid their fixation and the consequences that come with it^[15]. In everyday practice, a physiotherapist will find redundant likening his or her patient's results with the population of other country's results. He or she will focus on the assessment of the effectiveness of the therapy, and the ability to make modifications of the exercises according to the actual functional need. It is not about classification or searching for ready-made therapeutic conspectuses, but about an individual approach.

Conclusions

- a. Regular physical activity has a positive effect on the posture of children and youth.
- b. Reduction of thoracic kyphosis among training children can be the result of the large amount of anti-kyphosis exercises and extensor spinae muscles exercises.
- c. Often occurring issues with maintaining proper trunk stability among children may be related to the sedentary lifestyle or the lack of properly coordinated physical education.
- d. Changes in the posture affect global movement patterns.

References

1. Osiński W.: Antropomotoryka. Wydanie II rozszerzone. AWF Poznań 2003
2. Raczek J.: Antropomotoryka. Teoria motoryczności człowieka w zarysie. Wydawnictwo Lekarskie PZWL 2010
3. Górski J.: Fizjologia wysiłku i treningu sportowego. PZWL Warszawa, 2010
4. Brzęk A., Famuła A.: Parametry posturo - metryczne mięśni posturalnych u dzieci i młodzieży z rozpoznaną skoliozą niskostopniową. Wyd. Uniwersytetu Jagiellońskiego Kraków 2012, 160-174
5. Czarkowska – Pączek B, Przybylski J.: Zarys fizjologii wysiłku fizycznego. podręcznik dla studentów. Wyd. Urban & Partner Wrocław, 2006
6. Panjabi M.: The stabilizing system of spine. Part 1. Function and dysfunction adaptation and enhancement. J. Spinal. Disord., 1992, 5(4), 383-389.

7. Gant R., Saulicz E., Kokosz M.: Zaburzenia funkcjonowania systemów stabilizacyjnych kompleksu biodrowo- miedniczo- lędźwiowego. *Polish Journal of Physiotherapy* 2006.
8. Nowotny J., Ptaszek K., Kramarz W., A modification of point scoring of posture useful in screening examinations, *Polish Journal of Physiotherapy* 2001.
9. Kasperczyk T., *Wady postawy ciała. Diagnostyka i leczenie*, Wyd. Kasper, Kraków, 1994.
10. Durmała J., Detko E., Krawczyk K. Values of thoracic kyphosis and lumbar lordosis in adolescents from Czestochowa. *Scoliosis* 2009.
11. Kiesel K., Plisky P., Butler R. Functional movement test scores improve following a standardized off-season intervention program in professional football players. *Scandinavian Journal of Medicine and Science in Sport*. 2009.
12. Minick K., Kiesel K., Burton L., Taylor A.: Interrater Reliability of the functional movement screen. *Journal of Strength and Conditioning Research*. 2010
13. Brich K, McLaren D, George K.: *Fizjologia sportu*. PWN Warszawa 2008
14. Rigo M, Quera-Salvá G, Villagrasa M: Sagittal configuration of the spine in girls with idiopathic scoliosis: progressing rather than initiating factor. *Stud Health Technol Inform* 2006
15. Zuvela F., Bozanic A., Miletic D. POLYGON- A New movement skills test for 8 old children: construction and validation. *Journal of Sports Science and Medicine* 10, 2011: 157-163