Zych Ewa, Gębska Magdalena. Assessment of body mass index and spine mobility in children with constitutional hypermobility. Journal of Education, Health and Sport. 2018;8(8):97-111. eISNN 2391-8306. DOI http://dx.doi.org/10.5281/zenodo.1298425
http://ojs.ukw.edu.pl/index.php/johs/article/view/5607
https://pbn.nauka.gov.pl/sedno-webapp/works/868644

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: 01.06.2018. Revised: 08.06.2018. Accepted: 26.06.2018.

Assessment of body mass index and spine mobility in children with constitutional hypermobility

Ewa Zych[1], Magdalena Gębska[2]

1 Student of Physiotherapy, Pomeranian University of Medical Science

2 Department of Rehabilitation Musculoskeletal System Pomeranian University of Medical Science

Address for correspondence:

dr n. zdr. Magdalena Gębska, Department of Rehabilitation Musculoskeletal System Pomeranian University of Medical Science, mgebska@pum.edu.pl

SUMMARY

Introduction. Hypermobility is a genetic condition that affects the connective tissue. The main symptoms of this syndrome include laxity of joint capsules and ligaments, increased range of movement and pain. Although the condition is genetically determined, different factors may influence the occurrence if symptoms and the intensity of the disorders.

Aim. Assessment of body mass index and spine mobility in children with hipermobility of joints.

Material and methods. The study included a group of 100 children aged from 6 to 10 years. The presence of hypermobility was determined using Beighton scale. 21 boys and 13 girls with established hypermobility were admitted for the study group. The control group was chosen at random, taking into account the number and sex. The body mass index was additionally examined in all children. The results were plotted on centile grid, suitable for the age and sex of the subjects. The last examination carried out was the assessment of the spine joints mobility.

Results. The comparison between the two groups of subjects showed the results were statistically insignificant ($p > 0.05$) for BMI values. Statistical analysis showed association ($p \leq 0.05$) between ranges of spinal movements in particular sections in children with HS only in three movements: slope sideways to the right in the thoracolumbar section, thoracolumbar segment turn to the right and thoracolumbar segment turn to the left.

Key words: hypermobility, Beighton scale, body mass index, spinal mobility

BACKGROUND

Constitutional hypermobility is also referred to as joint laxity and is classified as a genetic disorder [1, 2]. Characteristic for the individual are excessive mobility in joints in relation to generally accepted norms and abnormalities in the structure of connective tissue of the whole organism [1, 2, 6]. Increased mobility in the joints is not accompanied by any congenital defects, additional rheumatic or neurological symptoms [1, 2, 4]. Disorders in the connective tissue, caused by the defect of genes encoding connective tissue matrix, such as elastin, fibrillin, tenastin and collagen lead to the relaxation of the ligamentous apparatus and increase its elasticity. In the course of the disease, there are also disproportions between the production of collagen [1, 6, 7, 18] . BHJS is a disease whose occurrence includes various latitudes. It is estimated that increased mobility of joints affects about 38% of the African and Asian populations, while in western countries the problem affects about 10% of the population [2, 3]. This is a significant group of the population, more often children and adolescents, because the unfinished development process does not mask the symptoms as it is the case in older people. Female gender is more prone to be affected than males, therefore it is assumed that the abnormalities are inherited in a dominant way, related to the female sex [6, 10, 13, 15]. Typical symptoms of joint laxity are: subluxation or dislocation of joints (as a result of trauma, increased physical activity, daily activities), posture defects (lumbar hyperlordosis, curvature of the spine, flat feet, valgus knees) and chronic pain in the joints reported by patients [5, 8]. Pain can affect every joint. The most vulnerable are the joints that carry the largest loads such as ankles, knees, spine joints [3,9,10,12]. An additional burden for joints in children with hypermobility may be incorrect body weight. Increasing overweight and obesity among children is becoming a problem that should not be neglected. It is the cause of many diseases including musculoskeletal disorders. Being overweight weight leads to a decrease in physical activity which results in a reduced physical performance. The level of motor features decreases causing overloading in the bone-joint-ligament system [11,14]. Due to the consequences of laxity of joints and the incidence of overweight and obesity in children, it seems reasonable to address the topic of hypermobility in these patients and conduct further research to improve the diagnosis, and facilitate introduction of appropriate prophylaxis and therapy [7,8,16].

AIM

Assessment of body mass index and spine mobility in children with hypermobility of joints.

