Cardinali Mario, Weber Nowakowska Katarzyna. Rating anthropometric parameters of children with polyarticular hypermobility. Journal of Education, Health and Sport. 2018;8(03):67-77. eISNN 2391-8306. DOI http://dx.doi.org/10.5281/zenodo.1186136
http://ojs.ukw.edu.pl/index.php/johs/article/view/5309

The journal has had 7 points in Ministry of Science and Higher Education parametric evaluation. Part b item 1223 (26.01.2017).
1223 Journal of Education, Health and Sport eissn 2391-8306 7

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 05.02.2018. Revised: 10.02.2018. Accepted: 01.03.2018.

Rating anthropometric parameters of children with polyarticular hypermobility

Mario Cardinali[1] Katarzyna Weber-Nowakowska[2]

[1]Physiotherapy student, Pomeranian University of Medical Science

[2]Department of Musculoskeletal System Rehabilitation Pomeranian University of Medical Science

Address for corespondence

PhD. Katarzyna Weber-Nowakowska, Department of Musculoskeletal System Rehabilitaton Pomeranian University of Medical Science. katarzyna.weber@pum.edu.pl

Summary

Introduction: Polyarticular hypermobility manifests in an increased range of motion in the joints compared to standards that include gender and age. It is given that it occurs even in 30% of children. It can lead to many biomechanical disorders and injuries. Science, which describes the measurement of the different body parameters such as height, body weight or fat content in the body is anthropometry and it was used to characterize the child diagnosed with arthritis polyarticular hypermobility.

Material and Methods: The study was conducted on the group of 35 children aged 6 to 11 years old with diagnosed polyarticular hypermobility. The control group were randomly selected children in the same age from the same school without diagnosed polyarticular hypermobility. Anthropometric parameters of all children were measured according to accepted methods. The children were tested for body weight, height, body mass index, WHR index and their skinfolds were measured by skinfolds calipers.

Objective: The aim of this study was to evaluate the anthropometric parameters of children with diagnosed polyarticular hypermobility and to compare these results to their contemporaries with no identified polyarticular hypermobility.

Results: All the examined parameters (height, body weight, BMI, WHR, skinfolds measurement) in the two groups were on very similar levels, there were no statistically significant differences (BMI p = 0.3435, WHR p = 0.806).

Conclusions: There is no significant difference between the study group and the control group in the examined anthropometric parameters (height, body weight and BMI). Children with diagnosed polyarticular hypermobility in terms of weight and height do not stand out from their peers.

Keywords: hypermobility, anthropometry, BMI, WHR, skin-folds

Introduction

Polyarticular hypermobility is manifested by increased range of motion in the joints compared to standards that include gender and age in the absence of concomitant systemic rheumatic diseases. More often polyarticular hypermobility is diagnosed in school-age children than adults. The literature indicates that generalized articular hypermobility occurs in 10-15% of boys and girls 20-40%. Children whose ranges of motion in the joints are increased are more prone to sports injuries, but also injuries during daily physical activity. This may caused by taking extreme positions of the joints, increased activity of certain muscle groups (for example. group of sciatic-tibial muscles) or aberrant prioprioceptive dysfunctions, higher incidence of postural disorders [1-13].

Height and body weight, the circuits of its each sections or content of fat tissue in the body are individual, characteristic variable features for each human. Their study and description is part of science called anthropometry. Measuring and comparing those parameters can provide us a lot of information not only about the individual, but also the whole social groups suffering from the same disease entity [14-15]. The rest of this article will describe anthropometric studies conducted on children in age from 6 to 11 years with diagnosed polyarticular hypermobility from West Pomeranian Province in Poland.

Objective of the study

The objective of the study was to evaluate the anthropometric parameters (such as body weight, height, BMI, skin fold measurements, body circuits) of children with diagnosed polyarticular hypermobility. Research also intended to determine whether there is any correlation between anthropometric parameters and hypermobility and to compare the results of measurements of children with diagnosed hypermobility and their healthy peers.

Material and Methods

The research was conducted in two primary schools in Szczecin. After receiving the consent of parents and school management were tested and measured 102 children, including 69 boys and 33 girls aged 6 to 11 years. To recognize polyarticural hypermobility was used established and widely used Beighton score. The test consists of the analysis of mobility in the spine and peripheral joints. Each action performed is assessed on both sides of the body on a scale of 0 to 1. The test consists of following steps:

- rating passive dorsiflexion fifth metacarpophalangeal (MCP) joints $\geq 90°$,

- rating of the possibility of bringing the thumb to the front of the forearm,

- rating of the elbow hyperextension above 10 °

- rating of hyperextension of the knee than 10 °

- rating of forward slope with putting hands flat on the ground while keeping the extension in the knee joints.

