

**Original research article**

**A COMPARATIVE ANALYSIS OF THE POSTURAL STATUS OF  
YOUNG GIRLS VOLLEYBALL PLAYERS FROM VOJVODINA  
AND THEIR PEERS\***

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**Abstract.** *The aim of the research was to analyze the postural status of young female volleyball players from Vojvodina and their peers, primary school students who did not play volleyball. The research was conducted on 429 female participants, aged between 11.5 and 16.5 in decimal years. The sample of female volleyball players included 189 players who had been training volleyball for at least 3 years, while the sample that included their female peers numbered 240 female primary school students. Their posture was determined using a clinical method. By means of the Mann-Whitney U test, the differences between certain age categories were tested in two samples of participants, while the method of cross tabulation was used to establish absolute and relative frequencies of the values for certain subsamples. The results of the research showed deviation from the normal status of the shoulders, shoulder blades and spine in the coronal plane in older female volleyball players at a greater percentage when compared to their peers. Distorted posture was found only in older female players, i.e. in those who were involved in the training process for a longer period of time.*

**Key words:** *Posture, female volleyball players, female students, differences.*

INTRODUCTION

Volleyball abounds with fast and forceful movements of the entire body, and it requires not only an exquisite level of physical fitness, but also good posture of the body as

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a whole and of its individual segments. It is a sport where in order to achieve top sport levels, difficult physical exercises are repeated a number of times, often involving unilateral movements done in specific, unnatural body positions. This leads to considerable overloading of the musculoskeletal system and in particular of the spine (Schiller & Ebersson, 2008). Serious physical effort decreases the ability of adaptation not only of the passive spine elements, but also of the muscles responsible for proper spinal posture.

If the pattern of the good body posture is adopted early in life, not only can it be beneficial for the proper growth and development of children, but it positively influences their health as well, later in life. Good posture formation largely depends on how much parents, teachers, and professors are engaged in the process, but also on the level of one's personal engagement in sports activities. The role of the spinal column as the focal supporting part of the movement apparatus is significant for good posture formation (Kosinac, 2008), while good body posture and the absence of body deformities represent the basis of high quality of life (Protić-Gava, Bošković, Krsmanović, & Romanov, 2009).

Good posture is the state of good musculoskeletal balance, which prevents the occurrence and progressive development of postural disorders of the structures supporting the body in an upright position or in any other position, whether we are stationary or in motion (Protić-Gava, Šćepanović, & Rakić, 2011). Good posture is a combination of the proper assembly of all body joints in a given moment when the movement is performed (Kendall, McCreary, & Provance, 1993), i.e. it represents the balance between all the body segments (Paušić & Dizdar, 2011) and its role is to create the necessary conditions for properly performing the given movement (Vareka & Dvorak, 2001).

Postural status is the result of earlier growth and development, but also of dominant physical activity or a sport and individual practices (Shumway-Cook & Woollacott, 2000). Postural disorders and asymmetry of the musculoskeletal system occur both in the general population and among athletes (Vařeková, Vařeka, Janura, Svoboda, & Elfmark, 2011). Good postural status, or in other words good body posture, is necessary for the proper spiritual and physical development of children (Calka-Lizis et al., 2008), while the formation of the proper posture of children depends not only on their parents, but on their teachers and coaches, as well. The latter are obliged to notice any postural disorder in a timely manner if the parents do not recognize it themselves, and to motivate and inspire children to exercise with the aim of correcting it.

Extensive overload in sport that a young body is subject to can lead to deformities in the locomotor system (Sławińska, Rožek, & Ignasiak, 2006), as well as to deviation of the spine from its normal posture in the coronal or sagittal planes. However, appropriate and properly planned physical activity eases and positively influences the developmental process, corrects postural disorders and deformities and develops positive motor habits (Grabara & Hadzik, 2009a). On the other hand, athletes with bad posture do not perform their movements in an optimal manner (Vařeková et al., 2011), which triggers a series of disorders in the movement system, primarily in terms of function and structure (Shumway-Cook & Woollacott, 2000). Finally, control of body posture is particularly important as the control of a body's position in space with the aim of keeping balance and orientation (Dudek et al., 2011).

