ANTHROPOLOGIE • XLII/2 • pp. 129–136 • 2004

KATARZYNA KOCHAN-JACHEĆ, ZOFIA IGNASIAK, JAROSŁAW FUGIEL, IGA KRYNICKA

THE BODY POSTURE OF URBAN CHILDREN IN RESPECT OF THE PHYSICAL DEVELOPMENT

ABSTRACT: Postural deformities in adolescent children are a serious social problem. Numerous postural deformities in children are scolioses, since intensive development processes result in possible curvature progression. It leads to permanent changes in locomotor system, labile spine stabilization, muscle weakening and systemic inefficiency (Kasperczyk 1994, Lizis et al. *1997, Skolimowski* et al*. 1993). The research aimed at defining the occurrence frequency of an incorrect body posture of children, as well as at assessing the relations between an incorrect posture and morphofunctional development of examined children. A group of 926 children aged 7–9 were examined by Moire topography. Body height and weight were measured for purposes of morphological assessment. The motor tests provided the diagnosis of the chosen conditional abilities: static strength of the right hand muscles and explosive power of the lower limbs. The results of our tests indicated that asymmetry occurred in the positioning of the spinous process in 48% of boys and 46% of girls. In both sex groups there was no dependence between the spinous process value from the C7-S1 line and the morphofunctional development level of the boys and girls at their early school age.*

KEY WORDS: Body posture – Urban children – School age – Morphofunctional development – Moire topography

INTRODUCTION

Postural deformities in adolescent children are a serious social problem. Numerous postural deformities in children are scolioses, since intensive development processes result in possible curvature progression. It leads to permanent changes in locomotor system, labile spine stabilization, muscle weakening and systemic inefficiency (Kasperczyk 1994, Lizis *et al*. 1997, Skolimowski *et al*. 1993).

The correct posture is compatible with the development dynamics of a healthy person of a particular sex in a given period of ontogenesis. It ensures a harmonious activity of an organism with optimum efficiency (Cieślik *et al.* 1994). Factors affecting the body posture can be divided in two groups: a) inherent, b) acquired. In the latter group there are the malnutrition of a child, incorrect body posture during sitting and standing, the accompanying diseases (short sight, partial deafness), physical tiredness, bad psychological condition (Milanowska, Dega 2001). The dilemma of an incorrect posture is a universal issue, which is confirmed by numerous publications devoted to screening researches carried out on both children and adolescents (Daruwalla, Balasubramaniam 1985, Górniak 1999, Slawinska, Ignasiak 2002, Laulund, Sojbjerg, Horlyck 1982, Różański 1998, Skolimowski 1991).

AIMS

The research undertaken aimed at assessing the frequency of lateral curvature exhibited by younger schoolchildren inhabiting the ecologically endangered regions. The selected morphofunctional features were also assessed in respect of varied body posture.

Paper presented at the International Anthropological Congress "Anthropology and Society", commemorating the 60th anniversary of death of Dr. Aleš Hrdlička, held on May 22–24, 2003 in Prague, Czech Republic.

MATERIAL AND METHODS

The research was carried out in September 2002 in the primary schools of Polkowice situated in the south-west of Poland. The material was compiled by the employees of the University of Physical Education, Department of Anatomy in Wrocław. A group of 926 children at the age from 7 to 9, among them 444 boys and 459 girls, were chosen to be examined. The Moire topography (Adair 1977, Nowotny 1992) was applied to assess the body posture. The spinous process deviations from the C7-S1 line (UK) formation of every examined person was put to analysis. UK is a linear parameter measured in millimetres. The degree of spine deviation in the frontal plane was taken into consideration while classing a child in one of the 3 groups:

1) the ≥ 0 ≤ 5 UK deviation value – the spine conforming to standards,
2) the > 5 <10 UK deviation value – a group to be observed,
3) the ≥ 10 UK deviation value – a group to be subject to further specialist diagnosis.

Because of the fact that there were very few children in the groups with the highest vertebral deviation line from the UK line (from 4% to 11%), the first two groups were taken into consideration for further analysis: children with a normal spine as well as children who tend to have a lateral curvature.

The children's basic somatic features: height and body weight were measured. Physical fitness was measured according to the "EUROFIT" test (1989). Motor tests aiming at the diagnosis of selected conditional abilities:

– the explosive power of the lower limbs – standing broad jump
– the static strength of the right hand and forearm muscles – hand grip.