MATERIAL AND METHODS

The study was conducted in a group of 100 children (69 boys, 31 girls) aged 6 to 10 years attending elementary schools in Szczecin. The caregivers of the children were informed about the purpose and expressed their written consent for the child to participate in the study. To determine the occurrence of hypermobility in children, a 9-point Beighton scale was used. It consists of 5 tests: passive extension of the finger V above 90°, passive moving of thumb tip to the inner surface of the forearm, extension in the elbow joint above 10°, extension in the knee joint above 10°, positioning of entire hands on the ground during the forward slope with straight knee joints. The basis for the diagnosis of joint hypermobility syndrome is obtaining a minimum of 4 points out of 9 possible in the test. In the examined group, the occurrence of joint flaccidity was found in 21 boys and 13 girls. Children diagnosed with hypermobility were a study group GI (H). The control group G II (C) was randomly selected, consisted of the same number of male and female children, the same age and no hypermobility found. In all children the body mass index (BMI) was assessed, then the results were analyzed on the basis of indicators included in centile charts appropriate for age and sex. Then, in Group I and II the ranges of mobility of the spine joints were assessed. The spine mobility study was made using a tailor's centimeter according to A. Zembaty methodology [19]. The free position, with the eyes facing forward, was the starting position for the measurements. The following measurements were made:

a) cervical spine section (examined movements: Pic 1. bend, Pic 2. extension, Pic 3. lateral flexion, Pic 4. turn), Pic 1. flexion of the cervical spine