Early inclusion of children in a specialized training process, especially if it abounds in asymmetrical movements, along with the already existing body asymmetry can lead to spinal deformities. Therefore, monitoring the postural status emerges as a highly significant element of training and selection (Grabara & Hadzik, 2009a).

Postural deformities of the locomotor apparatus among athletes from different sports were the subject matter of many studies (Sławińska, Rożek, & Ignasiak, 2006; Lichota, 2008; Całka-Lizis et al., 2008; Grabara & Hadzik, 2009a; Grabara & Hadzik, 2009b; Grabara, 2010; Barczyk-Pawelec et al., 2012; Lichota, Plandowska, & Mil, 2011). The studies were mostly conducted with the aim of comparatively analyzing posture in athletes and their non-athlete peers. Regardless of different methods applied for body posture assessment and data processing, the authors have a uniform opinion when it comes to early specialization and excessive overload during the critical period of growth and development of young athletes, which altogether might lead to postural deformities of the vertebral column in both planes, sagittal and coronal, depending on the sport an athlete has been practicing for a long time.

This research was carried out with the aim of answering the question: Are there any differences in the postural status of young female volleyball players and their peers who do not play volleyball? In case differences do occur, in what segments of posture do they occur?

#### THE METHOD

The sample of participants was defined as a non-random stratified sample, taken from the population of female volleyball players and students from the territory of the Autonomous Province Vojvodina, aged between 11.5 and 16.5. The sample of volleyball players included 189 female players from seven clubs who had trained volleyball for at least three years and were involved in contest-related activities at their clubs. Sample stratification was done according to the existing contest categories of volleyball in Serbia. To be more precise, it was done on younger junior players aged 11.5-13.5 in decimal years, with a total of 64 female athletes, on intermediate junior players aged 13.5-14.5 in decimal years, with a total of 66 female athletes and on older junior players aged 14.5-16.5 in decimal years, with a total of 59 female athletes. With the aim of carrying out a comparative analysis of the sample of 240 female students who did not practice volleyball the following were studied: 113 female participants belonging to a younger junior group, 74 female participants belonging to intermediate junior group and 53 female participants belonging to older junior group.

Postural status was established using a clinical method that includes the assessment of 8 indicators: *Head Posture*, *Shoulder Posture*, *Shoulder Blades Posture*, *Level of Chest Development*, *Deviation of the Spinal Column in the Frontal Plane*, *Posture of Anterior Abdominal Wall*, *Leg Shape* and *Feet Arch* (Ulić, 1997). A grading scale that comprises three levels was used, where grade 0 was assigned to the normal condition, grade 1 to slight deviations (functional changes), and grade 2 was assigned to considerable deviations from the normal status (structural changes). Measuring was done by trained measurers abiding by the unique and standard assessment protocol. The participants were barefoot and with minimum clothes on.

Testing the differences between female volleyball players and female students in terms of posture based on the age-based subsamples was done using the Mann-Whitney U test. The statistical significance of the differences was established at the assessment level of  $p < 0.05$ . A cross tabulation method was used to determine the absolute and relative frequencies of values for certain subsamples of young female volleyball players and female students in terms of body segments, where contingency tables were analyzed for the variables for which statistically significant differences were observed. The data were analyzed using IBM SPSS Statistics 20.0 (SPSS ID: 729225).

## RESULTS

The results of the research in terms of testing the differences between female volleyball players and female students in terms of individual age categories are given in Table 1. Statistically significant differences were observed when assessing the status of head posture in all of the three age categories ( $p < 0.01$ ), shoulder posture in the category of the oldest athletes ( $p = 0.014$ ), blades posture in all three categories ( $p < 0.05$  in the youngest category and  $p < 0.01$  in the two older categories), the status of the spinal column ( $p < 0.05$ ) and the leg shape ( $p < 0.01$ ) in the oldest athletes category.

