

COMPARISON OF POSTURE BETWEEN GYMNASTS AND NON-ATHLETES**Mića Radaković¹, Dejan Madić¹, Ksenija Radaković¹, Branka Protić-Gava¹,
Danilo Radanović¹ and Kamenka Živčić Marković²***Faculty of Sport and Physical Education, University of Novi Sad, Serbia**²Faculty of Kinesiology, University of Zagreb, Zagreb, Croatia**Original scientific paper***Abstract**

The aim of this study was to determine the difference in the postural status of the spine of school children who engage in gymnastics and their peers who do not engage in sports. Postural disorders occur in people who are not involved in sports, and in athletes also. The incidence of postural disorders is most common in children during critical periods of growth and development. The sample consisted of 97 primary school students from Novi Sad, Futog and Rumenka, aged 11 and 12. One group was consisted of students who engage in gymnastics more than three years, and other group consisted of students who are not engaged in sports. To determine the postural status it was used the modified method of Napoleon Wolanski. For determining the differences in postural status of pupils it was used the nonparametric method of chi-square test. Results show that significant differences were found in left chest scoliosis ($p=0.017$) between student who are not engaged in sports and those who are engaged in gymnastics.

Key words: *postural disorders, gymnastics, school children*

Introduction

Lack of physical activity represents one of the main causes of certain diseases and postural disorders (World Health Organization, 2002). Based on this report for 2001, the World Health Organization adopted the act on the Global strategy on healthy diet, physical activity and health (World Health Organization, 2004), which emphasizes the importance of adopting the habit of regular physical activity as early as the childhood age. Unfortunately, the adoption of bad habits is already evident in children of school age. Postural disorders of the locomotor system can occur at any age (Protić-Gava & Romanov, 2008). The incidence of postural disorders is most common in children during critical periods of growth and development (Demeši-Drljan & Mikov, 2012). As a result of the growth and development, body posture is also caused by the dominant physical activity, but also by the sport in which the child engages (Shumway-Cook & Woolacott, 2000). Postural disorders occur in people who are not involved in sports, and in athletes also (Vařeková et al., 2011). Large loads to which young athletes are exposed can cause the appearance of deformities of the locomotor system (Sławińska et al., 2006), but properly dosed appropriate activity positively affects the development process, correcting postural disorders and developing positive motor habits (Grabara & Hadzik, 2009). Monitoring postural status represents a manifold useful activity because it indicates the adequacy of the process of growth and development of children, helps in understanding the current, and may serve as a prognostic factor for their future health (Zdravković, 2001). Postural disorders represent individual and general social problem, and become growing social-health problem of the modern world (Marković et al., 2008).

The aim of this study was to determine the difference in postural status of spine in school children who were engaged in gymnastics and their peers who were not engaged in any sport.

Methods*Subjects*

The sample consisted of 97 primary school students from Novi Sad, Futog and Rumenka, aged 11 and 12. The schools included in the survey were primary school "Prva Vojvođanska Brigada", primary school "Petefi Šandor", primary school "Vuk Karadžić", primary school "Žarko Zrenjanin", primary school "Đorđe Natošević" from Novi Sad, primary school "Sveti Sava" from Rumenka and primary school "Miroslav Antić" from Futog. The students were divided into two groups. One group was consisted of 47 students who are engaged in gymnastics more than three years, and other group consisted of 50 students who are not engaged in any sport.

Procedures

To determine the postural status we used the modified method of Napoleon Wolanski according to Radisavljević, which means observing the body segments in the sagittal and frontal plane (Protić-Gava & Šćepanović, 2012). Posture of the spine was evaluated by the following assessments: zero (0) - normal physiological status, one (1) - less deviation from normal physiological status, two (2) - larger deviation from the normal physiological status (Radosavljević, 2001). While monitoring the posture of spine in order to determine the postural status, the respondents took a natural upright position, with the view directed forward, with arms relaxed beside the body.

The respondents were minimally dressed and barefoot. The observation was carried out from a distance of 2-3 meters from the lateral, rear and front side (Sabo, 2006).