A). starting position B). end position

Pic 2. extension of the cervical spine

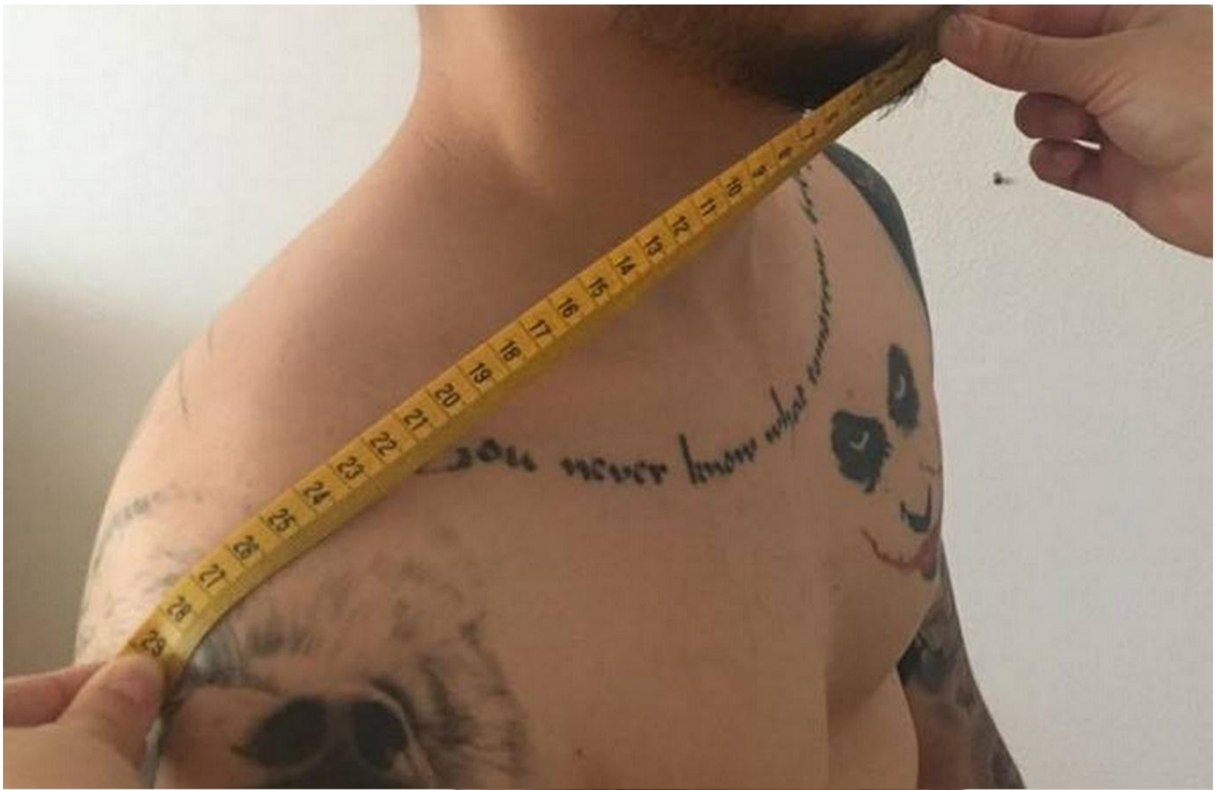
A). starting position B). end position

Pic 3. lateral flexion of the cervical spine

A). starting position B). end position

Pic 4. turn of the cervical spine

A). starting position



B). end position

b) chest section (Pic 5. bend),

Pic 5. flexion of the thoracic spine

A). starting position B). end position

c) lumbar spine (Pic 6. bend, Pic 7. extension),

Pic 6. flexion of the lumbar spine

A). starting position B). end position

Pic 7. extension of the lumbar spine

A). starting position B). end position

d) thoraco-lumbar section (Pic 8. lateral flexion, Pic 9. turns),

Pic 8. lateral flexion of the thoracolumbar section of the spine

A). starting position B). end position

Pic 9. turn of the thoracolumbar section of the spine

A). starting position B). end position

A). starting position B). end position

e) Pic 10. total backbone slope

The examined ranges were measured on both sides of the body according to generally accepted norms [19]. The obtained results were subjected to statistical analysis using Microsoft Office Excel 2007. The Student's t-test was used to assess statistical significance. The p value ≤ 0.05 was assumed as the level of significance.

RESULTS

First, the results of the body mass index analysis in Group I and II were presented. The BMI index is calculated based on the basic anthropometric measurements such as body mass and height. The result is obtained by dividing the body mass in kilograms by the square of body height expressed in meters. The results obtained are mainly used in the assessment of adult body mass. When weight is assessed in children, the values obtained should be applied to age and sex-appropriate centile charts.

Group characteristic	Body Mass Index			
	BMI		Percentils	
	Gr. I (H) (n=34)	Gr. II (C) (n=34)	Gr. I (H) (n=34)	Gr. II (C) (n=34)
min - max	12.01-27.55	3.33-16.00	1.50-100	4.50-96
$\overline{x}$	17.58	9.49	63.90	60.90
m_e	17.70	9.67	65	70
SD	2.99	3.06	29.21	25.63
p (Student’s t test)	0.43		0.65	

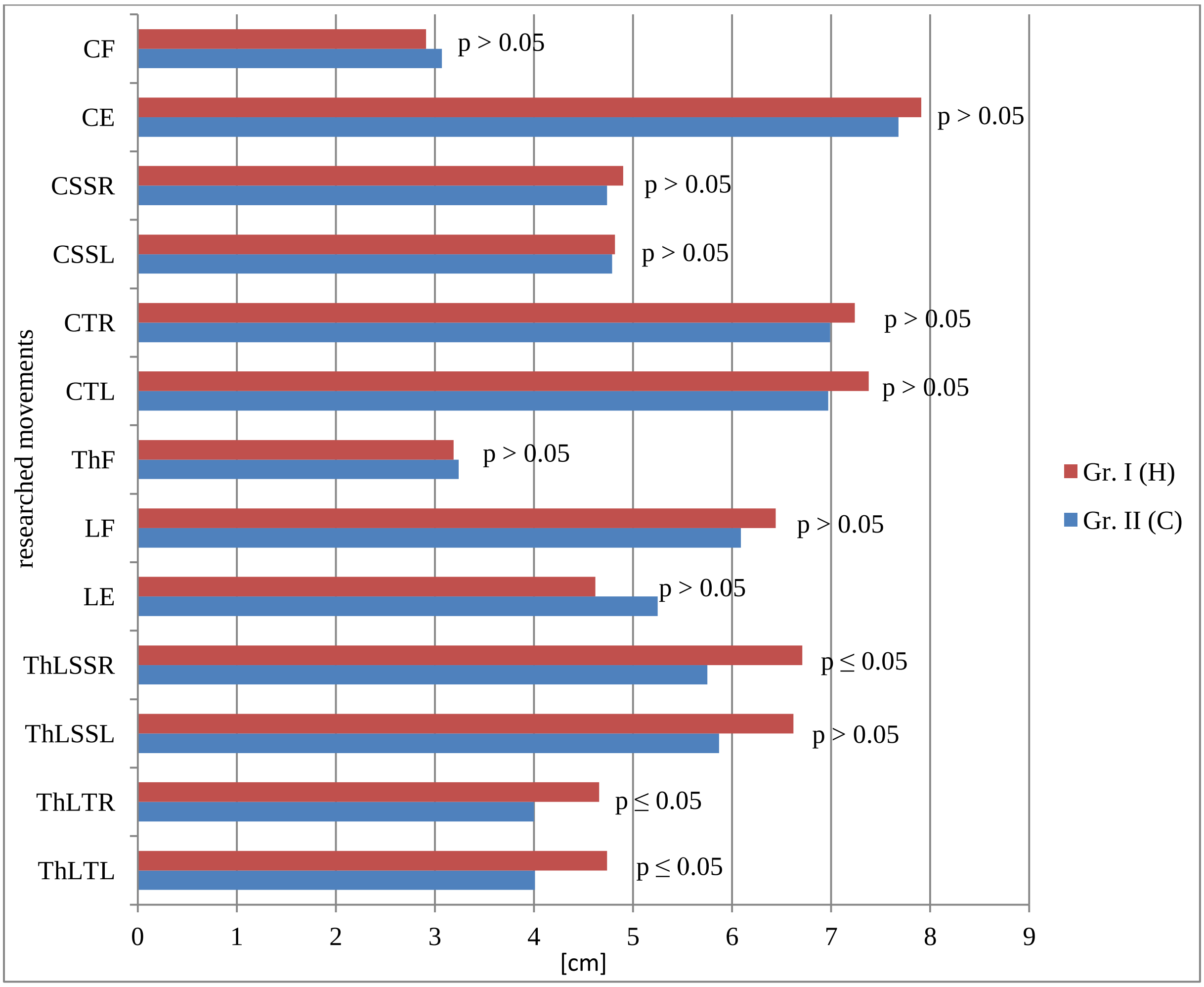
Legend:

