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Review article

REVIEW OF NATIONAL AND INTERNATIONAL RESEARCH STUDIES IN POSTURAL DEFORMITIES: THE PERIOD FROM 2006 TO 2009

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Abstract. *In the last few years the increasing number of postural deformities in children, athletes and non – athletes is evident. This alarming problem has forced a great number of home and foreign authors to deal with it. The goal of this research is to compare the differences in the methodology of research and results made by home and foreign authors. The selection of studies has been done based on the problems of the postural status of children and adolescents, athletes and non – athletes. The narrow selection includes 72 studies (local and foreign ones), with a note that the sample of research individuals included individuals younger than the age of 25. By analyzing the selected studies we reached the conclusion that there is a difference in the approach and methodology of studies between home and foreign authors. The results of all the reviewed studies also show statistically relevant changes under the influence of the realized corrective programs. Therefore, the focus is on the necessity of prevention and diagnosing postural deformities with the aim of their effective correction. This is precisely the reason why the authors emphasize the necessity for regular and systematic physical activity.*

Key words: *postural deformities, athletes, schoolchildren, anthropological status, research methodology.*

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1. INTRODUCTION

Prolonged and improper seating in the school bench, and in front of television sets and computers, heavy school bags and insufficient physical activity are just some of the causes of spinal deformities, which particularly affect the elementary/high school and university student population. Interestingly enough, the deformities of the spine and lower extremities are not unique to grade schoolers and students but preschoolers as well.

Deformities can occur in puberty, when children are rapidly growing and evolving while at the same time participating in organized and regular physical activity at school. Physical education teachers may be involved in changes of the locomotor system, whose functional characteristics can be repaired using motor stimulants (Živković, 2000).

Kyphosis is the reinforcement of the physiological curvature of the spine in the sagittal (Artero-posterior) plane in the thoracic region of the spinal column, with the convexity facing backwards (Bogdanović, 2008).

Scoliosis is a lateral curvature of the spine, or angular deviation of the normal position by one or more segments (Živković, 2000).

Lordosis is the curvature of the spinal column with a convexity facing forward (Živković, 2000). Mainly the result of weak abdominal muscles, and deformity of the feet and knees that lead leg and pelvis into an irregular position with pronounced curvature in the lumbar spine.

In the case of the feet, the most common deformities are fallen arches and flat feet. What primarily leads to the occurrence of these deformities are genetic factors and physical inactivity, obesity, and inadequate shoes. The consequences are difficulty in walking, running and standing, pain in the legs, sometimes in the lower back.

The correction of the deformity is a lengthy process that requires great commitment on the part of health care workers and children and their parents. Only a well-selected and fully implemented corrective exercise program provides an opportunity to prevent and correct the deformity.

The subject matter of this paper is an overview of the research carried out in the period from 2006 to 2009 and which was related to the postural status of participants younger than 25.

The main aim was to collect scientific and research papers dealing with such problems and analyze the results and conclusions that the authors have found.

2. THE METHOD

2.1 The study of the existing literature

The search for studies carried out by local and foreign authors was conducted using the browser Google Scholar and Kobson to find a journals in the field of sport science (The Journal of Sports Medicine and Physical Fitness, Medicine & Science in Sports & Exercise, PubMed, Spine, Journal of the American Pediatric Medical Association , Society on Scoliosis Orthopaedic and Rehabilitation Treatment, British Journal of Sports Medicine, The Journal of Bone & Joint Surgery, Facta Universitatis, Serbian Citation Index, Journal of Anthropological Society of Serbia, etc.) including the following key words: postural status, postural deformities, postural disorders, scoliosis, kyphosis, lordosis, genu valgum, genu varum, flatfoot, pes planus, schoolchildren, athletes (wrestler, football player, folklore, cricket, dancers, Ballerinas, tennis, football, basketball). The search is limited to studies carried out in the last three years.

2.2 The selection of studies

The studies were primarily chosen based on titles and keywords. The field selection includes 71 studies, noting that on this occasion, the included studies are concerned with the postural status of children and young people, athletes and non-athletes. Other papers met the selection based on analysis appropriate in terms of age (under 25).

