THE INCIDENCE OF SAGITTAL POSTURAL DEFORMITIES AMONG HIGH SCHOOL STUDENTS: PRELIMINARY STUDY

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Abstract
INTRODUCTION: The regular posture of children and youth is nowadays, in a global sense, a great challenge. AIM: The goal of the current research was to make an assessment of the postural status of the high school children, both male and female, and determine the frequency of the postural deformities in the sagittal plane, i.e., the frequency of kyphotic, lordotic, and kypho-lordotic bad body posture, as well as if there is a statistically significant difference with the determined deformities regarding the sports activities and the sex of the subjects. METHODS: The data of the postural status were achieved within the research project OI179024, funded by the Ministry of Education and Science of the Republic of Serbia. The sample of the subjects comprised 236 participants (of male sex, N=103 or 43,6%; female sex N=133 or 56,4%) of the high school of economy in Nis, of bodily height of 173, 42+7,62 cm, bodily weight 64,6+10,35 or of age 16,82+1,33 (Mean+St.Dev). The sample of subjects was divided into sub-samples of athletes (N=116 or 49,2%) or sub-sample of non-athletes (N=120 or 50,8%). The results are shown by table, applying the descriptive statistics and z-test for the difference between two proportions. RESULTS: Kyphotic, lordotic and kypho-lordotic bad body posture was found among 20,8%, 24,2% or 33,1% of the subjects respectively. Significant changes of deformities of the spinal column, between athletes and non-athletes, are present regarding the kyphotic bad body posture (more present in the sample of non-athletes, sig = 0,000), while the significance regarding the lordotic bad body posture is at the threshold of significance (sig=0,062). Between boys and girls, there are statistically significant differences regarding the kyphotic, lordotic and kypho-lordotic bad body posture (more present with the girls, sig=0,000, sig=0,000,; sig=0,000; respectively). CONCLUSION: While preventing and correcting postural deformities, there should be a focus on the isometric muscle potential first, i.e. the endurance of the musculature and the strength with the statistical conditions of muscular strain.

Key words: *sagittal postural status, high school population, frequency, athletes, non-athletes, boys, girls*

Introduction

The regular posture of children and youth is nowadays, in a global sense, a great challenge. Many studies have dealt with the problem of hypokinesis and its detrimental influence on the functional characteristics and its locomotor status of children (Biddle et al., 2001; Živković, D., 2000; Riddoch, 1998). Different cumulative strains which children are exposed to have a negative influence on ligament, muscular, cartilaginous and bone structure, i.e., the very spinal column (Bogduck, 2005). The given strains can be of different etiologies, like the irregular body posture which additionally burdens ligaments and muscles and influences on the decrease of crane-cervical angle, the position of torso and shoulders and the appearance of pain in the back (Korovesis et al., 2005). The exercise of different demanding sports activities could cause micro-traumas, i.e., plastic deformities of the given structures (Bubanj, R., 1997). A child who is old 6-7 years is in a critical period of posture-genesis when there should be a prevention of the postural problems and deformities (Cordon et al., 2002).

Between 7 and 14 year, there are many morphological and functional changes which influence the regular posture of the spinal column and in this period active corrective exercises of appropriate programmes should be performed. So, no matter whether the postural deformities comprising the kyphotic and lordotic body posture are the result of hypokinesis and sedentary way of life or an excessive performance of different sports activities, the cause is in the muscular imbalance between agonists and antagonists of the shoulder blade and chest musculature, i.e., the muscle imbalance between lumbar, pelvic, gluteal and upper-knee musculature, respectively (Dejanović and Fratrić, 2007). The aim of the current research is to carry out the assessment of the postural status of school boys and school girls of the high school age and to determine the frequency of postural deformities in the sagittal plane, i.e., the frequency of the kyphotic, lordotic and kypho-lordotic bad body posture as well as to determine if there is a significant difference with the determined deformities regarding the sports activities and the sex of the subjects.