With the purpose of determining students engaging in sports, a questionnaire was used, which was drawn up for the purpose of this survey and by means of which data were obtained whether the

students were involved in gymnastics or not involved in sports and for how long.

Statistical analysis

The obtained results were processed in SPSS version 20. For determining the differences in postural status of pupils it was used the nonparametric method of chi-square test, at significance level $p \leq 0.05$.

Results

Table 1. Numerical and percentage distribution of postural spinal disorders in children who engage in gymnastics

Postural disorders	Assessments of postural disorders							
	Good posture (0)		Bad posture (1)		Extremely bad posture (2)		Total	
	Number	%	Number	%	Number	%	Number	%
Kyphosis	40	85.1%	7	14.9%	0	0.0%	47	100%
Lordosis	36	76.6%	10	21.3%	1	2.1%	47	100%
Kypho-lordosis	42	89.4%	4	8.5%	1	2.1%	47	100%
Flat back	43	91.5%	4	8.5%	0	0.0%	47	100%
Winged scapulae	12	25.5%	32	68.1%	3	6.4%	47	100%
Left chest scoliosis	32	68.1%	15	31.9%	0	0.0%	47	100%
Right chest scoliosis	42	89.4%	5	10.6%	0	0.0%	47	100%
Left lumbar scoliosis	47	100.0%	0	0.0%	0	0.0%	47	100%
Right lumbar scoliosis	46	97.9%	1	2.1%	0	0.0%	47	100%
Compensatory scoliosis	46	97.9%	1	2.1%	0	0.0%	47	100%
Compensatory scoliosis	45	95.7%	2	4.3%	0	0.0%	47	100%

Table 2. Numerical and percentage distribution of postural spinal disorders in children who are not engage in sports

Postural disorders	Assessments of postural disorders							
	Good posture (0)		Bad posture (1)		Extremely bad posture (2)		Total	
	Number	%	Number	%	Number	%	Number	%
Kyphosis	40	80.0%	8	16.0%	2	4.0%	50	100%
Lordosis	35	70.0%	10	20.0%	5	10.0%	50	100%
Kypho-lordosis	40	80.0%	10	20.0%	0	0.0%	50	100%
Flat back	42	84.0%	8	16.0%	0	0.0%	50	100%
Winged scapulae	20	40.0%	29	58.0%	1	2.0%	50	100%
Left chest scoliosis	44	88.0%	6	12.0%	0	0.0%	50	100%
Right chest scoliosis	40	80.0%	10	20.0%	0	0.0%	50	100%
Left lumbar scoliosis	49	98.0%	1	2.0%	0	0.0%	50	100%
Right lumbar scoliosis	47	94.0%	3	6.0%	0	0.0%	50	100%
Compensatory scoliosis	46	92.0%	2	4.0%	2	4.0%	50	100%
Compensatory scoliosis	49	98.0%	1	2.0%	0	0.0%	50	100%

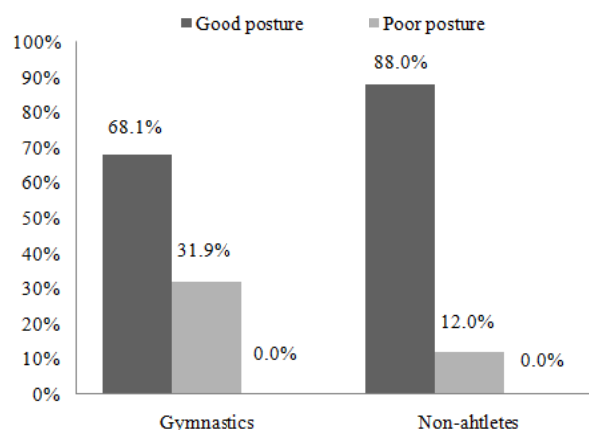


Figure 1. Percentage difference of left chest scoliosis posture between children who are engaged in gymnastics and those who are not engaged in sports

Figure 1 shows percentage difference of left chest scoliosis posture between children who are engaged in gymnastics and those who are not engaged in sports. The results show a statistically significant difference between the groups of respondents ($\chi^2=5.665$, $p=0.017$) at $p \leq 0.05$ significance level.