2.3 Research method

In order to review the subject matter of the selected papers we used a descriptive method. The studies were divided into three groups. The first group of studies (Table 1) dealt with spinal deformities in the sagittal and frontal plane, then the second group of studies (Table 2) dealt with postural disorders of the lower extremities and finally the third group (Table 3) of selected studies dealt with postural disorders and anthropological status.

THE RESULTS

The authors of 31 (21 foreign and 10 local) and 49 studies (21 foreign and 28 local) dealt with the issues of the deformity of the spinal column in the sagittal and frontal planes (Table 1 and Table 2) respectively. In their research, the authors used subjective methods such as somatoscopy, questionnaires, experiments (Bogdanović, 2006; Jovović & Canjak, 2006; Protić-Gava et al., 2006; Bogdanović, 2007; Kosinac & Banović, 2007; Romanov et al., 2007; Sabo, 2007; Đonović & Damnjanov, 2008; Vasić, 2008; Bogdanović, 2008; Bogdanović & Milenković, 2008). On the other hand, foreign authors used objective methods such as scanning, magnetic resonance imaging, electromyography, photogrammetry, electrogoniometer and the radiographic method (Anwajler et al., 2006; Freeman et al., 2006; Heinrichs et al., 2006; Ashton - Miller, 2007; Engstron, 2007; Kenanidis et al., 2008; Limberg et al., 2008; Rajabi et al., 2008; Smith et al., 2008; Szulc et al., 2008).

The research topic of postural disorders of the lower extremities (Table 3) was mainly dealt with by foreign authors (72%) compared to local (28%) ones. The studied deformities indicate the existence of flat feet in all of the participants (Videmšek et al., 2006; Dondur et al, 2006; Mihajlović & Tončev, 2008; Jerosch et al., 2009; Ritchie et al., 2008; Zafiropoulos et al., 2008; El et al., 2006; Pfeiffer et al., 2006; Wolf et al., 2007). The used method included the plantogram (Dondur et al., 2006) and computerized digitized podography (Mihajlović et al., 2008). On the other hand, foreign authors have used more sophisticated instruments such as a 3D laser scanner, 3D optical marker, X-ray imaging, and magnetic resonances (Ritchie et al., 2008; Pfeiffer et al., 2006; Wolf et al., 2007).

Table 4 shows the postural disorders and anthropological status that have been studied by local authors. For the nine reviewed studies it can be concluded that the research had a transversal character which involves a large number of young school age children (ages 4 to 15). The study was conducted on the basis of subjective and objective methods: the plantogram method, photo-visual indicators, orbiters and manipulators, and Biering-Sorrensen's test (Čojbašić et al., 2006; Vukanić, 2006; Živković et al., 2008).

Table 1. Studies of spinal deformities in the sagittal and frontal planes carried out by foreign authors

Study	Age	Sex	N	Investigated deformity	Used method
Anwajler et al.	14.7±2.3	F	35	Scoliosis	Photogrammetry
Freeman *et al.*	Students	M/F	10	Load on the spine during physical exertion	Surface electromyography
Geldhof et al.	9-11 years	M/F	365	Posture	Experiment, survey
Grivas et al.	6-18 years	M/F	8245	Mild thoracic, thoracolumbar and lumbar spine	Bending test (standing), Pruijs's skoliometar
Heinrichs et al.	/	F	41	Bone mineral density, lumbar spine	Scanning
Ashton-Miller	10-20 years	M/F	/	Thoracic kyphosis	Radiography
Engstrom et al.	/	M	51	Lumbar spine	Magnetic resonance imaging
Jee-Soo et al.	/	M/F	78	Lumbar lordosis, thoracic kyphosis, thoracolumbar angle, sagittal vertical axis	/
Putcha et al.	/	/	/	Lumbar spine	Experiment
Cebula et al.	11-14 years	M/F	90	Proper posture, scoliosis, kyphosis and lordosis	Modified Klapp method plurimetar Rippstein, Bunner scoliometar
Kenanidis et al.	13,4 years	M/F	2387	Idiopathic scoliosis	The questionnaire, radiographic evaluation and examination by an orthopedist
Limberg & Gudavalli	27,3 years	M	22	Range of motion of the cervical spine	Electromagnetic sensors
Meyer et al.	Adolescents	F	269	Adolescent idiopathic scoliosis, curvature of the spine and sports activity	/
Olszewska & Trzcińska	8-11 years	M/F	365	Proper posture	Moiré's technique
Paalanne et al.	19 years	F	874	Pain in lower back, posture, muscle strength	The questionnaire, Latent Class Analysis (LCA)
Schumann et al.	7-21 years	M/F	100	Idiopathic scoliosis	Surface topography
Smith et al.	Adolescents	M/F	766	Posture	Radiographic methods
Szulc et al.	7-14	F	33	Idiopathic scoliosis, convex and halux	Twinn 99 software assisted PEL-38, and Penny & Giles tensiometric electrogoniometer
Rajabi et al.	23± 0.9 years	M	60	Kyphosis	Electrogoniometer
Zaina et al.	14-16 years	M	68	Idiopathic scoliosis	Cobb's angle
Jee-Soo et al.	/	M/F	53	Degenerative kyphosis, lumbar lordosis	/

