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Polyarticular hypermobility and its consequences in rowers and swimmers: a preliminary report

MAGDALENA GĘBSKA, KATARZYNA WEBER-NOWAKOWSKA, MICHAŁ OKLEJAK, RADOSŁAW BOĆKOWSKI, JAKUB ŻYŻNIEWSKI, EWELINA ŻYŻNIEWSKA-BANASZAK

Abstract

Practicing competitive sports by people with joint hypermobility syndrome carries an increased risk of injury. For such athletes it is important to establish a correct diagnosis and modify their training programs in order to minimize the risk of injury during training or competition. The aim of this study was to evaluate the prevalence of polyarticular hypermobility and its consequences in rowers and swimmers. The study sample comprised 15 male rowers 15 male swimmers. A questionnaire survey assessing the knowledge and awareness of hypermobility and its complications was carried out. In order to determine the prevalence of hypermobility in the athletes under study the Beighton and Brighton scores were used. The results of the study suggest that hypermobility in the joints is statistically more prevalent in swimmers than in rowers. Also, the swimmers suffered from injuries and pain within the musculoskeletal system more often than the rowers. Swimmers are more prone to polyarticular hypermobility. It is therefore essential to perform tests to detect joint hypermobility in this group of athletes. It is necessary to develop and introduce special training programs for athletes with elastopathy, which will help to protect their joints against overloads and injuries. When selecting children and young people for various sports, the applied system of medical examinations should include a physiotherapeutic musculoskeletal examination for the presence of polyarticular hypermobility.

KEYWORDS: hypermobility, rowers, swimmers, injuries in sports, physiotherapy.

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Corresponding author: mgebska@pum.edu.pl

Pomeranian Medical University in Szczecin, Independent Laboratory of Physical Therapy and Biological Rejuvenation, Szczecin, Poland

What is already known on this topic?
Hypermobility is an inherited abnormality in the structure of connective tissues throughout the body, manifested by disturbances in the proportion of collagen. Hypermobile joints are always overloaded, which leads to faster appearance of degenerative changes of the entire limb or spine. There are no reports evaluating the presence of hypermobility and its consequences on people practicing rowing and swimming, this prompted the authors to undertake this topic.

Introduction

Physical activity is a natural need of the human body and an important part of maintaining good health and well-being. Numerous studies have confirmed the beneficial effects of exercise on the functioning of the body, in particular, the cardiovascular system, musculoskeletal system, nervous system, and immune system [1]. Engaging in physical activity should be guided not only by personal interests or current trends, but also by one's health limitations. Special consideration should be given to the negative aspects of practicing sports by people with innate disorders of the soft tissue, e.g. with polyarticular hypermobility. In

the case of athletes with joint hypermobility improperly selected and applied physical loads can lead to frequent injuries and overloads of the musculoskeletal system, consequently, to degenerative changes and disability [2, 3, 4]. The term Hypermobility Syndrome (HS) was used for the first time by Kirk et al. in 1967, who described ailments of the musculoskeletal system due to hypermobility of the joints in adults [5]. Benign joint hypermobility syndrome (BHJS) is an inherited abnormality in the structure of connective tissues throughout the body, manifested by disturbances in the proportion of collagen [6]. The main symptoms of this syndrome include: laxity of joint capsules and ligaments, which increases the range of mobility in the joints, pain in the joints, as well as numerous disorders within body organs and systems containing connective tissue [7].

Aim of Study

The aim of the study was to evaluate the prevalence of polyarticular hypermobility and its consequences in rowers and swimmers.

Material and Methods

The study was conducted in 2016 in the Municipal Sports Center for Recreation and Rehabilitation in Szczecin. The study groups consisted of 15 rowers and 15 swimmers aged 15 to 21 years. The average age of the swimmers was 18 years, and of the rowers 17 years. The average body height and body mass were similar in both groups: 185 cm and 80 kg in rowers; 183 cm and 75 kg in swimmers.

A questionnaire survey was conducted consisting of questions regarding participants' self-awareness of hypermobility, and history of previous traumas or pains of the musculoskeletal system.

In order to determine the prevalence of joint hypermobility, a five-point Beighton test was performed by all participants. It consisted of:

1. Passive extension of the fifth finger to above 90 degrees.
2. Thumb adduction outward to the inner side of the forearm.
3. Elbow joint overextension to above 10 degrees.
4. Overextension of the knee joint to above 10 degrees.
5. Placing the entire surface of hands on the floor while standing with legs straight in knee joints.