n – group size, Gr – group, H – hypermobile group, C – control group, min – minimal value, max – maximal value, $\overline{x}$ – arithmetic average, m_e – median, SD – standard deviation, p – statistical significance level

Statistical evaluation of body mass index between groups I and II showed no statistically significant difference p ≤ 0.05.

Next, the occurrence of the relationship between the range of motion in the joints of the spine and the hypermobility of the joints found in the Beighton test were assessed. For this purpose, the arithmetic mean was calculated for each study movement in the groups Gr. I (H) and Gr. II (C) , the obtained values are shown in the graph below.

Correlation between ranges of spinal movements in particular sections



Legend:

p – statistical significance, Gr – group, H- hypermobile group, C – control group, CF - Cervical segment flexion, CE - Cervical segment extension, CSSR - Cervical segment slope sideways to the right, CSSL - Cervical segment slope sideways to the left, CTR - Cervical segment turn to the right, CTL - Cervical segment turn to the left, ThF - Chest segment flexion, LF - Lumbar segment flexion, LE - Lumbar segment extension, ThLSSR - Thoracolumbar segment slope sideways to the right, ThLSSL - Thoracolumbar segment slope sideways to the left, ThLTR - Thoracolumbar segment turn to the right, ThLTL - Thoracolumbar segment turn to the left

The analysis of the results shows that statistical significance was recorded in three cases. The significance was $p \leq 0.05$ for thoracolumbar segment slope sideways to the right, thoracolumbar segment turn to the right and thoracolumbar segment turn to the left. In other cases no statistical significance was noted ($p > 0.05$).

DISCUSSION

The occurrence of hypermobility among children and adolescents is a serious problem because it can cause numerous ailments connected with the musculoskeletal system and affect the quality of life as well as reduce the physical activity of young patients. People with joint laxity are particularly vulnerable to overloads in the musculoskeletal system and the introduction of inadequate therapy may result in increased severity of symptoms. The incidence of hypermobility in population is significant and due to the variation and non-specific symptoms that characterize joint hypermobility, the diagnosis is difficult [1, 8].