Table 2. Studies of spinal deformities in the sagittal and frontal planes carried out by local authors

Study	Age	Sex	N	Investigated deformity	Used method
Romanov et al.	19-26	M/F	/	The Volansky method	The Volansky method
Bogdanović & Milenković	Junior grades	M/F	434	Kyphotic and lordotic posture	/
Bogdanović & Milenković	11 years	M/F	299	Postural disorders of the spinal column in the sagittal plane	Questionnaire
Milenković & Bogdanović	Students	M/F	/	Kyphotic and lordotic posture	/
Milenković & Bogdanović	10-12	/	/	Kyphotic, scoliotic and lordotic posture	/
Bogdanović, Z.	Junior grades	M/F	434	Kyphotic posture	Experiment
Bogdanović, Z.	Elementary school children	M/F	434	Lordotic posture	Experiment
Bogdanović, Z.	/	M/F	/	Kyphotic and lordotic posture	/
Bogdanović, Z.	11 years	M/F	/	Kyphotic and lordotic posture	/
Bogdanović, Z.	Junior grades	M/F	299	Kyphotic and lordotic posture	/
Bogdanović, Z.	Elementary school children	M/F	/	Kyphotic posture	Experiment
Bogdanović, Z.	10 years	M/F	/	Lordotic posture	/
Bogdanović, Z.	Elementary school children	M/F	/	Kyphotic and lordotic posture	/
Bogdanović, Z.	Elementary school children	M/F	/	Kyphotic and lordotic posture	/
Bogdanović, Z.	Elementary school children	M/F	/	Lordotic posture	Experiment
Bogdanović, Z.	Elementary school children	M/F	/	Postural disorders	/
Medojević &Jakšić	7-15	M/F	/	Postural disorders	Questionnaire
Protić-Gava et al.	3-7	M/F	712	The parameters of social status (50) - 25 for 25 for his father and mother, postural status (keeping your feet, head, anterior abdomen, shoulder, scapula, lateral curvature of the spine, form the legs)	The Volansky method

Study	Age	Sex	N	Investigated deformity	Used method
Kosinac & Banović	Junior grades	M/F	305	Torticollis, pectus carinatum, pectus excavatum, kyphosis, scoliosis, lordosis, genu valgum, genu varum, internal rotation of the thigh, genu recurvatum, foot status, obesity, malnutrition, gender, age.	Mayer's method
Sabo, E.	3.5-7	M/F	1259	Postural space (keeping the head, shoulder and scapula, abdomen, chest, spinal column in the frontal plane, the shape of the leg, instep)	The Volansky method
Sabo, E.	4-7	M/F	280	Postural space (keeping the head, shoulder and scapula, abdomen, chest, spinal column in the frontal plane, the shape of the leg, instep)	The Volansky method
Vasić et al.	10-12	M/F	262	Thoracolumbar scoliosis, thoracic kyphosis, kyphoscoliosis	Clinical examination and bending test
Ostojić et al.	7-14	M/F	2517	Scoliosis	/
Filipovic& Viskic-Štalec	Elementary school children	M/F	/	Idiopathic scoliosis	Step test, Cobb's angle, electromyography
Sabo, E.	Preschool and primary school children	M/F	/	Proper posture, deformities	/
Krsmanović et al.	7-11	M/F	847	Scoliosis and spinal flexibility	The Volansky method
Jovović & Canjak	13.7±6	M/F	120	Winged scapula	Somatoscopy, voluntary contraction of the muscle test, a test in a higher position and method of manual palpation
Obradović & Milošević	6,05±0,01	M/F	242	Keeping the head, shoulders, shoulder blades, Mr Recycle, spinal column in the frontal plane, keeping the abdomen, shape the legs, instep	The Volansky method