The basis for HS diagnosis was a minimum 4 out of 9 points in the test. In addition, the athletes took the Brighton test in order to diagnose possible mild joint hypermobility syndrome (BHJS). The Beighton test includes the results of the Brighton test and symptoms such as joint pain, degenerative changes in the spine, subluxation of the joints, skin symptoms, ocular symptoms, possibility of hernias, varicose veins, rectal prolapse, and the physique. The results were divided into Large and Small criteria. The basis of BHJS diagnosis was the presence of at least two "large criteria", one "large criterion" and two "small criteria", or four "small criteria". All tests were conducted in the same conditions by the same person. The results were analyzed using an MS Excel spreadsheet and the Statistica software package.

Results

As shown in Figure 1, 6% of the rowers realized they had symptoms of hypermobility, and 13% experienced an increased range of motion in their joints. None of the swimmers recognized hypermobility symptoms in themselves, while 27% noticed an increased range of motion in the joints.

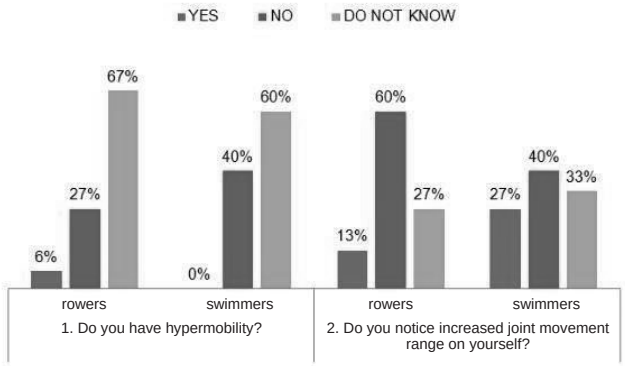

Figure 1. Percentage assessment questionnaire of awareness of hypermobility and increased range of movement in the joints in rowers and swimmers

The answers "NO" and "DO NOT KNOW" were compared with the positive Beighton and Brighton scores. Nearly one half (approx. 43%) of rowers who in the personal questionnaire answered "NO/DO NOT KNOW" to the question regarding the prevalence of hypermobility were positive on the Brighton scale and/or Beighton scale. Using the same criteria, 67% of the swimmers showed positive results.

The results in Table 1 indicate a statistically significant difference ($p < 0.0001$) between swimmers and rowers in both the Beighton test and the Brighton test. The increased range of motion in the joints was statistically more frequent in swimmers than in rowers in both tests. The swimmers had also higher average values in the hypermobility scales.

Table 1. Distribution of polyarticular hipermobility measured with the Beighton test and the Brighton test in rowers and swimmers

Distribution characteristics		Hypermobility prevalence assessment scale			
		Brighton score		Beighton score	
		Rowers (n = 15)	Swimmers (n = 15)	Rowers (n = 15)	Swimmers (n = 15)
min. – max		0 – 1	0 – 1	0 – 8	1 – 9
$\bar{x}$ (SD)		0.2 (0.41)	0.86 (0.35)	3.46 (2.61)	6.46 (2.19)
Significance level	Shapiro-Wilk Test	< 0.001	< 0.001	0.145	0.109
	Wilcoxon signed-rank test	< 0.0001		< 0.0001	

n – group size; min. – minimum; max – maximum, $\bar{x}$ – arithmetic mean; SD – standard deviation

The data in Figure 2 shows that joint hypermobility occurs more frequently in swimmers than in rowers. In both the Beighton and Brighton tests, 86.6% of the swimmers achieved positive results, which indicates the presence of BHJS. In the group of rowers the number of people with hypermobility was significantly lower.

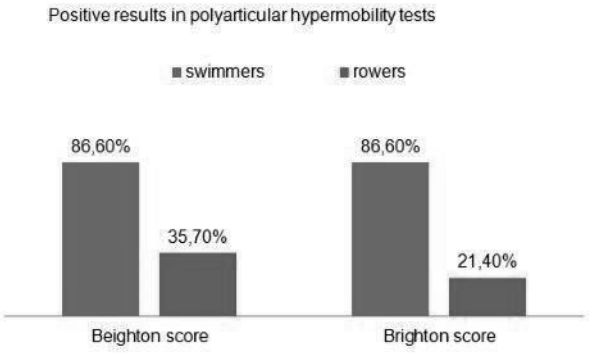

Figure 2. Percentage of polyarticular hypermobility incidence calculated with the Brighton and Beighton tests

The results in Figure 3 show that more injuries within the musculoskeletal system occurred in swimmers than in rowers. Among the most common injuries in the swimmers were overload injuries (78% of athletes) and periarticular soft tissue tearing (20% of athletes). The prevalence of other types of injuries, e.g. strain injuries, spraining and dislocation, was comparable in both groups. As shown in Figure 4 injuries within the musculoskeletal system in swimmers usually affected the shoulder joint (67% of respondents) and the elbow joint (26% of respondents). Injuries of the ankles and wrists were more frequent in rowers than in swimmers.