**Table 1.** Differences in the postural status between female volleyball players and female students according to age.

Variable	Category 11,5–13,5 (years)		Category 13,5–14,5 (years)		Category 14,5–16,5 (years)	
	Z	P	Z	p	Z	p
	Head posture	-2.946	0.003**	-4.950	0.000**	-3.430
Shoulder posture	-0.565	0.572	-0.764	0.445	-2.467	0.014*
Breast posture	-0.102	0.918	-0.910	0.363	0.000	1.000
Blades posture	-2.051	0.040*	-2.625	0.009**	-3.594	0.000**
Spinal column	-1.618	0.106	-3.541	0.000**	-1.934	0.053*
Belly posture	-1.310	0.190	-1.132	0.258	-0.339	0.735
Leg shape	-1.119	0.263	-1.022	0.307	-3.034	0.002**
Feet posture	-0.252	0.801	-1.138	0.255	-1.356	0.175

Legend: Z – Mann Whitney coefficient; p – significance; \*\*  $p < 0.01$ ; \*  $p < 0.05$ ;

Grade distributions of head posture showed that normal head posture occurs more often in the case of young female volleyball players by more than 20% when compared to the female students of the same age who did not train volleyball. In intermediate and older junior group of female volleyball players, normal head posture was observed to occur at a great percentage rate (90.9%; 83.1%), while in the case of female students as close as 50% of the cases were observed to have a slighter or bigger deviation from normal head posture.

The results of the grade distribution for the variable shoulder posture indicate the presence of a high percentage of the functional deformity of shoulder posture in all three age categories (about 50%). This condition is more pronounced in volleyball players that belong to the oldest category (64.4% as opposed to 43.4%), where a statistically significant difference was observed between volleyball players and students ( $p = 0.014$ ).

The results of the analysis of blade posture in all the categories of female volleyball players and their female peers show that a great number of the participants have a functional disorder of shoulder posture status. In the youngest category of volleyball players when compared to the students we found a statistically significant difference at the  $p = 0.04$  level. As far as the subsample of participants who belong to the intermediate junior category are concerned, testing the differences in grade distribution for blade posture status between volleyball players and students showed a statistical significance at the  $p = 0.009$  level. As for the young female volleyball players from the older junior category, the percentage of athletes with functional disorder of the shoulder blade posture increases

and exceeds 67%, while the difference when compared to the students is statistically significant at the  $p=0.000$  level.

Analyzing the results of the Leg Shape parameter in the subsamples of younger volleyball participants when contrasted to the students of the same age, we may observe a small percentage of deviation in the leg shape status from the normal and the differences are not statistically significant. The distribution of grades for the leg shape status among the category of intermediate junior volleyball players is at the same level as among the younger female volleyball players, but here we detect a statistically significant difference in the category of junior volleyball players when compared to the subsample of the students at the  $p=0.002$  level. The difference is precisely in the grades referring to the functional stage of deviation from the normal status (grade 1) in terms of their higher occurrence among the volleyball players.

## DISCUSSION

Intense exercises are applied in different sports for the sake of skill improvement, which further on leads to top sports results (Sławińska et al., 2006). Asymmetric load-bearing exercises that are often performed lead to postural deformities, especially if done by very young athletes. The application of exercises which require athletes to remain for a longer period of time in positions that may lead to muscle strain in the back region and muscle shortening in the front of the chest, can cause different stages of kyphosis, of a milder or more severe form (Kosinac, 2008). Head, shoulder and shoulder blade posture when observed in the sagittal plane can indicate these postural irregularities.