Table 3. The studies of postural disorders of the lower extremities carried out by foreign and local authors

Study	Age	Sex	N	Investigated deformity	Used method
El et al.	9.23±1.66	M/F	579	Flat foot	Beighton's system of evaluating joint weakness
Mickle et al.	4.4±0.7	M/F	34	Dynamic foot pressure	/
Pfeiffer et al.	3-6	M/F	835	Flatfoot	3D laser scanner
Sa Pinto et al.	7-14	M/F	96	Genu valgum, genu recurvatum	/
Jenkins et al.	/	M/F	105	The structure of the foot	/
Oztekin et al.	/	F	55	Length of second finger	/
Wolf et al.	8.2 ± 0.7	M/F	18	Flat feet, Hallux valgus	3D optical marker
Nazar et al.	Students	M/F	261	Genu varum, thoracic kyphosis, halluh valgus	The questionnaire, spondilometer
Videmšek et al.	3	M/F	127	Flatfoot	Plantogram
Dondur et al.	11-14	M/F	58	Flatfoot	Plantogram
Mihajlović & Tončev	4-6	M/F	/	Foot deformity	Computerized digitized podography
Jerosch et al.	8-14	M/F	21	Flatfoot	Radiological stop screw technique
Ritchie & Singh	12-17	M	/	Peroneal Spastic straight foot	X-ray image, magnetic resonance
Zafiropoulos et al.	3-6	M/F	651	Flat feet, hip rotation	Contact Index II

Table 4. Studies of postural disorders and anthropological status carried out by local authors

Study	Age	Sex	N	Investigated deformity	Used method
Madić et al.	4-7	M/F	1344	Postural space (keeping the head, shoulder and scapula, abdomen, chest development, spinal column in the frontal plane, the shape of the legs, arch), motor area	The Volansky method
Vukanić, I.	11-14	M/F	112	To assess the status of the foot (flat foot, foot length and width) of explosive leg strength, running speed	Plantogram, IBP
Čojbašić et al.	10-15	M/F	171	Status of the spinal column (scoliosis, kyphosis, lordosis, posture), anthropometry	Photo-visual indicator, the orbiter and the manipulator
Milenković & Bogdanović	10-12	M/F		Kyphosis, scoliosis, lordosis, anthropometric measures	/
Bogdanović, Z.	Junior grades	M/F	434	Lordosis, anthropometric measures	/
Sabo, E.	4-7	M/F	1351	Postural status, anthropometric characteristics	/
Trajković & Nikolić	12	M/F	299	Postural disturbances (bad posture and flat feet), anthropometric characteristics	/
Živković & Dejanović	7 - 10	M/F	199	Anthropometric characteristics	Biering-Sorrensen's test

3. DISCUSSION

Once the existing literature was surveyed, over 400 references from both local and foreign authors were chosen. Based on certain keywords, we found 71 studies (38 by local and 33 by foreign authors). From the selected studies, 11 were longitudinal (Čojbašić, 2006; Dondur et al., 2006; Geldhof et al., 2006; Heinrichs et al., 2006; Bogdanović, 2007; Bogdanović, 2008; Nazar et al., 2008; Zaina et al., 2008; Jee-Soo et al., 2009; Jerosch et al., 2009), and others were of the transversal type.

A large number of foreign authors selected school-age children for their sample of participants in their research on spinal deformities in the sagittal and frontal planes (Anwajler et al., 2006; Geldhof et al., 2006; Grivas et al., 2006; Cebula et al., 2008; Kenanidis et al., 2008, Meyer et al., 2008; Olszewska et al., 2008, Smith et al. 2008; Paalanne et al., 2008; Szulc et al., 2008; Zaina et al. 2008) as well as students, such as Freeman et al. (2006). In their research, two authors included both the school and student population (Limberg et al., 2008; Rajabi et al., 2008).