Research conducted by Mikołajczyk et al. included a research group of 120 people (60 boys, 60 girls) at the age of 15. 13 clinical tests were used to assess joint mobility. The following were examined: trunk retroflexy, torso foregrain, lateral flexion in the lumbar region, trunk rotation, head and neck rotation, hyperextension in the metacarpophalangeal joints, passive thumb application to the palmar surface of the forearm, hyperextension in the elbow joints, indicative mobility in the shoulder girdle, mobility in the shoulder joints, passive extension in the knee joint, passive abduction to the hip joint and rotation in the hip joint. The criterion was a positive result of 7 out of 13 tests. The occurrence of the Hypermobility Syndrome was found in 8.3% of the total number of respondents [1]. A much higher percentage of children with hypermobility was shown in studies conducted by Pawłowska et al. The analysis included 128 children (64 boys, 64 girls) aged 9 to 13 years. A Beighton 9-point test was carried out. Excessive elasticity of the joints was demonstrated in 32 people (21 boys, 11 girls), which constituted 25% of the studied group [3]. In the author's work, the percentage of people with established hypermobility was 34% of those surveyed. Data on the occurrence of joint laxity in children are varied and range from 7% to 65%. Czaprowski et al. notices this in his work, and for the reason of the discrepancy he gives a multitude of concepts used by the authors in the literature on the subject [5]. Discrepancies in the results of the conducted research may also be caused by differences in the age and the number of individuals in the examined groups, as well as tests and scales used to determine the occurrence of hypermobility. Doctors Wahezi and Ilowite report that the child's weight has a significant influence on exercise tolerance. According to Wehezi and Ilowite, there is a relationship between the occurrence of HS and increased body weight in children. They attribute the irregularities to pain syndromes and hence reduced ability to undertake physical activity. It is not determined whether inactivity, sedentary lifestyle and obesity cause distress or are symptoms of its occurrence. The authors also emphasize the psychological aspect of the described unit. They note that less frequent participation in sports activities can result in being excluded from one’s peers and lead to reduced social interaction and psychological disorders [17]. Bone overload changes are also mentioned as early effects of obesity by Jordowska et al.

[11]. In such patients, it seems very important to promote healthy lifestyle, changing the diet (if necessary) and controlling body weight to prevent the development of obesity. Statistical assessment of body mass between groups I and II in the author's work did not show statistical significance. This fact may be caused by too few examined persons. The generalized joint laxity affects the joints carrying the largest axial loads, which is why many of these ailments affect the spine joints. Czaprowski et al. In their studies show a lack of relationship in the ranges of mobility of the spine between the study group with confirmed hyper-activity and children without HS. They also note that for routine clinical assessment of the skeletal system, it would be reasonable to include the assessment of the prevalence of HS [8]. Authors work shows statistical significance in the three cases: thoracolumbar segment slope sideways to the righ, thoracolumbar segment turn to the right and thoracolumbar segment turn to the left. Due to the small amount of publications in literature and the fact that the topic of hypermobility among children and adolescents is not widely known, despite frequent occurrence, it is difficult to refer the obtained results to other research and draw far-reaching conclusions that will help in the correct diagnosis and therapeutic proceedings in the future. It is certain that the task of physicians and physiotherapists should be to deepen the knowledge on the described unit and conduct research focusing on the frequency of occurrence of this phenomenon, as well as conduct analysis and the search for the relationship between hypermobility and factors that may affect its occurrence and result in aggravation of ailments.

CONCLUSIONS

1. The values of the body mass index for children with diagnosed joint hypermobility and children without determined abnormalities are comparable.

2. Further research should be conducted to establish the relationship between the occurrence of hypermobility in the joints of the spine and the hypermobility of the joints found in the Beighton test.

Bibliography:

1. Mikołajczyk E., Szczygieł A., Jankowicz- Szymańska A., Kopf P. (2012). Występowanie zespołu hipermobilności stawów (ZHS) u 15-letnich dziewcząt i chłopców w kontekście problemów diagnostycznych, terapeutycznych i profilaktycznych. *Fizjoterapia Polska*, 3(4),Vol. 12, 229-240.

2. Mirska A., Kalinowska A. K., Topór E., Okulczyk K., Kułak W. (2011). Łagodny zespół hipermobilności stawów (BHJS). *Neurologia dziecięca*, 41, Vol. 20, 135-140.

3. Pawłowska P., Czaprowski D., Kolwicz A., Leszczewska J. (2013). Dolegliwości bólowe kręgosłupa u dzieci- ocena związku z hipermobilnością stawową i elastycznością wybranych mięśni kompleksu lędźwiowo- miedniczno- biodrowego. *Nowa Pediatria,* 2, 39- 43.

4. Smolewska E., Brózik H., Stańczyk J. (2004). Zespół nadmierniej wiotkości jako przyczyna bólów stawów u dzieci. *Przegląd Pediatryczny*, Vol 31, 1, 13- 16.

5. Czaprowski D., Kotwicki T., Stoliński Ł. (2012). Ocena wiotkości stawowej u dzieci i młodzieży- przegląd metod. *Ortopedia Traumatologia Rehabilitacja*, 5(6), Vol 14, 407- 420.

