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DIFFERENCES IN POSTURAL STATUS OF LOWER-GRADE PUPILS WITH RESPECT TO THE LEVEL OF PHYSICAL ACTIVITY

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Abstract

A basic posture is thought to be inherited, but it can be modified by environmental factors such as illness, age, physical activity, living conditions, physical environment, diet, and many others. The purpose of this study was to determine the differences in postural status between trained athletes and untrained children of the same age. The population sample included boys aged 8-10 years from elementary schools in the city of Novi Sad, as well as from sport clubs in the same area. They were assigned to either of the three groups: A) pupils participating in an individual sport (N=50); B) pupils participating in a team sport (N=51), and C) pupils attending physical education (PE) classes only (N=50)(control group). All measurements of postural status were taken using the Napoleon Wolanski method. The analyses showed that the situation in the control group is rather worrisome, where postural status is very poor. The weakest links are the abdominal muscles, but also the head, shoulders, shoulder blades, spine, feet and legs.

Keywords: postural status, pupils, physical activity, sport

Introduction

A good posture is all about optimal relations among all segments of the human body, which are fairly stable for the most part (Sabo, 2006; Purenović, 2007). The optimal posture represents a biological value of the human kind, passed on by phylogenetic development. It can be defined as an activity using the least amount of energy required for normal functioning of the internal organs and maintenance of psychomotor abilities.

Principles of the basic body posture are very complex and are based on conditioned and unconditioned reflexes. Since the former are dependent on external influences, body posture is more subject to individual differences. Essentially, basic posture seems to be mostly genetic, however it can also be altered by environmental factors like illness, age, level of physical activity, living conditions, physical environment, eating habits, and many others.

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In order to maintain a normal, steady, upright standing position, both active and passive forces of the locomotor system are engaged, specifically muscles, ligaments and bones. The greatest of all external forces disturbing the optimal posture is gravity. Active forces are produced by muscles, whereas the passive ones come from ligaments, bones and joints. In any activity, all the forces affecting body posture must be in balance. Any disturbance inside this system can cause an imbalance within the individual segments of the body. This imbalance mostly occurs at the expense of the active portion of these forces, ie. muscles, which may succumb due to fatigue, their poor conditioning, or disease. The consequence of this muscle weakness is an increased strain on the passive portion of the locomotor system, which in turn begins to deteriorate over time, adapting to a completely new role (Ulić, 1997).

A fundamental condition for establishing and maintaining a normal standing posture is a well-balanced relationship between internal and external forces. These forces are the same in magnitude, but act in opposite directions. When there is an imbalance, a good posture has been compromised.

Biological development of children is characterized by certain natural laws. Psychological and physical development is an ongoing process, both gradual and irregular, with specific characteristics for each period. In other words, child growth and development are normally continuing processes, although certain anatomical, physiological and psychological segments do not develop at the same rate or end at the same time (Rowlands et al.,1999). Individual differences are present at any point during development. Besides exogenic and endogenic factors, there are many other factors affecting these differences (Nevill et al., 1998).

The period between 8-10 y of age is characterized by fairly steady, slowed gains in body height (Ruiz et al., 2006). Bone growth and calcification are ongoing, while physiological curvatures of the spine are already being fixed. Even though the muscular system is evidently becoming stronger, it is not fully developed. At the end of this period, soft muscle tissue accounts for about 30% of the total body weight.

During this stage, it is necessary to assess body posture and check for potential deformities in order to intervene and correct them in time.

The purpose of this study was to investigate and determine the differences, if any, in postural status between young athletes and the untrained children of the same age.

Method

Participants

The sample was derived from Novi Sad's elementary schools' boys, as well as from those participating in many sports clubs in the Novi Sad municipality. They were 8-10 y old (± 6 months).

Participants were assigned into one of the following three groups:

A) pupils participating in individual sports (N=50),

B) pupils participating in team sports (N=51),

C) pupils attending physical education (PE) classes only (N=50)

All participants had to be clinically healthy and free of any aberrations.