Local authors have mostly studied school age children (Jovović et al., 2006; Ostojić et al., 2006; Filipović et al., 2006; Krsmanović et al., 2006; Bogdanović, 2007; Kosinac et al., 2007; Medojević & Jakšić, 2007; Vasić et al., 2008), preschoolers (Obradović et al., 2008; Protić-Gava et al., 2006; Sabo, 2007) and students (Milenković et al., 2008; Romanov et al., 2007). Preschool and school children made up the sample of participants for Sabo (2007) and Đonovic et al. (2008).

Most foreign authors have studied the postural disorders of the lower extremities of school children (El et al., 2006; Sa Pinto et al., 2006; Videmšek et al., 2006; Wolf et al., 2007; Ritchie et al., 2008; Jerosch et al., 2009), then preschool children (Mickle et al., 2006; Pfeiffer et al., 2006; Zafiropoulos et al., 2008) and finally students (Nazar et al., 2008). On the other hand, local authors have focused more on preschool (Mihajlović et al., 2008) and school age children (Dondur et al., 2006).

Postural disorder research and anthropological status was dealt with exclusively by local authors, mostly on samples including children of the school (Čojbašić, 2006; Vukanić, 2006; Bogdanović, 2007; Milenković et al., 2008; Trajković et al., 2008; Živković et al., 2008) and pre-school age (Madić et al. 2006; Sabo, 2007). If we look at the sample of participants in the research of spinal deformities in the sagittal and frontal planes, we can say that the foreign authors often included up 100 participants in their studies (Anwajler et al., 2006; Freeman et al., 2006; Heinrichs et al., 2006; Engstrom et al., 2007; Jee-Soo et al., 2007; Cebula et al., 2008; Limberg et al., 2008; et al., 2008; Schumann et al., 2008; Szulc et al., 2008; Zaina et al. 2008; Rajabi et al., 2008). A small number of studies had 1000 participants (Geldhof et al., 2006; Meyer et al., 2008; Paalanne et al., 2008; Smith et al., 2008) and two studies by (Grivas et al., 2006; Kenanidis et al., 2008) had over 1000 participants. In comparison with foreign, local authors have worked with small samples, 100 respondents (Sabo, 2007), those including over 1000 (Ostojić et al., 2006; Sabo, 2007) while the majority have worked with samples numbering 1000 participants (Jovović et al., 2006; Krsmanović et al., 2006; Protić-Gava et al., 2006; Bogdanović, 2007; Kosinac et al., 2007; Obradović et al., 2008; Vasić et al., 2008).

For the purpose of studying postural disorders of the lower extremities, foreign authors have relied on samples numbering approximately 100 subjects (Mickle et al., 2006; With Pinto et al., 2006; Oztekin et al., 2007; Wolf et al., 2007; Jerosch et al., 2009) and up to 1000 respondents (El et al., 2006; Pfeiffer et al., 2006; Videmšek et al., 2006; Jen-

kins et al., 2007; Nazar et al., 2008; Zafiropoulos et al., 2008). On the other hand, there is a study carried out by local authors Dondur et al. (2006) who included 100 participants in their study.

The relation between postural disorders and anthropological status was studied by local authors on samples numbering up to 100 participants (Čojbašić, 2006; Vukanić, 2006; Bogdanović, 2007; Trajković et al., 2008; Živković et al., 2008) and 1000 participants (Madić, 2006; Sabo, 2006). We can conclude that the smallest number of participants (10) was included a study carried out by Freeman et al. (2006), while the greatest sample of participants (8245 school age children), was included in the study carried out by Grivas et al. (2006).