Hypermobility polyarticular according to Beighton test is diagnosed after getting at least 4 points of maximum 9 [16-18].

Anthropometric evaluation asses was based on the body mass index, WHR and measuring skinfolds.

BMI (body mass index), the most widely used to assess the nutritional status diagnosed overweight, obesity or underweight. This parameter is easy to calculate and relatively highly correlated with body fat. BMI was calculated according to the formula:

$$BMI = \frac{mass\ [kg]}{height^2 [m]}$$

According to the basic classification results should be interpreted as follows:

<18.5 - underweight

18,5-24,99 - correct value

≥ 25.0 - obesity [19-21]

Another indicator used during testing was WHR (waist-hip ratio). It is used to evaluate the distribution of fat tissue in the human body and the type of obesity. To calculate the values of WHR, it need to be measured the circuit of waist and hips and substituted into the following formula:

$$WHR = \frac{waist\ circumference}{hips\ circumference}$$

Waist circumference should be made midway between the lower edge (arc) of the ribs and the upper edge of the iliac crest. In contrast, the hip circumference measurement is carried out leading centimeter by the largest protuberance gluteal, iliac below. On its basis, you can identify the type of obesity:

Android obesity, abdominal (such as 'apple'), recognize when the WHR is greater than or equal to 0.8 for females and 1.0 for males.

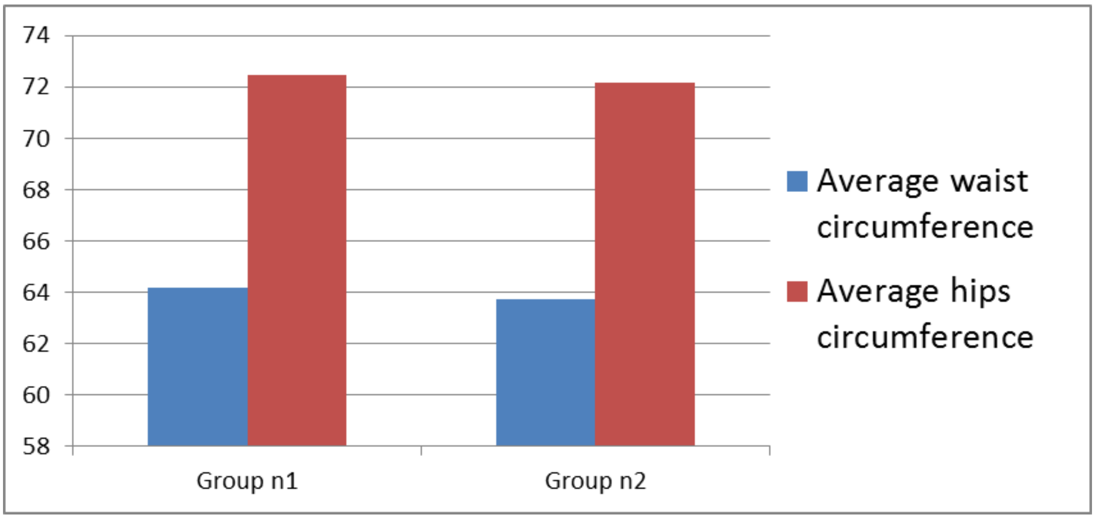
Gynoidal obesity, gluteal-femoral (type "pear") recognize when the WHR is lower than 0.8 for females and 1.0 for males. [20,22]