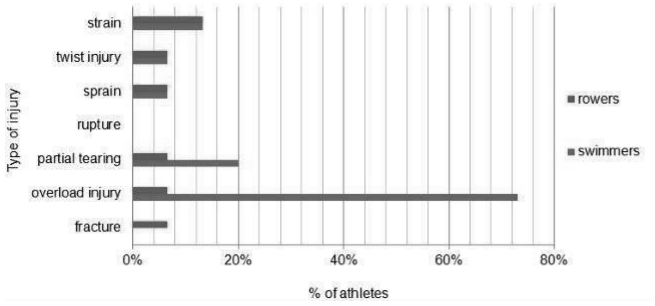

Figure 3. Type of injury as reported by the athletes

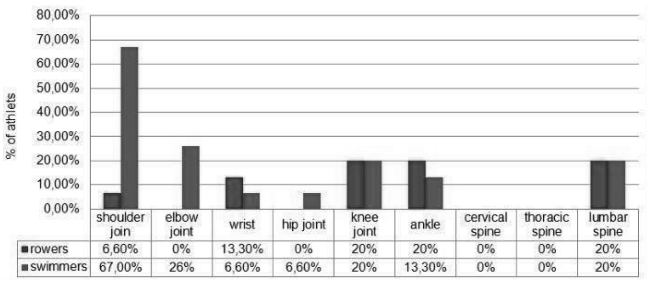

Figure 4. Areas of injury suffered while training

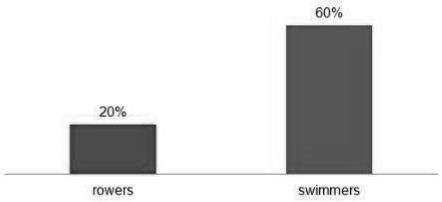

Figure 5. The occurrence of pain in the joints of swimmers and rowers

The results in Figure 5 show that joint pain is three times more frequent in swimmers (60%) than in rowers (20%). The higher percentage of swimmers with joint pain can be caused by the presence of polyarticular

hypermobility in this group. One of the symptoms of polyarticular hypermobility is, among others, arthralgia.

Discussion

Conventional wisdom suggests a positive impact of sport on human health. Without a doubt, physical activity is an important factor in shaping health, developing proper habits and healthy behaviors. However, in order to practice sport in a safe way, athletes should be tested for factors that may lead to frequent injuries, pain, and early disability. The musculoskeletal system is composed largely of collagen. Disorders of collagen metabolism conditioned by polymorphisms of genes coding collagen proteins affect dysfunctions within the musculoskeletal system as well as tissues and organs such as bones, tendons, joints; and they worsen the general state of health [8]. Pathologies within the connective tissue (resulting from disorders of collagen metabolism) may indicate the presence of BHJS. Hypermobile joints are always overloaded, which leads to unfavorable biomechanical changes in the musculoskeletal system, rapid wear of the articular surfaces, congestion, pain, injury, and early degenerative changes [9].

Publications on hypermobility of the joints in groups of athletes (e.g. football players, dancers, volleyball players) can be found in English and Polish literature [10, 11, 12, 13]. Anwajer et al. conducted a survey among Polish women training acrobatics [14] aimed at an analysis of the range of motion of joints. The authors singled out three groups of participants: athletes practicing acrobatics at the time of the study (n = 35), former athletes (n = 15), and non-training controls (n = 20). In the group of female athletes practicing acrobatics at the time of the study as many as 93% were positive on the Brighton hypermobility scale. As many as 56% of former acrobats reported back pain (mainly L-S) and frequent health problems with the knee and hip joints.

The association between constitutional hypermobility and ankle injuries in female and male volleyball players was studied by Rutkowska. Joint hypermobility was examined according to the scheme proposed by Stodolna-Tukendorf. The results of the study confirmed that women with joint hypermobility who started training when they were under 10 years old suffered from more injuries than athletes without hypermobility. Unlike in women, in men a relationship between injury rates and the length of their career was not observed [15].

The authors of the present study work were not able to find any earlier publications comparing the prevalence of joint hypermobility in swimmers and rowers. It is reasonable to compare these two groups because both sports feature low traumatism and do not involve sudden movements [16]. In this study, hypermobility was more common in swimmers than in rowers. There was a statistically significant difference between the swimmers and rowers in the Beighton and Brighton tests. Musculoskeletal pain and injuries were more frequent in swimmers than in rowers.