The results collected during the examination were put to statistical analysis. The Student's t-test was brought about in order to define the important differences between the examined groups. The relationships between the shape of the vertebral line and the morphofunctional development level of boys and girls were assessed on the basis of the straight line Pearson correlation.

DISCUSSION

According to conducted analyses concerning the frequency of lateral curvature of the spine it was concluded that the most boys with correct body posture were in the group of 7-year-old boys. The most boys with medium scolioses were from the group of 8-year-old boys. This indicates the appearance of the primary scoliosis (*Figure 1*).

In the groups of girls there was a decrease according to the age in the number of children to be observed and an increase in the number of children with correctly shaped spinous process line. Similarly to boys, the lowest number of children – from 6% to 9% – were found in the third group of children with a high degree of spine curvature (*Table 1, Figure 2*).

While comparing the UK line shape in the sex groups, it can be noted that in the case of boys the number of children with vertebral line deviation increases according to the age, and in the case of girls it respectively decreases. In the male group the most boys aged seven have the UK line shape conform to standards, in the female group it is like that for the girls aged nine (*Figures 3, 4*). These differences can be related to a different development pace of boys and girls. Girls are featured by higher development dynamics at the age of seven, during their school time their bodies start growing earlier. The biggest number of children with incorrectly shaped UK line was observed at that time. In the case of boys the most children from this group were at the age of eight, which results from the fact that their school growing-up phase starts later. This situation confirms a known regularity that the most posture faults of children appear in the intensive organism growing period (Kutzner-Kozińska 1992)

None of the groups with a different spine line shape differs distinctively in respect of the body height development according to the carried out analysis (*Tables 2–7*, *Figure 5*). This situation was observed in the whole analysed development period and it occurred in both the group of boys and girls. However, the children from the groups to be observed exhibited a tendency to have a higher body height value.

In both sex groups, in the whole analysed age period no relation between a body height vertebral line shape was found in the frontal plane (*Table 11*).

There were no statistically significant differences between the children reckoned among the group within the norm and that to be observed during the analysis of the body weight development level in the particular groups divided in respect of the vertebral line shape (*Tables 2–7*, *Figure 6*). This situation was also observed in the whole analysed development period and it concerned the groups of boys and girls.

No relation with the vertebral line shape was observed in the case of this somatic feature (*Table 11*).

The tests selected for the analysis of motor development level are abilities defining one's fitness. Their development is related to the physical development level of an individual. A higher level of somatic development and a bigger body size result in better outcome in the tests estimating the state of motor development.

In the case of the analysed motor predispositions there was no relation between the development level of the lower limbs explosive power and the static strength of hand muscles and the vertebral line shape in the frontal plane (*Table 11*). These dependencies did not occur during the whole analysed development period and they concerned the groups of boys and girls.

The lower limbs explosive power is related also to the length of limbs and therefore taller people have often a

TABLE 1. Percentage of urban children with different course of C_7-S_1 line.

Age	Sex	n	Group conforming to standards	Group to be observed	Group to further diagnosis
7 years	boys	127	56 %	38 %	6 %
	girls	129	45 %	48 %	7 %
8 years	boys	151	45.5 %	43.5 %	11 %
	girls	165	52 %	42 %	6 %
9 years	boys	166	53.5 %	42.5 %	4 %
	girls	164	53 %	38 %	9 %

TABLE 2. Characteristic of morphofunctional development of 7-year-old boys from the groups conforming to standards and to be observed.

Morphofunctional features	Group conforming to standards			Group to be observed		
	x	s	v	x	s	v
body height	123.91	5.77	4.66	125.41	5.82	4.64
body weight	25.00	5.23	20.93	25.36	5.12	20.21
explosive power	100.13	17.62	17.60	97.94	20.18	20.60
static strength of hand	12.69	2.56	20.15	12.38	2.84	22.94
UK	3.20	1.18	36.82	6.85	1.30	18.99

TABLE 3. Characteristic of morphofunctional development of 8-year-old boys from the groups conforming to standards and to be observed.

Morphofunctional features	Group conforming to standards			Group to be observed		
	x	s	v	x	s	v
body height	129.02	5.62	4.36	130.69	6.21	4.75
body weight	26.18	4.23	16.16	28.08	6.70	23.85
explosive power	110.41	18.52	16.77	114.89	15.62	13.59
static strength of hand	13.59	2.90	21.30	13.92	2.79	20.04
UK	3.13	1.36	43.36	7.13	1.48	20.74

TABLE 4. Characteristic of morphofunctional development of 9-year-old boys from the groups conforming to standards and to be observed.