Measures

In order to assess the overall postural status, the following parameters were looked at: 1) Head posture; 2) Shoulder posture; 3) Shoulder blade posture; 4) Thorax development status; 5) Digression of the spine in the frontal plane or Spine posture; 6) Abdomen posture; 7) Leg shape; and 8) Foot arch.

The measurements of the postural status of children were taken according to the Napoleon Wolanski method (Radisavljević, 2001). Three marks (0-2) were used: 'zero' (0) was given when all the parameters were in normal, expected relations. 'One' (1) represented a certain digression from a normal status of body posture, which could be corrected with appropriate exercises (the active portion of the locomotor system was weakened in some way), and 'two' was given in more severe cases with significant digression from the normal status of body posture (structural changes of the locomotor system).

During examination, children were barefoot and in their underwear. The observations were done from the distance of about 2 m, and were recorded in a set order. It was ensured that measurement conditions were the same for all participants during the morning hours, in well-lit and spacious rooms, at an optimal room temperature, and the same people taking the measurements.

The results were analyzed by the frequency of appearance by categories of postural status, and were expressed both numerically and in percentages. Differences between groups calculated using Chi-square test.

Results

Table 1 shows the results for Head posture, Shoulder posture, Shoulder blade posture, Thorax development status, Spine shape and posture, Abdomen posture, Leg shape, and Foot arch.

Table 2 shows that there is a statistically significant difference among tested groups of pupils in variables *shoulder posture*, *abdomen posture*, *leg shape* and *foot arch* at the level of significance $p \leq 0.01$. Whereas with a variables *Spine shape* and posture, this difference is at the level of significance $p \leq 0.05$, respectively.

By analyzing results of the frequencies in head posture, it can be noticed that the best group, with greatest percentage in normal posture was found in group A (50%), followed by group C (46%) and group B (37%). In addition, results of significant digression from normal head posture were found in group C (control group) and B with frequency of 4%, whereas group A had 2%.

The results in shoulder posture were as follows: 80% in group A and 74.5% in group B of the boys with an optimal shoulder status. Only 46% of the boys in control group had good shoulder posture and 4% of significant digression from optimal posture.

Table 1

Postural status of 8-10 year-old pupils participating in individual sports (A), team sports (B), and those not participating in any sports (C.

	mark	Frequency (%)		
		A	B	C
Head posture	0	25 (50%)	19 (37.3%)	23 (46%)
	1	24 (48%)	30 (58.8%)	25 (50%)
	2	1 (2%)	2 (3.9%)	2 (4%)
	Total	50 (100%)	51 (100%)	50 (100%)
Shoulder posture	0	40 (80%)	38 (74.5%)	23 (46%)
	1	10 (20%)	13 (25.5%)	25 (50%)
	2	-	-	2 (4%)
	Total	50 (100%)	51 (100%)	50 (100%)
Thorax shape	0	45 (90%)	44 (86.3%)	43 (86%)
	1	5 (10%)	7 (13.7%)	5 (10%)
	2	-	-	2 (4%)
	Total	50 (100%)	51 (100%)	50 (100%)
Shoulder blade position	0	31 (62%)	25 (49%)	20 (40%)
	1	17 (34%)	24 (47.1)	29 (58%)
	2	2 (4%)	2 (3.9%)	1 (2%)
	Total	50 (100%)	51 (100%)	50 (100%)
Spine shape and posture	0	44 (88%)	40 (78.4%)	31 (62%)
	1	6 (12%)	11 (21.6%)	18 (36%)
	2	-	-	1 (2%)
	Total	50 (100%)	51 (100%)	50 (100%)
Abdomen posture	0	17 (34%)	10 (19.6%)	3 (6%)
	1	25 (50%)	19 (37.3%)	31 (62%)
	2	8 (16%)	22 (43.1%)	16 (32%)
	Total	50 (100%)	51 (100%)	50 (100%)
Leg shape	0	44 (88%)	42 (82.4%)	26 (52%)
	1	6 (12%)	9 (17.6%)	14 (28%)
	2	-	-	10 (20%)
	Total	50 (100%)	51 (100%)	50 (100%)
Foot arch	0	22 (44%)	31 (60.8%)	8 (16%)
	1	28 (56%)	20 (39.2%)	39 (78%)
	2	-	-	3 (6%)
	Total	50 (100%)	51 (100%)	50 (100%)