The increased incidence of hypermobility and injury in swimmers may result from the biomechanical nature of swimming training. Swimming is a biokinematic, open-chain exercise characterized by high speed and freedom of movement with little stability. During swimming proprioception is stimulated to a slight degree, and mostly agonistic and synergistic muscles are activated. A disruption of the functioning of the upper limbs in particular may occur more frequently during swimming training because biokinematic open-chain exercise involves an imbalance between the stability and mobility of the limbs. Static and dynamic structures must function correctly for the functional stability to be preserved [17]. The articular hypermobility, often initially perceived as a predisposition for swimming, can be a factor in frequent accidents and injuries. In order to reduce the negative consequences of exercises performed in open kinematic chains in athletes diagnosed with polyarticular hypermobility, appropriate physiotherapy procedures should be implemented.

During rowing training the majority of movements are performed in partially closed kinematic chains, which results in better joint stabilization in rowers than in swimmers. Exercises in closed kinematic chains enhance proprioception and at the same time activate the agonistic, synergistic, and antagonistic muscles, and are safer for athletes with hypermobility.

Training exercises based on closed biokinematic chains minimize the shear forces in the joints, often causing damage or overloading of periarticular structures. This mechanism occurs in swimming training.

What this study adds?

Described studies are the first on the occurrence of hypermobility of people practicing rowing and swimming. To determine the frequency of its occurrence will reduce the risk of injury to an athlete. The results indicate the need to implement special training plans for patients with impaired proportions of collagen.

References

1. Wojtasik W, Szulc A, Kołodziejczyk M, Szulc A. Wybrane zagadnienia dotyczące wpływu wysiłku fizycznego na organizm człowieka. J Educat Health Sport. 2015; 5(9): 350-372.
2. Palmer S, Bailey S, Barker L, Barney L, Elliott A. The effectiveness of therapeutic exercises for joint hypermobility syndrome: a systemic review. Physiotherapy. 2014; 100: 220-227.
3. Keer R, Simmonds J. Joint protection and physical rehabilitation of the adult with hypermobility syndrome. Curr Opin Rheumatol. 2011; 23: 131-136.
4. Złotkowska R, Skiba M, Mroczek A, et al. Negatywne skutki aktywności fizycznej oraz uprawiania sportu. Hygeia. 2015, 50(1): 41-46.
5. Kirk JA, Ansell M, Bywaters EGL. The hypermobility syndrome. Ann Rheum Dis. 1967; 26: 419-425.
6. Pacey V, Tofts L, Wesley A, et al. Joint hypermobility syndrome: A review for clinicians. J Paediatr Child Health. 2015, 51: 373-380.
7. Iomdina E, Tarutta E, Markossian G, et al. Sclera as the target tissue in progressive myopia. Pomeranian J Life Sci. 2015; 61: 146-152.
8. Abrahams S, Posthumus M, Collins M. A polymorphism in a functional region of the COL5A1Gene: Association with ultra-endurance running performance and joint range of motion. Int J *Sport Physiol.*, 2014; 9: 583-590.
9. Ross J, Grahame R. Joint hypermobility syndrome. BMJ. 2011; 342: 275-277.
10. Soper K, Simmonds JV, Kaz Kaz H, Ninis N. The influence of joint hypermobility on functional movement control in an elite netball population: A preliminary cohort study. Phys Ther *Sport. 2015;* 16: 127-134.
11. Smith R, Damodaran AK, Swaminathan S, Campbell R, Barnsley L. Hypermobility and sports injuries in junior netball players. Br J Sports Med. 2005; 39: 628-631.
12. Konopiński MD, Jones GJ, Johnson MI. The effect of hypermoblility on the incidence of injuries in elite-level professional soccer players: a cohort study. Am J Sports Med. 2012; 40(4): 763-769.
13. Sanches SB, Oliveira GM, Osório FL, Crippa JAS, Martín-Santos R. Hypermobility and joint hypermobility syndrome in Brazilian students and teachers of ballet dance. Rheumatol *Int.* 2015; 35: 741-747.
14. Anwajler J, Wojna D, Stępak A, Skolimowski T. Wpływ uprawiania akrobatyki sportowej na zakres ruchomości stawów kręgosłupa, kończyn górnych i dolnych. Fizjoter Pol. 2005; 5: 57-64.
15. Rutkowska A. Związek hipermobilności konstytucjonalnej z urazami stawu skokowego u siatkarzy i siatkarek. VII Wiosna z Fizjoterapią. Cykliczne Sympozjum Kół Naukowych. Warszawa, 19 kwietnia 2013 r.
16. Szyguła Z, Trzaska T. Profilaktyka urazów sportowych u dzieci i młodzieży. Med Sport. 2007; 11: 29-33.
17. Fitzgerald GK. Open versus closed kinetic chain exercise: issues in rehabilitation after anterior cruciate ligament reconstructive surgery. Phys Ther. 1997; 77(12): 1747-1754.