6. Słowińska I., Rutkowska- Sak L. (2014). Benign joint hypermobility syndrome. *Reumatologia*, 52, 6, 398–401.

7. Scheper M. C., Engelbert H. H., Rameckers A. A., Verbunt J., Remvig L., Juul-Kristensen B. (2013). Children with Generalised Joint Hypermobility and Musculoskeletal Complaints: State od the Art on Diagnostics, Clincal Characteristics, and Treatment. *Biomed Res Int.* 13 pages.

8. Czaprowski D., Pawłowska P. (2013). Wpływ uogólnionej hipermobilności stawowej na wielkość strzałkowych krzywizn kręgosłupa u dzieci w wieku 10-13 lat. *Ortopedia Traumatologia Rehabilitacja*, 6(6), Vol 15, 545- 553.

9. Dobosiewicz K. (2006). Niespecyficzny ból kręgosłupa u dzieci i młodzieży- uwarunkowania biomechaniczne, neurofizjologiczne oraz psychospołeczne. *Neurologia Dziecięca,* Vol 15, 30, 51- 57.

10. Bogucka A., Głębocka A. (2017). Postawa ciała 9 – 12-letnich dzieci o zróżnicowanej względnej masie ciała wyrażonej wskaźnikiem BMI. *Aktywność Fizyczna i Zdrowie Physical Activity and Health*, 12, 11-17.

11. Jodkowska M., Woynarowska B., Oblacińska A. (2007). Test przesiewowy do wykrywania zaburzeń w rozwoju fizycznym u dzieci i młodzieży w wieku szkolnym. Materiały metodyczne dla pielęgniarek szkolnych oraz lekarzy podstawowej opieki zdrowotnej. *Instytut Matki i Dziecka, Warszawa*, Nr 5102045, 13-14.

12. Adib N., Davies K., Grahame R., Woo P., Murray K. J. (2005). Joint hypermobility syndrome in childchood. A not so benign multisystem disorder? *Rheumatology*, Volume 44, 6, 744–750.

13. Izydorczyk- Styś A., Izydorczyk- Styś B. (2013). Ocena gibkości dzieci w wieku wczesnoszkonym. Assessment of suppleness of children in early school age. *Fizjoterapia,* 21, 4, 28-34.

14. Mikoś M., Mikoś M., Mikoś H., Obara- Moszyńska M., Niedziela M. (2010). Nadwaga i otyłość u dzieci i młodzieży. Overweight and obesity in children and adolescents. *Nowiny Lekarskie*, 79, 5, 397- 402.

15. Bird H. A. (2011). Hypermobility- Does It Cause Joint Symptoms? *European Musculoskeletal Review*, 6, 1, 34- 37.

16. Palmer S., Terry R., Rimes K. A., Clark C., Simmonds J., Horwood J.(2016). Physiotherapy menagment of joint hypermobility syndrome- a focus group study of patient anf health professional perspectivess. *Physiotherapy*, 102, 93- 102.

17. Wahezi M., Ilowite N. (2010). Dolegliwości stawowe i nadmierna ruchomość stawów. *Pediatria po Dyplomie*, Vol. 14, 3, 66- 69.

18. Gębska M., Weber-Nowakowska K., Żółtowska O., Żyżniewska-Banaszak E., Woitas Ślubowska D. (2017). Deep stabilization muscles training in patients with polyarticular hypermobility. *J Educ Health Sport*, 2017, 7, 9, 101-135.

19. Zembaty A. (2002). Kinezyterapia Tom I, *wyd. Kasper*, 123- 126, 151- 157.

20. Gębska M., Weber- Nowakowska K., Oklejak M., Boćkowski R., Żyżniewski J., Żyżniewska-Banaszak E. (2016). Polyarticular hypermobility and its consequences in rowers and swinners: a preliminary report. *Trends Sport Sci*, 3, 141-145.

21. Przymuszała A., Roszak M., Kulik O., Uździcki A.,Turoń- Skrzypińska A., Rotter I., Ptak M. (2018). Generalised joint hypermobility as a symptom of chosen diseases and syndromes. *J Educ Health Sport*, 8, 4, 246-255.

22. MT Hudda, CM Nightingale, AS Donin, CG Owen, AR Rudnicka, JCK Wells, H Rutter, DG Cook , PH Whincup. (2018). Patterns of childhood body mass index (BMI), overweight and obesity in South Asian and black participants in the English National child measurement programme: effect of applying BMI adjustments standardising for ethnic differences in BMI-body fatness associations. *International Journal of Obesity*, 1–9.