A normal thorax shape and posture was found in 90% of the boys in group A, 86.3% in group B and 86% in control group, whereas 4% of significant digression in posture was found in control group.

The results for Shoulder-blade posture in groups shows that in all groups highest percentage was with normal posture, but there was found within all three groups small percentage (around 4%) of significant structural changes due to a scoliotic body posture.

Table 2

Differences in postural status between groups of pupils

Body segment	Chi-square (df)	p
Head posture	2.00 (4)	.736
Shoulder posture	17.069 (4)	**.002**
Thorax shape	4.514 (4)	.341
Shoulder blade position	5.933 (4)	.204
Spine shape and posture	10.590 (4)	.032
Abdomen posture	19.143 (4)	**.001**
Leg shape	28.693 (4)	**.000**
Foot arch	25.460 (4)	**.000**

A normal spine posture was had by 88% in group A, 78.4% in group B and 62% in control group C. A significant digression with severe structural changes taking place had 2% in control group.

Only 34% of the boys in group A had a normal abdomen posture, 50% had a slight digression from normal abdomen posture, and even 16% had a significant digression. It appears that the underlying cause of this finding may as well be a weakened active portion of the locomotor apparatus or musculature, which can have result in a lordotic body posture. The situation in groups B and C was similar, with high percentage of a significant digression from normal abdomen posture.

The situation with leg-shape posture, in group A and B, high percentage of normal posture were found (over 80%), while the rest of the subjects had slight alterations in posture that could be corrected by strengthening the stabilizing muscles, especially in the knee joint and ankle. In group C, 52% had a normal leg shape, 28% were with a slight digression, and even 20% had a significant digression from normal leg shape. This can certainly be attributed to a poor level of physical activity and the result in weakening of the stabilizing musculature and ligaments of the lower leg joints.

Finally, highest percentage of the participants in group A and B showed a normal foot arch, and the remaining percentage had a slight digression from a normal postural status. None had a significant digression. A dire situation was found in group C where only 16% of the boys had a normal foot arch, 78% had a slight digression, and 6% (3 boys) had a significant digression from normal foot arch. Feet are always the first to relent as a direct consequence of insufficient physical activity, poor diet and obesity.

Discussion

From all these analyses, it can be inferred that the most sensitive areas in 8-10 year-old boys participating in individual sports are the abdominal section, scapular area and feet. In these regions of the body there was the greatest number of pupils with a slight digression from a normal postural status.

One can also observe that the situation with boys participating in team sports is worse than with those involved in individual sports. There were more compromised regions, with a poor postural status in the abdominal section, the head, scapular region, and the feet.

Very disturbing results compared to the other two groups, were found in group C with untrained boys participating only in PE classes at school. In this group, the overall postural status was very poor. The weakest links seem to be the abdominal region, the head, shoulders, scapular area, spine, feet and legs. These findings suggest that further analysis looking at the root-cause of this phenomenon is needed in order to make corrections, and, more importantly, provide meaningful and timely prevention strategies to the problem.

This study was run on 151 boys aged 8-10 years, divided into three groups: trained – individual sports, trained – team sports, and untrained. Eight variables were measured for the assessment of the overall postural status, with the purpose of examining the differences between the trained vs. the untrained pupils of the same age.