When it comes to studying spinal deformities in the sagittal and frontal planes between the two sexes, we can conclude that foreign authors usually studied both sexes (Anwajler et al., 2006; Freeman et al., 2006; Geldhof et al., 2006; Grivaset al. , 2006; Ashton-Miller, 2007; Jee-Soo et al., 2007; Cebula et al., 2008; Kenanidis et al., 2008, Schumann et al., 2008, Smith et al., 2008), while only female participants were included in studies carried out by (Heinrichs et al., 2006; Meyer et al., 2008; Paalanne et al., 2008; Szulc et al., 2008) and only male participants in (Engstrom et al., 2007; Limberg et al. 2008; Rajabi et al., 2008; Zaina et al., 2008). As opposed to foreign, local authors only examined both sexes (Jovović et al., 2006; Filipović et al., 2006; Krsmanović et al., 2006; Ostojić et al., 2006; Protić-Gava et al., 2006; Romanov et al., 2007; Bogdanović, 2007; Kosinac et al, 2007; Medojević et al., 2007; Sabo, 2007; Milenković et al., 2008; Obradović et al., 2008; Vasić et al., 2008; Đonovic et al., 2008).

In studies involving postural disorders of the lower extremities, foreign authors included both sexes in their research (El et al. 2006; Mickle et al., 2006, Pfeiffer, et al., 2006; Pinto et al., 2006; Videmšek et al., 2006; Jenkins et al., 2007; Wolf et al., 2007; Nazar et al., 2008; Zafiropoulos et al., 2008; Jerosch et al., 2009). There are two studies, one by Oztekin et al. (2007) that includes only female and one by Ritchie et al. (2008), which includes only male participants. Local authors based their research on both sexes (Dondur et al., 2006; Mihajlović et al., 2008).

The research relationships of postural disorders and anthropological status were only dealt with by local authors, we can conclude that this type of research includes both sexes (Čojbašić, 2006; Madić et al, 2006; Vukanić, 2006; Bogdanović, 2007; Sabo, 2007; Milenković et al., 2008; Trajković et al., 2008; Živković et al., 2008).

The deformity known as scoliosis has been the subject of interest in 7 studies carried out by foreign authors (Anwajler et al., 2006; Cebula et al., 2008; Kenanidis et al., 2008; Meyer et al., 2008, Schumann et al., 2008; Szulc et al., 2008; Zaina et al., 2008), as well as by local authors (Krsmanović et al., 2006; Protić-Gava et al., 2006; Sabo, 2006; Kosinac et al., 2007; Romanov et al., 2007 ; Sabo, 2007; Obradović et al., 2008). Only Krsmanović et al. (2006) examined the relationship between scoliosis and spinal mobility. The deformity of the spine in the sagittal plane, kyphosis, caught the attention of four foreign authors (Ashton-Miller, 2007; Jee-Soo et al., 2007, Cebula et al., 2008; Rajabi et al., 2008) while a slightly higher interest in it was shown by local authors (Kosinac et al., 2007; Romanov et al., 2007; Bogdanović, 2007; Milenković et al., 2008; Bogdanović et al., 2008; Vasic et al, 2008). Another deformity in the sagittal plane, lordosis, was the subject of research of only two authors (Jee-Soo et al., 2007; Cebula et al., 2008), and four local (Kosinac et al., 2007, Romanov et al., 2007; Bogdanović et al., 2008; Milenković et al., 2008). Jovović et al. (2006) dealt with the winged scapula. Foreign authors

(Geldhof et al., 2006; Cebula et al., 2008; Olszewska et al., 2008; Paalanne et al., 2008, Smith et al., 2008) evaluated the relationship between posture and existing spinal deformities. Similar case studies were found among three of our local authors (Protić-Gava et al., 2006; Sabo, 2007; Obradović et al., 2008). The more common problem of pain in the lumbar spine caught the interest of only foreign authors (Grivas et al., 2006, Heinrichs et al., 2006, Engstrom et al., 2007; Putch et al., 2007; Paalanne et al. 2008).

The range of motion of the cervical spine was investigated in the study of Limberg et al. (2008).

In terms of the applied methods, foreign authors used modern tools such as a 3D laser scanner Pfeiffer et al. (2006), and 3D optical marker Wolf et al. (2007).

The authors Anwajler et al. (2006) used photogrammetry as a research method in their work. Local authors usually apply the method devised by Volansky (Krsmanović et al., 2006; Protić-Gava et al, 2006, Romanov et al., 2007; Sabo, 2007; Obradović et al., 2008). When it comes to electromyography, in the work carried out by foreign authors it was used in the research of Freeman et al. (2006), and in the work by local authors, it was used by Filipović et al. (2006).