Methods

The data of the postural status achieved within the project of the elementary research OI179024 funded by the Ministry of Education and Science of the Republic of Serbia. The sample of subjects comprised 236 pupils (of male sex N=103 or 43,6%; of female sex N=133 or 56,4%) of the high school of economy in Niš, of bodily height of 173, 42+7,62 cm, bodily weight 64,6+10,35 or of age 16,82+1,33 (Mean+St.Dev). The sample of subjects is divided into sub-samples of athletes (N=116 or 49,2%) or sub-samples of non-samples (N=120 or 50,8%). In the selection of athletes the criterion of Kenanidis et al. (2008) has been applied according to which a sportsman is a child who is an active member of sports association/club, who, systematically and in continuity, performs sports activities for 10 hours a week, for two or more years before the beginning of research. The postural status in the sagittal plane, i.e. the kyphotic, lordotic and kypho-lordotic (combined) status of the spinal column, determined by the use of the wireless device Spinal Mouse with the appropriate software whose work is based on the technology of ultra-sound (Bubanj, S. et al., 2010; Zsidai and Koscis, 2001). For the purpose of data processing, the software SPSS version 13 is used. The results are displayed by tables, by applying a descriptive statistics and z-test for the difference between two proportions (Pallant, 2007).

Results and discussion

Table 1. The frequency of kyphotic, lordotic and kypho-lordotic bad body posture.

kyphotic	frequency	%	lordotic	Frequency	%	Kypho-lordotic	frequency	%
no	187	79,2	no	179	75,8	no	158	66,9
yes	49	20,8	yes	57	24,2	yes	78	33,1
total	236	100,0	total	236	100,0	Total	236	100,0

Table 2. The frequency of kyphotic, lordotic and kypho-lordotic bad body posture and the significance between the two proportions (athletes and non-athletes).

	kyphotic	N	%	Sig	lordotic	N	%	Sig	Kypho-lordotic	N	%	Sig
Non-athletes	no	90	75	0,000	no	88	73	0,062	no	77	64	0,108
	yes	30	25		yes	32	27		yes	43	36	
	total	120	100		total	120	100		total	120	100	
Athletes	no	97	84		no	91	78		no	81	70	
	yes	19	16		yes	25	22		yes	35	30	
	total	116	100		total	116	100		total	116	100	

Table 3. The frequency of kyphotic, lordotic and kypho-lordotic bad body posture and the significancy of difference between two proportions (boys and girls).

	kyphotic	N	%	Sig	lordotic	N	%	Sig	Kypho-lordotic	N	%	Sig
Boys	no	85	83	0,000	no	84	82	0,000	No	68	66	0,000
	yes	18	17		yes	19	18		yes	35	34	
	total	103	100		total	103	100		total	103	100	
Girls	no	31	23		no	95	71		no	43	32	
	yes	102	77		yes	38	29		yes	90	68	
	total	133	100		total	133	100		Total	133	100	

According to the results of z-test for comparing the two proportions (table 2), it could be concluded that significant differences of the spinal column deformities, between athletes and non-athletes, are related to the bad kyphotic body posture (present with the sample of non-athletes), while the significance of differences related to the bad lordotic body posture is at the threshold of significance.

The results of the significance of differences related to bad kyphotic and lordotic body posture regarding the sports activities of subjects (athletes and non-athletes) are according to the results of research carried out by Nilsson et al. (1993), who, with athletes of the athletes of the first year of studies of ballet (N=23) related to non-athletes (N=36), determined a less visible lordosis in the lumbar part of the spinal column and kyphosis in

the chest of the spinal column. According to the results for comparison of two proportions (table 3), it could be concluded that significant differences with the deformities of the spinal column, between boys and girls, are present in relation to the kyphotic, lordotic and kypho-lordotic bad body posture (all the three deformities are significantly present with the female sample).

The results of the significance of difference with the bad kyphotic body posture in relation to the sex of the subjects are not according to the results of research carried out by Đokić et al. (2010), who found out that the population of boys is more endangered compared to the population of girls (the one who is taller than average for the given research) within the research sample of 1523 pupils (775 school boys and 748 school girls, of school age 3-6 grade, 9-12 years of age). Regarding the total number of subjects (N=1523), 7,6% of subjects have kyphosis while 1% of subjects have lordosis. The results of the significance of difference related to the bad kyphotic body posture regarding the sex of the subjects are not according to the results of research done by Widhe (2001), who carried out longitudinal research of the sagittal postural status on the sample of 90 children. Widhe found out that the relation between kyphosis and lordosis does not depend on the sex of the subjects in the initial measurement when the subjects were between 5 and 6 years of age. However, in the final measurement, 10 years later, kyphosis in relation to lordosis was statistically much less visible with girls than with boys. The results of the significance of difference related to the bad lordotic body posture in relation to the sex of the subjects are according to the results of research done by Bogdanović and Marković (2010) who, found out the frequency of bad lordotic body posture of 35, 19% with the girls, i.e. 24, 26% with the boys, on the sample of pupils who are 12+6 months of age and some more numerous subjects (N=299) in relation to the current research.