All measurements were taken by the Napoleon Wolanski method. The analyses of the results led us to the following conclusions:

- The most sensitive areas in 8-10 year-old boys participating in individual sports are the abdominal section, scapular area and feet. In these regions of the body there were the most pupils with a slight digression from a a normal postural status.
- A worse situation was seen with boys participating in team sports than with those involved in individual sports. There were more compromised regions, with a poor postural status found in the abdominal section, the head, scapular region, and the feet.
- The worst results were found in the control group, where there was a very worrying situation. The weakest links were the abdominal region, the head, shoulders, scapular area, spine, feet and legs.

After starting school, spontaneous movement activities in children are reduced. In addition to a prolonged time spent in a sitting position, whether in school or at home, the musculoskeletal system is negatively influenced by ergonomically inadequate school furniture, mental stress, and in particular lack of overall movement (Filipova et al., 2003). The attitude of parents toward movement activities appears to be very important for the creation of positive relationships of children with respect to sports and exercise. Education (Van de Mheen et al., 1998; Groholt et al., 2003) is an important factor influencing the state of health. Educated people have better attitudes toward healthy lifestyles, including exercise. A gradually developing muscular imbalance initially manifests as a functional disorder with characteristic signs of changing body profile, which is followed by structural changes, first affecting the soft tissues (ligaments, cartilage, and muscles) and later the bony and joint structures. The latter is known as fixed postural abnormality. Unlike fixed abnormalities, poor posture in a functional disorder phase can be willingly corrected by active muscle effort (Groholt et al., 2003) and may be influenced by regular and special exercise (Filipova et al., 2005).

This work provides evidence that deficit of movement activities is associated with the development of poor posture. Interventional measures, which should be implemented on a large-scale basis, especially as part of school physical education. There is a lack of guidance and the cooperation between health care professionals and educators regarding how best to implement physical activities. The results of our study can be used as evidence with officials in the area of prevention, to support efforts to improve the health of our school children and to reduce the risk of postural damage to children's health.

References

Filipová V, Kratěnová J, Trestrová Z. *(*2005). *National Program of Health—Grant Projects for the Support of Health 1994-2004 [in Czech]*. Prague, Czech Republic: Regional Public Health Authority and Institute of Health of the Middle Bohemian Region.

Groholt, E., Stigum, H., & Nordhagen, R. (*2003*). Recurrent pain in children, socio-economic factors and accumulation in families. *European Journal Epidemiology, 18,* 965-975.

Nevill, A., Holder, R., Baxter-Jones, A., Round, J., & Jones, D. (1998). Modeling developmental changes in strength and aerobic power in children. *Journal of Applied Physiology, 84,* 963-970.

Purenović, T. (2007). Review of national and international research studies in postural deformities: The period from 2000 to 2007. *Facta Universitatis – Physical Education and Sport, 5,* 139-152.

Rowlands, A. V., Eston, R. G., & Ingledew, D. K. (1999). Relationship between activity levels, aerobic fitness, and body fat in 8- to 10-yr-old children. *Journal of Applied Physiology, 86*(4), 1428-1435.

Ruiz, J. R., Rizzo, N. S., Hurtig-Wennlof, A., Ortega, F. B., Warnberg, J., & Sjostrom, M. (2006). Relations of total physical activity and intensity to fitness and fatness in children: the European Youth Heart Stady. *The Amercan Journal of Clinical Nutrition, 84*(2), 299-303.

Sabo, E. (2006). Posturalni status dece predškolskog uzrasta u Novom Sadu [Postural status of pre-school children in the city of Novi Sad]. *Pedagoška stvarnost, 7-8,* 615-625.

Ulić, D. (1997). *Osnove kineziterapije* [The foundations of kinesitherapy]. Novi Sad: Samostalno autorsko izdanje.

Van de Mheen, H., Stronks, K., & Kolman, C. W. *(*1998). Does childhood socioeconomic status influence adult health through behavioral factors*? International Journal of Epidemiology, 27*(3), 431-437.

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