Morphofunctional features	Group conforming to standards			Group to be observed		
	x	s	v	x	s	v
body height	134.62	5.72	4.25	134.99	7.69	5.70
body weight	30.55	6.27	20.53	30.27	6.36	21.02
explosive power	119.70	18.60	15.54	114.82	16.92	14.74
static strength of hand	15.61	3.45	22.11	15.45	3.70	23.95
UK	3.44	1.12	32.71	6.99	1.32	18.86

TABLE 5. Characteristic of morphofunctional development of 7-year-old girls from the groups conforming to standards and to be observed.

Morphofunctional features	Group conforming to standards			Group to be observed		
	x	s	v	x	s	v
body height	122.94	5.31	4.32	123.15	5.01	4.06
body weight	24.05	4.68	19.47	24.51	4.73	19.29
explosive power	93.23	15.42	16.54	90.50	16.67	18.42
static strength of hand	10.35	2.90	28.03	10.41	2.65	25.42
UK	3.18	1.15	36.04	7.01	1.16	16.57

TABLE 6. Characteristic of morphofunctional development of 8-year-old girls from the groups conforming to standards and to be observed.

Morphofunctional features	Group conforming to standards			Group to be observed		
	x	s	v	x	s	v
body height	127.89	5.94	4.64	129.89	6.59	5.07
body weight	26.69	5.41	20.29	27.28	5.75	21.10
explosive power	102.35	16.20	15.83	98.39	13.28	13.50
static strength of hand	11.64	2.77	23.84	12.23	2.82	23.06
UK	3.16	1.37	43.21	6.77	1.51	22.25

TABLE 7. Characteristic of morphofunctional development of 9-year-old girls from the groups conforming to standards and to be observed.

Morphofunctional features	Group conforming to standards			Group to be observed		
	x	s	v	x	s	v
body height	133.38	6.12	4.59	134.40	6.15	4.57
body weight	29.72	6.32	21.27	30.63	6.46	21.09
explosive power	112.42	16.44	14.63	112.63	15.91	14.13
static strength of hand	13.71	3.33	24.30	14.32	3.38	23.59
UK	3.25	1.16	35.54	6.80	1.41	20.77

TABLE 8. Significant differences (NIR) of the level of morphofunctional development of 7-year-old boys and girls from the group with different course of C_7-S_1 line.

Morphofunctional features	Boys			Girls		
	Groups 1:2	Groups 1:3	Groups 2:3	Groups 1:2	Groups 1:3	Groups 2:3
	NIR	NIR	NIR	NIR	NIR	NIR
body height	0.18	0.35	0.77	0.82	0.43	0.50
body weight	0.71	0.86	0.99	0.59	0.58	0.77
explosive power	0.54	0.64	0.46	0.36	0.55	0.89
static strength of hand	0.56	0.81	0.97	0.91	0.98	0.97
UK	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 9. Significant differences (NIR) of the level of morphofunctional development of 8-year-old boys and girls from the group with different course of C_7-S_1 line.

Morphofunctional features	Boys			Girls		
	Groups 1:2	Groups 1:3	Groups 2:3	Groups 1:2	Groups 1:3	Groups 2:3
	NIR	NIR	NIR	NIR	NIR	NIR
body height	0.12	0.99	0.42	**0.04**	0.47	0.13
body weight	0.06	0.68	0.55	0.50	0.87	0.67
explosive power	0.17	0.81	0.62	0.09	**0.01**	0.06
static strength of hand	0.53	0.69	0.46	0.18	0.74	0.84
UK	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 10. Significant differences (NIR) of the level of morphofunctional development of 9-year-old boys and girls from the group with different course of C_7-S_1 line.

Morphofunctional features	Boys			Girls		
	Groups 1:2	Groups 1:3	Groups 2:3	Groups 1:2	Groups 1:3	Groups 2:3
	NIR	NIR	NIR	NIR	NIR	NIR
body height	0.76	0.53	0.67	0.31	0.34	0.13
body weight	0.80	0.24	0.19	0.39	0.57	0.94
explosive power	0.12	0.61	0.14	0.32	0.35	0.14
static strength of hand	0.81	0.94	0.82	0.29	0.052	**0.01**
UK	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 11. Correlation between C_7-S_1 line and morphofunctional development of boys and girls.