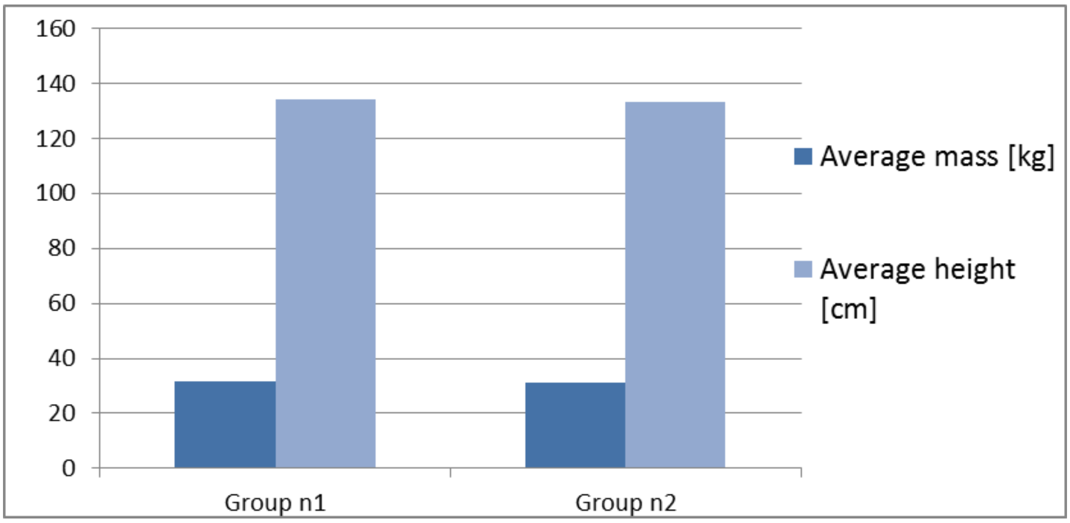
The last survey used to examine children with polyarticular hypermobility were measurements of skinfolds using skinfold caliper in accordance with accepted methods. The studies measured the thickness of skinfolds on the arm (at the biceps brachii muscle and the triceps), under the shoulder blade, on the stomach and on the calf (for gastrocnemius muscle). With these measurements it is possible to accurately monitor changes in the patients organisms, determining the amount of fat mass in the body or as an indicator of protein nutrition. The advantages of this method is a low costs of measurment, the ability to make measurements in almost any location, availability of measuring instruments and accuracy in the observation of changes. [23-27]

Results

On the basis of the Beighton test polyarticular hypermobility was diagnosed in 35 children (34%), this was tested group (n1) and consisted of 14 girls and 21 boys. The control group (n2) were randomly chosen children of the same age from the same school without proven articular hypermobility.

The first considered factor was BMI. In the group with known polyarticular hypermobility (n1), the average height was 134.14 cm; the average body weight 31.82 kg; what gave the average BMI 17.61 of whole group. In the control group (n 2) the average height was 133.45 cm; the average body weight 31,22kg and the average BMI for whole group was 17.33. After completion of the analysis of variance there were no differences between the BMI values of the group with hypermobility and the group without hypermobility (p = 0.3435).





Graph no.1 Height and mass results in both groups.

Another examined factor was WHR. The average waist circumference in children with polyarticular hypermobility was 64.2 cm, hip circumference was 72.44 cm and the WHR was 0.88. In group of children with no identified polyarticular hypermobility average waist circumference was 63.75 cm, hips circumference was 72.15 and WHR was 0.88. After completion of the analysis of variance there was no statistically important differences between WHR values in the group with hypermobility and without hypermobility group ($p = 0.806$).

Graph no.2 Average hips and waist circumference in both groups.

The last aspect taken into account in the research of were measurements of the skinfolds. The average results of the measurements are provided in Table 1.

Place of measurement	Group n1			Group n2			P value
	Average	Standard deviation	min-max	Average	Standard deviation	min-max	
At the front of the arm	10.07	3.30	4.5 - 21	9.45	3.93	4 - 21	0.254
At the back of the arm	13.5	4.22	7 - 24	14.4	5.14	7 - 28	.2887
Under the shoulder blade	11.2	6.86	4 - 30	11.25	6.49	5 - 28	.6821
On the stomach	9.2	4.69	4 - 23	9.4	5.88	4 - 21	.2991
On the calf	16.9	5.44	8 - 30	16.8	4.67	9 - 28	.3465

Table no.1 Skinfolds measurement

There were no significant differences between the individual measurements of skinfolds in group with hypermobility and the group without hypermobility.

The studies examined the correlation between the previously examined parameters and the occurrence of hypermobility. The results are shown in Table 2.

Parameter tested	Correlation coefficient	Dependence
BMI	0.08	weak dependence
WHR	0.08	weak dependence
Skinfold on the front of arm	0.12	weak dependence
Skinfold on the back of arm	0.3	weak dependence
Skinfold under the shoulder blade	0.1	weak dependence
Skinfold on the stomach	0.3	weak dependence
Skinfold on the calf	0.09	weak dependence

Table no. 2 Correlation coefficient of tested parameters.