Mayer's method was used in the study by Kosinac et al. (2007).

Two foreign authors (Geldhof et al., 2006; Putch et al., 2007) used the experiment as their method of choice, but only Bogdanović (2007) as a local author chose this method. Heinrichs et al., (2006) used scanning in their study. The subjective questionnaire method found its place in the works of both local (Bogdanović, 2007; Bogdanović et al., 2008), and foreign authors (Geldhof et al., 2007; Kenanidis et al., 2008). Olszewska et al. (2008) applied Moiré's technique to assess body posture. Zaina et al. (2008) had as the subject of his research idiopathic scoliosis and studied it using Cobb's angle, as did Filipovic et al. (2006).

The bending test was used by a foreign author Grivas et al. (2006), as well as local ones, Vasić et al. (2008). The radiographic evaluation of scoliosis was used by Kenanidis et al. (2008).

In lower limb deformities, dynamic pressure of the foot was dealt with in the paper by Mickle et al. (2006). Only one group of foreign authors, Jenkins et al. (2007), dealt with the foot deformity, and explored the length of the second finger. Foot structure was the subject of interest of Oztekin et al. (2007). In terms of the methods used for assessing lower limb deformity, Beighton's scoring system for weaknesses in the wrist, was used in the research of El et al. (2006). This method, including methods such as Contact Index II, which was used by Zafiropoulos et al. (2008), the X-ray image used by Ritchie et al. (2008) and the radiological stop screw technique used by Jerosch et al. (2009), did not appear to be used in the works of local authors. On the other hand, the plantogram as a method appears exclusively in the work of local authors Dondur et al. (2006). Computerized digitized podography was used in the study by Mihajlović et al. (2008).

Among the studies of postural disorders and anthropological status, local authors (Madić et al., 2006; Vukanić, 2006) examined the postural and motor area. The postural area and anthropometric characteristics were investigated in a number of works by local authors (Čojbašić et al., 2006; Bogdanović, 2007; Sabo, 2007; Milenković et al., 2008; Trajković et al., 2008; Živković et al., 2008). In the investigated domain, the method used was the one by Volanskom (Madić et al., 2006), the plantogram (Vukanić, 2006), Biering-Sorrensen's test (Živković et al., 2008), and the photo-visual indicator, the orbiter and manipulator (Čojbašić et al., 2006).

In the majority of studies carried out by local authors, the corrective effects of exercise on the postural status of the spinal column are programmed (Medojević et al., 2007; Bogdanović et al., 2008). The mere presence of postural disorders of the spinal column is the subject matter of the studies carried out by (Jovović et al., 2006; Protić-Gava et al., 2006; Ostojić et al., 2006; Sabo, 2007; Bogdanović et al., 2008; Obradović et al., 2008; Vasić et al., 2008), while the role of teachers in the formation and evaluation of proper posture was the subject matter of research carried out by (Sabo, 2007; Bogdanović, 2008). Milenković et al. (2008) explored the potential of isometric deep spinal muscles in patients who had an established kyphotic and lordotic posture.

On the other hand, foreign authors have directed their interests towards more complex issues such as the size of the physiological spinal curvature and muscle functional parameters among patients with postural disorders of the spinal column (Anwajler et al., 2006), the slope of the spine compared to the second cervical vertebra in younger patients (Olszewska et al., 2008). The authors Freeman et al. (2006) explored the amount of muscle shape and spinal loads during certain physical activities, while Putch et al. (2007) calculated the force in the lumbar spine with certain models. Determining the relationship between postural disorders of the spinal column with sports and other various forms of physical activity has also been the subject matter of research carried out by (Kenanidis et al., 2008; Limberg et al., 2008, Meyer et al., 2008; Rajabi et al., 2008; Zaina et al., 2008;) and the determination of the effects of certain programs by Geldhof et al. (2006).