Discussion and conclusion

Postural disorders that occur in most sports are scoliosis and kyphosis, while lordosis occurs in a slightly smaller percentage (Asghar & Imanzadeh, 2009). The results obtained in this study partially coincide with this statement. In this study, differences were found in postural disorder scoliosis. Some predominantly "feminine" sports such as gymnastics, rhythmic gymnastics, figure skating and dance are characterized by an extremely large range of motion in the spine.

Athletes who practice these sports have a higher risk of injury and improper development of the spinal column (Stošić, Milenković, & Živković, 2011). Intense physical training combined with a still underdeveloped spinal cord in children leads to the formation of postural disorders of the spinal cord. Children involved in gymnastics are under this negative influence the most, which may be associated with early specialization in this sport (Wojtys et al., 2000). Grabara (2010) in her study concluded that gymnastics training in early childhood can lead to postural changes, where these changes reflect the asymmetry in the frontal plane of the spinal column in relation to persons who are not involved in sports. Also, Kums, Erelina, Gapayeva, Pääsuke & Vain (2007) found in their study that rhythmic gymnasts have a reduced

angle of kyphotic and lordotic curvature than in the group of respondents who are not involved in sports. Research conducted by Tanchev, Dzherov, Parushev, Dikov & Todorov (2000) was aimed to determine the prevalence of scoliosis in rhythmic gymnastics, analyzing its specific characteristics and trying to present some etiological explanations of some specific forms of scoliosis. Of the total sample, scoliotic curvature over 10° was present in 12% gymnasts, which represents a large share compared to 1.1% of children of the same age who do not do sports. In the aforementioned study, the authors speak of three big factors that separate gymnasts from their peers who are not involved in sports, and these factors are likely to contribute to increased incidence of scoliosis. These factors are laxity in the joints as well as hereditary factors, slow growth and maturation as a result of physical, dietary and psychological stress and continuous asymmetric loading of the spinal cord. Also, in this study it can be seen that gymnasts have a higher percentage of scoliotic poor posture (31.9%) compared to non-athletes (12%). On the basis of these results, overlaps between the two studies are evident. All of this coincides with the research Hellstrom, Jacobson, Sward and Peterson's (1990), who proved that athletes have two to three times higher percentage of scoliosis compared to non-athletes. Based on results, it can be concluded that a similar percentage of postural disorder occurs in gymnasts and non-athletes. It can be assumed that the postural disorders in gymnasts occur due to premature selection in this sport, large loads of muscles and bones in periods of development, as well as the use of asymmetric exercise and early specialization, thereby contributing to the development of postural disorders.

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USPOREDBA POSTURALNOG STATUSA IZMEĐU DJECE GIMNASTIČARA I NESPORTAŠA

Sažetak

Cilj ovog istraživanja je utvrditi razlike u posturalnom statusu kralježnice djece školskog uzrasta koja se bave gimnastikom i njihovih vršnjaka koji se ne bave sportom. Posturalni poremećaji se javljaju kod ljudi koji se ne bave sportom, ali i kod sportaša. Učestalost posturalnih poremećaja najčešće se javlja kod djece u kritičnim razdobljima rasta i razvoja. Uzorak ispitanika činilo je 97 učenika osnovnih škola iz Novog Sada, Futoga i Rumenke, dobi od 11 i 12 godina. Jedna skupina se sastojala od učenika koji treniraju gimnastiku više od tri godine, a druga skupina se sastojala od učenika koji nisu uključeni u sport. Da bi se odredio posturalni status kralježnice korištena je modificirana metoda Napoleona Volanskog. Za utvrđivanje razlika u posturalnom statusu učenika koristila se neparametrijska metoda - hi-kvadrat test. Rezultati pokazuju da su značajne razlike nađene u posturalnom poremećaju lijeva prsna skolioza ($p=0.017$) između učenika koji se ne bave sportom i učenika koji treniraju gimnastiku.

Ključne riječi: posturalni poremećaji, gimnastika, djeca školskog uzrasta.

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