The assessment of the results in the case of head posture, where a greater and statistically significant deviation was observed when comparing children who did not train volleyball young female volleyball players can partly be the result of the volleyball technique. Most elements of the basic volleyball technique, particularly volleying the ball with your fingers and forearms, require head posture with considerable extension of the head. This prolonged backward head posture surely resulted in the decrease of head posture deformities in young female volleyball players. Similar results were obtained by Grabara & Hadzik (2009a), which referred to the visual assessment of head posture, where over 30% of female participants had forward protruding heads.

The results of shoulder posture assessment given here, which imply a statistically greater occurrence of bad shoulder posture in older female volleyball players when compared to the students, are probably in part the result of the *volleyball bump* technique, which requires a player to lean forward with shoulders stretched frontward to a maximal extent and forearms pressed together when in contact with the ball (Nolen, 2006). Such specific movements in the shoulder region when performed for a longer period of time cause disorders in shoulder posture, which indicates the occurrence of kyphosis. This is precisely the case in this subsample, since these female volleyball players have been practicing volleyball for 6-7 years. Grabara and Hadzik (2009a) state that kyphotic bad posture is more common in female volleyball players (36%) rather than in female students who do not train volleyball (26%), but the difference is not statistically significant ( $p=0.10$ ), which coincides up to a point with the results of our research. Furthermore, visually observed, 15% of the participants have bad shoulder posture, which differs from the results obtained in this research, where the percentage of bad shoulder posture in all categories exceeds 40%. Kyphotic bad

posture also characterizes young tennis players, unlike their peers who do not play this sport (Barczyk-Pawelec et al., 2012), which is probably the result of specific body posture, head and body extremities during practice and games. Blades that rest close to the chest reflect good posture (Kosinac, 2008), while winged scapula represents an indication of kyphotic posture. The analysis of blade posture in young female volleyball players clearly suggests a problem which was already addressed in the case of shoulder posture analysis. Typical posture in female volleyball players is characterized by rounded back and rounded and forward protruding shoulders and extremities (Grabara & Hadzik, 2009a). Therefore, it is necessary to take preventive action in order to avoid this type of deformity among female volleyball players (Lichota, 2008), particularly because they are in the critical period of growth and development at this age.

The deviation of processus spinosus from the C7-S1 line along with the asymmetric height of shoulder blades points to scoliotic posture, which is more common in male and female athletes (Sławińska et al., 2006). Asymmetric posture of the spine in the frontal plane can be accompanied by pelvic torsion in the horizontal, as well as by pelvic inclination in the frontal plane, while the frequency of occurrence of these types of deviations is much higher in children who play some sport than in non-athletes. Sports characterized by intense muscle work on one side of the body during movement performance help create asymmetry of the body (Barczyk-Pawelec et al., 2012). The foot is the contact segment of the locomotor apparatus with the base and as a support organ it bears the weight of the entire human body, absorbs blows and bumps and ensures the strength and stability of the body in everyday life and sports activities (Trzcińska, Tabor, & Olszewska, 2008). The results of the foot status assessment in our research, as well as in the research by Całka-Lizis et al. (2008), reveal a higher percentage of the first degree of postural deformities in athletes when compared to their peers who do not practice sports, while the percentage increases with the number of years an athlete spends practicing volleyball. The results of the research done by Popović, Protić-Gava, Šćepanović, Dimitrić, & Dan (2011) indicate a higher percentage of the first degree of postural deformities of the feet in the subsample of male participants when compared to female participants.

The presented analysis of the postural status of young female volleyball players of the three age categories, conducted using a clinical method, pointed to the occurrence of certain unwanted changes which were primarily identified as bad shoulder posture (over 40% of the cases) and shoulder blade posture (more than 60% of the cases), which indicates kyphotic posture and certain deviation in the posture of the spinal column in the frontal plane in older female volleyball players in over 40% of the cases (scoliotic posture). Similar results were also obtained during the research done by Protić-Gava et al. (2011), where 62% of the participants were diagnosed with bad posture of the shoulders and blades.