The interest of local authors in the research of the postural disorders of the lower extremities was aimed in the direction of establishing deformities (Dondur et al., 2006; Mihajlović et al., 2008) as opposed to foreign authors, whose attention was focused on establishing the connection between obesity and postural disorders (Mickle et al., 2006; Pfeiffer et al., 2006; the Pinto et al., 2006), the connection between structure and foot injuries and the possible effects (Jenkins et al., 2007; Oztekin et al., 2007; Zafiropoulos, 2008). Studies have also focused on reliable methods for the treatment of postural disturbances of the lower extremities, such as the study by Jerosch (2009) as well as a study of the movements of the feet in children's shoes (Wolf et al., 2007).

The correlation between postural disorders in children and their motor skills has been the subject matter of research by some of our local authors (Madić, 2006; Vukanić, 2006). The interest of our local authors has taken them in the direction of the relation between postural disorders and anthropometry (Čojbašić, 2006; Bogdanović, 2007; Sabo, 2007; Bogdanović & Milenković, 2008; Trajković et al., 2008; Živković et al., 2008).

4. CONCLUSION

Based on the review of all the studies, the research results show that postural disorders represent the presence of deformities in a large percentage. However, it is necessary to mention the fact that the methodology of our studies and the studies carried out by foreign researchers varies greatly.

National surveys have often investigated widely studied problems, but the work is too often reduced to merely determining the presence of a deformity, using questionnaires where individuals give their opinions, which are often without a scientific basis. And on the basis of these results it is difficult to achieve reliable results.

Foreign researchers on the other hand have excellent equipment, and their inventiveness is evident. They deal with new problems and solve them.

However, it should be noted that in all the reviewed studies, there was a statistically significant change under the influence of the realized corrective program. Therefore, the authors emphasize the necessity of regular and systematic participation in physical activity. Vasić et al. (2008) conclude that the deformity of the spine in school children is usually of the postural type, due to poor posture, the sedentary way of life, reduced physical activity, improper seating. Children with better motor rhythm, have a less pronounced postural disorder of the trunk and the lower extremities (Madić, 2006). Kyphotic posture was more pronounced in the male population than the female one, in which the lordotic posture was more pronounced (Bogdanović & Milenković, 2008). Through the intervention of teachers, better postural aspects related to keeping the spine in a proper position can be achieved and thus back pain in later life can be avoided (Geldhof et al., 2006). The modern obesity problem has a negative impact on the health of the bone-joint system, causing biochemical changes in the lumbar spine and lower extremities (Pinto et al., 2006). Obese children suffer much more pressure on the middle part of their bones which destroys the soft tissue (Mickle et al., 2006).

As all the obtained results suggest the presence of large postural disturbances, which should motivate us to take further measures aimed at the prevention and rehabilitation of the current problems. It is necessary to establish a plan and program that will have a preventive function and develop programmed corrective action in cooperation with specialists, experts in corrective gymnastics and physical education teachers, which would run throughout the school year.

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PREGLED ISTRAŽIVANJA POSTURALNIH POREMEĆAJA DOMAĆIH I INOSTRANIH AUTORA U PERIODU OD 2006. DO 2009. GODINE

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Poslednjih godina evidentna je prisutnost sve većeg broja posturalnih poremećaja kod dece, sportista i nesportista. Alarmantnost ovog problema je navela veliki broj domaćih i inostranih autora da se pozabave istim. Cilj ovog istraživanja je da se uporede razlike u metodologiji istraživanja i rezultata do kojih su došli domaći i inostrani autori. Selekcija radova je izvršena na osnovu problematike koja se odnosi na posturalni status dece i omladine, sportista i nesportista. Uža selekcija obuhvata 72 rada (domaćih i inostranih), uz napomenu da su uzorak ispitanika činili mlađi od 25 godina. Analizom selektiranih studija dolazi se do zaključka sa postoji razlika u pristupu i metodologiji rada između domaćih i inostranih autora. Rezultati svih pregledanih studija takođe ukazuju na statistički značajne promene pod uticajem realizovanih korektivnih programa. Zato se akcenat stavlja na neophodnost prevencije i ranog dijagnostikovanja posturalnih poremećaja u cilju efikasnije korekcije. I upravo iz tog razloga, autori ističu neophodnost redovnog i sistematskog bavljenje fizičkom aktivnošću.

Ključne reči: *Posturalni poremećaji, sportisti, deca školskog uzrasta, antropološki status, metodologija rada*