Discussion

Over the years, a noticeable increase in interest in polyarticular hypermobility which resulted in a number of studies on this topic. Unfortunately, there is still very little research on the correlation of anthropometric measurements and the prevalence of hypermobility in children. Sharon Bout-Tabaku and colleagues studied 142 school children (average age 13 years old) for correlation of pain of lower limbs, hypermobility and obesity. Polyarticular hypermobility (in study >6 points Beighton test) occurred in 2% of the obese children and found that obesity is not associated with hypermobility ($p = 0.3$) [28]. Oline Sohrbeck-Nøhr and colleagues studied 301 children aged 13-15 years (average age 14 years old) for the risk of a generalized feeling pain in adolescence due to the presence of polyarticular hypermobility. The results showed that children with hypermobility had a significantly higher body mass index (BMI) ($p = 0.004$) than their healthy peers [29]. Pacey and his colleagues studied 89 children with polyarticular hypermobility diagnosed under the age of 6 to 16 years in order to distinguish subtypes of joint hypermobility patterns for clinical signs and symptoms. One of the subtypes listed was a group of children who had a higher BMI than their peers without joint hypermobility signs and symptoms ($p <0.01$) [30]. In another study, V. Pacey and colleagues evaluating the impact of hypermobility on quality of life examined anthropometric parameters of 89 children aged 6 to 16 years diagnosed with polyarticular hypermobility. These studies show that the average height and BMI value of children diagnosed with hypermobility is in the normal range for children in the same age (BMI 59 percentile, height 60 precentile).

It should be noted that it is difficult to analyze the data due to the lack of identical diagnostic criteria. Criteria used during studies by the authors mentioned above for recognition of joint hypermobility are not identical in the different study groups.

It is necessary to conduct further studies on the hypermobility to verify the results and to start diagnostic programs for hypermobility in schools, because research shows that this problem affects about 30% of children in early school age.

Conclusions

1. There are no statistically significant differences between the study group and the control group in the studied anthropometric parameters (height, body weight and BMI). On the basis of calculations it can be concluded that children diagnosed with

polyarticular hypermobility in terms of weight and height do not stand out against their peers. ($p = 0.3435$)

2. Polyarticular hypermobility has no effect on circumference of waist and hips or WHR factor of children. ($p = 0.806$)
3. The content of fat in the two groups are very similar level, so it can be assumed that polyarticular hypermobility, has no effect on body fat.
4. The occurrence of hypermobility does not significantly change the value of the BMI factor, WHR and the thickness of skinfolds.

References:

1. Izydorczyk-Styś A. Izydorczyk Styś-B.: Evaluation of flexibility of children in early school age. Fizjoter 2013; 21 (4): 28-34.
2. Czaprowski D., Kotwicki T., Stolin L.: Evaluation of joint laxity in children and adolescents - a review of methods. Rehab Traumatol Orthop 2012; 5 (6): 407-420.
3. Wahezi DM Ilowite N.: ailments and joint hypermobility of joints. Dipl Pediatr 2010; 14 (3): 66-69.
4. Czaprowski D., Pavlovsk P.: The Effect of generalized joint hypermobility of the size of sagittal spinal curvatures in children aged 10-13 years. Orthop Traumatol Rehab 2013; 6 (6): 545-553.
5. Gocentas A., Jasceniniene N., Bar, M., W. Przybylski, Matulyte E., Mieliauskaite D., et al.: Prevalence of generalized joint hypermobility in school-aged children from East-Central European region. The film Morphol 2016, 75 (1): 48-52.
6. Mirska A., Stansfield AK, Ax E., Okulczyk K., Kułak W.: hypermobility syndrome mild arthritis (BHJS). Horseman Neurol 2011; 20 (41): 135-140.
7. Maciałczyk-Paprocka K., Krzyżaniak A., T. Kotwicki, Kałużny L., Przybylski J.: The posture preschool children. Probl Hig Epidemiol 2011; 92 (2): 286-290.
8. Wheeler E., Kotuła L., Wheeler, D., Gil-Kulik P., J. Karwat, Niedojadło A., et al.: Application of physiotherapy in the treatment of genetically determined hypermobility joints.
9. Zimmermann-Gorska I.: Excessive mobility of joints and rheumatism. Rheumatology 2007; 45 (6): 397-403.
10. Słowińska I., Rutkowska Sak-L.: A mild hyperstimulation syndrome joint mobility. Rheumatology 2014; 52 (6): 398-401.
11. Mikolajczyk E., A. Szczygieł, Jankowicz-Szymańska A. Kopf P.: hypermobility syndrome arthritis (ZHS) in 15-year-old boys and girls in the context of diagnostic problems, therapeutic and prophylactic. Fizjoter Pol 2012; 3 (4): 29-24.
12. Czaprowski D., Sitarski D.: Physiotherapy in generalized arthritis hypermobility. Practical Physiotherapy and Rehabilitation 2016; 76: 66-71.
13. Tejszerska D., E. Świtoński, Gzik M., ed.: Biomechanics of the human musculoskeletal system. Gliwice: Publisher. Scientific Institute for Sustainable Technologies - National Research Institute; 2011.
14. M. Steel, button-Hoof A, R.: Michnik Anthropometric upper limb and measuring the crush strength of the hand and thumb. Current Problems of Biomechanics 2012; 6: 93-98.
15. Nowacka W.Ł.: Shaping space from the perspective of a diverse customer-anthropometry as a tool in the design. Studies and Research Center for Nature and Forest Education 2008; 10 (1): 18-26.
16. Smolewska E, H Brožík, J. Staczyk Hypermobility Syndrome as a cause of arthralgia in children. Overview of Pediatric 2004; 34 (1): 13-16