Prolonged engagement in competitive sports, depending on intensity, technical requirements, as well as the level of competitive activity, present considerable load for the spine (Lichota et al., 2011). This causes vertebrae, intervertebral discs, ligaments and muscles to adjust to the given strain, which may result in an increase in the physiological curves of the spinal column and posture quality at the same time. Practicing modern volleyball requires subjecting a young athlete's body to great strain at an early age, which might lead to changes in the locomotor apparatus and spinal column due to the process of adjustment to excessive strain (Sławińska et al., 2006). Researchers apply different methods for posture assessment. However, regardless of the variety of methods, almost all of them identify the occurrence of asymmetric body posture in the sagittal plane, as well as of the feet status in

children who practice sport when compared to the population of schoolchildren, which coincides with the results of our research. Moreover, studies point to more common multiple deformities of the spine in the sagittal plane among athletes rather than in their peers who do not play sports (Grabara & Hadzik, 2009b). Kyphotic posture is more common in athletes than in their peers who do not practice sport (which was suggested by the results of our research as well), but these differences are not statistically significant in the studied population (Sławińska et al., 2006; Lichota et al., 2011). These results are accounted for by early specializing in the chosen sport (Sławińska et al., 2006), a prolonged number of years in the training process (Grabara & Hadzik, 2009a), intense load-bearing exercises for the muscles of only one side of the body which results in asymmetry, all of which are the consequence of specific demands of a particular sport athletes practice (Lichota et al., 2011; Barczyk-Pawelec et al., 2012), and of a specific player position and technique requirements in a given sport (Całka-Lizis et al., 2008; Leko, Čerkez, & Zeljko, 2009).

Puberty is one of the critical periods characterized with sudden growth and development, and thus the possibility of posture deformities (Kosinac, 2008). Yet, proper physical activity can ease the developing process in children and youth by improving body resistance, correcting postural disorders and developing positive motor habits (Grabara & Hadzik, 2009b). It is particularly important to constantly include compensatory exercises in the training process, since it may reduce the risk of the occurrence of posture deformities.

#### CONCLUSION

The results of our research clearly show that the training process of female volleyball players lacks concern for their postural status and the prevention of postural deformities. Therefore, we have to draw the attention of their coaches towards the need of inclusion of compensatory exercises in the training process with young female volleyball players, i.e. exercises improving development, primarily of back muscles, the muscles of the anterior abdominal wall and of the foot arches.

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## KOMPARATIVNA ANALIZA POSTURALNOG STATUSA MLADIH ODBOJKAŠICA VOJVODINE I NJIHOVIH VRŠNJAKINJA

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*Cilj istraživanja je bio da se analizira posturalni status mladih odbojkašica Vojvodine i njihovih vršnjakinja, učenica osnovne škole koje se ne bave odbojkom i utvrde eventualne razlike. Istraživanjem je obuhvaćeno 429 ispitanica ženskog pola uzrasta od 11,5 do 16,5 decimalnih godina. Uzorak odbojkašica činilo je 189 igračica koje su se bavile odbojkom najmanje 3 godine, a uzorak njihovih vršnjakinja 240 učenica osnovne škole koje se ne bave odbojkom. Posturalni status utvrđen je kliničkom metodom. Primenom Mann-Whitney U testa, testirane su razlika između pojedinih uzrasnih kategorija dva uzorka ispitanica a metodom krostabulacije utvrđene su apsolutne i relativne frekvence ocena za pojedine subuzorke. Rezultati istraživanja pokazali su da je odstupanje od normalnog statusa ramena, lopatica i kičmenog stuba u frontalnoj ravni utvrđeno kod odbojkašica starije uzrasne dobi u većem postotku u odnosu na njihove vršnjakinje. Narušen posturalni status prisutan je uglavnom kod odbojkašica starijeg uzrasta, dakle kod onih koje su u dužem vremenskom intervalu izložene trenažnom procesu.*

*Ključne reči: postura, odbojkašice, učenice, razlike.*