Giglio and Volpon (2007) found out that, no matter what the sex of the subjects is, the kyphotic curve in the chest and the lordotic curve in the lumbar part of the spinal column, grow linearly by 25 deg in the 7^{th} year of life up to 38 deg in the 19^{th} year of life (according to the formula: the angle of kyphosis = 25 deg + 0,58X the age of subjects), i.e. 22 deg in the 5^{th} year of life up to 32 deg inthe 20^{th} year of life (according to the formula: the angel of lordosis = 24 deg + 0,51X the age of subjects) respectively on the research sample comprising 718 healthy subjects, 5-20 years of age. According to Obradović and Milošević (2008), the following of growths, development and children body posture at the population level is a very significant health indicator and now in Serbia there are no data about longitudinal, systematic, organized following of the postural status of some population categories, and especially children. In many cases, the data are based on the target and sporadic research for a particular region or the sample in the given period applying different criteria or standards. By systematic following and assessment of the postural children status, many health problems could be stated in time before the situation becomes serious.

Conclusion

The cause of the relatively high frequency of postural deformities of the current research is seen in the muscular imbalance of the postural musculature. The very fact that the basic role of the given musculature of the body maintenance in the normal upright position concerned with the prevention and correction of the postural deformities is related to the focus on the development of the isometric muscular potential, i.e. the endurance of the given musculature and power in the static conditions of strain. Accordingly, the irregular and bad exercise performance could violate and endanger postural status. The choice and exercise performance should be taken into account seriously, respecting individual characteristics and capacities.

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UČESTALOST SAGITALNIH POSTURALNIH DEFORMITETA KOD SREDNJOŠKOLSKE POPULACIJE: UVODNO ISTRAŽIVANJE

Sažetak

UVOD: Pravilno držanje tijela djece i omladine predstavlja u današnje vrijeme, globalno promatrajući, veliki izazov. CILJ: Cilj aktualnog istraživanja bila je procjena posturalnog statusa učenika i učenica srednjoškolskog uzrasta i utvrđivanje učestalosti posturalnih poremećaja u sagitalnoj ravnini, tj., učestalost kifotičnog, lordotičnog i kifo-lordotičnog lošeg držanja tijela, kao i postoji li statistički značajna razlika u prisustvu utvrđenih deformiteta u odnosu na sportsku aktivnost i spol ispitanika. METODE: Podaci posturalnog statusa dobiveni su u okviru projekta temeljnih istraživanja OI179024, financiranog od Ministarstva prosvete i nauke Republike Srbije. Uzorak ispitanika činilo je 236 učenika (muškog spola, N=103 ili 43,6% i ženskog spola, N=133 ili 56,4%) srednje ekonomske škole iz Niša, tjelesne visine 173,42±7,62 cm, tjelesne težine 64,60±10,35 i uzrasta 16,82±1,33 (Mean±St.Dev). Uzorak ispitanika podijeljen je na sub-uzorak sportaša (N=116 ili 49,2%) i sub-uzorak nesportaša (N=120 ili 50,8%). Rezultati su iskazani tabelarno, primjenom deskriptivne statistike i z-testa za razlike između dvije proporcije. REZULTATI: Kifotično, lordotično i kifo-lordotično loše držanje tijela utvrđeno je kod 20,8%, 24,2% i 33,1% ispitanika, respektivno. Značajne razlike u postojanju poremećaja kičmenog stuba, između sportaša i nesportaša postoje u odnosu na kifotično loše držanje tijela (prisutnije u uzorku nesportaša sig=0,000), dok je značajnost razlika u odnosu na lordotično loše držanje tijela na granici praga značajnosti (sig=0,062). Između muškaraca i djevojaka, statistički značajne razlike postoje u odnosu i na kifotično, lordotično i kifo-lordotično loše držanje tijela (prisutnije kod djevojaka, sig=0,000; sig=0,000; sig=0,000; respektivno). ZAKLJUČAK: U prevenciji i korekciji posturalnih deformiteta treba se prvo fokusirati na razvoj izometrijskog mišićnog potencijala, tj. izdržljivosti navedene muskulature i snage u statičkim uvjetima mišićnog naprezanja.

Ključne riječi: *sagitalni posturalni status, srednjoškolci, učestalost, sportaši, nesportaši, muškarci, djevojke*

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