17. B. Smits-Engelsman, M. Klerks, A. Kirby: Beighton Score: A Valid Measure for Generalized Hypermobility in Children, The Journal of Pediatrics, Volume 158, Issue 1, January 2011, Pages 119-123.e4
18. H. Singh, M. McKay, J. Baldwin, L. Nicholson, C. Chan, J. Burns, CE Hiller Beighton scores and cut-offs across the lifespan: cross-sectional study of an Australian population, Rheumatology, Volume 56, issue 11, 1 November 2017, Pages 1857-1864
19. Stupnicki Romuald. "Relationships w height and BMI use in children and adolescents." School of Physical Culture and Tourism in Pruszkow, e-Publishing 34 (2014): 33-38.
20. Getter, Eve. "Indicators of BMI and WHR in Szczecin residents over the age of 50 years." Polish Gerontology 16.1 (2008): 47-50.
21. Jakubowska-Pietkiewicz E., Prochowska A., W. Fendler, Szadkowska.: A comparison of methods for measuring body fat percentage of children. Pediatric Endocrinology, Diabetes and Metabolism 2009; 15 (4): 246-250.
22. Drozdowski Z.: Anthropometry in physical education. Physical Education, Poznan 1998; 132
23. Wronka L. Overview of methods for assessing the nutritional status of adults. Vol. I. Methods Anthropometrical. Human Nutrition and Metabolism 2010/37/4
24. A. Malinowski, Chlebna Falcon-D.: The human baby, test methods and standards of biological development. Ankal, Lodz, 1998, 45-64
25. A. Malinowski, Wolański N., Methods of research in human biology. The choice of methods anthropological, PWN, Warsaw, 1988
26. A. Malinowski, Bożiłow W. Fundamentals of anthropometry. Methods, techniques, standards, PWN, Warsaw - Lodz, 1997
27. Miałkowska, Janina, and Jadwiga Pietraszewska. "Changes in the development of subcutaneous adipose tissue in children in rural areas during the early school." Biological Słupskie work 01 (2005).
28. Sharon Bout-Tabaku, Sarah B. Klieger, Brian H. Wrotniak David D. Sherry, Babette S. zemel Nicolas Stettler, adolescent obesity, joint pain, and hypermobility, Pediatr Rheumatol Online J 2014; 12: 11.
29. Oline Sohrbeck-Nøhr Halkjær Jens Kristensen, Eleanor Boyle, Lars Remvig, and Birgit Juul-Kristensen,: Generalized joint hypermobility in childhood is a possible risk for the development of joint pain in adolescence: a cohort study,; BMC Pediatr. 2014; 14: 302.
30. Pacey V. Adams RD., Tofts L. Munns CF Nicholson LL.,: Joint hypermobility syndrome subclassification in Paediatrics a factor analytic approach.; Arch Dis Child. 2015 Jan; 100 (1): 8-13.
31. Pacey V., L. Tofts, 5, Adams RD., Munns C., Nicholson LL.; Prediction quality of life in children with joint hypermobility syndrome; J Paediatr Child Health. 2015 Jul; 51 (7): 689-95.