Morphofunctional features	UK					
	7-year-old		8-year-old		9-year-old	
	Boys	Girls	Boys	Girls	Boys	Girls
body height	0.14	0.07	0.04	–0.04	0.06	0.01
body weight	0.08	0.10	0.11	–0.07	0.08	0.07
explosive power	–0.06	–0.10	0.04	–0.22	–0.02	–0.01
static strength of hand	–0.01	0.01	0.04	–0.04	0.03	–0.09

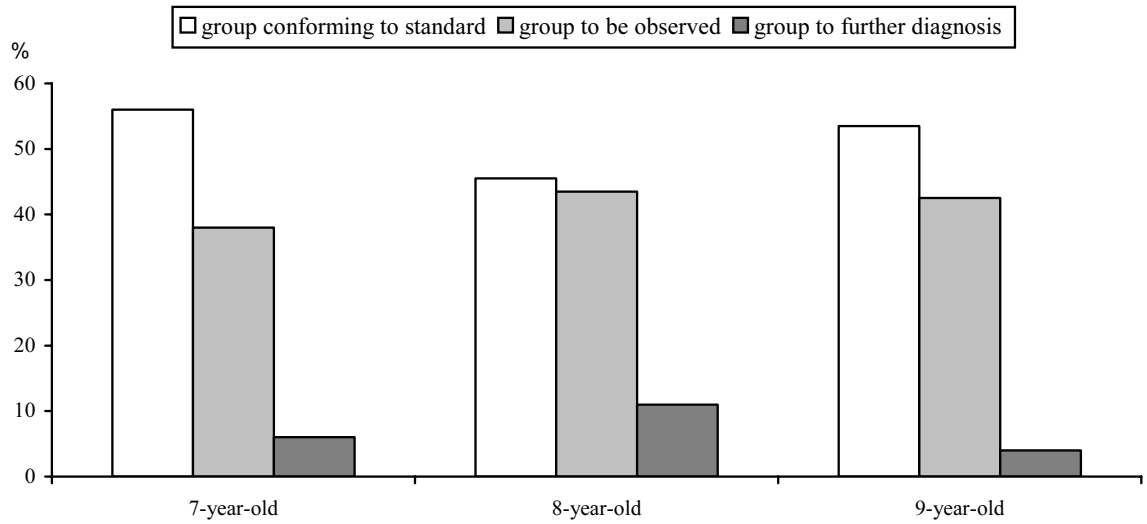

FIGURE 1. Percentage of boys with different course of C_7-S_1 line.

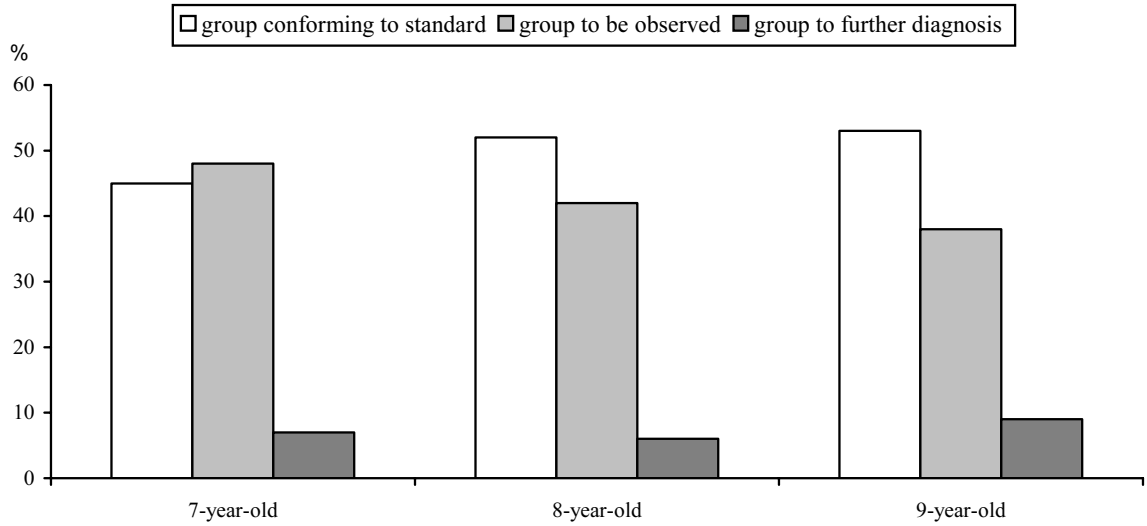

FIGURE 2. Percentage of girls with different course of C_7-S_1 line.

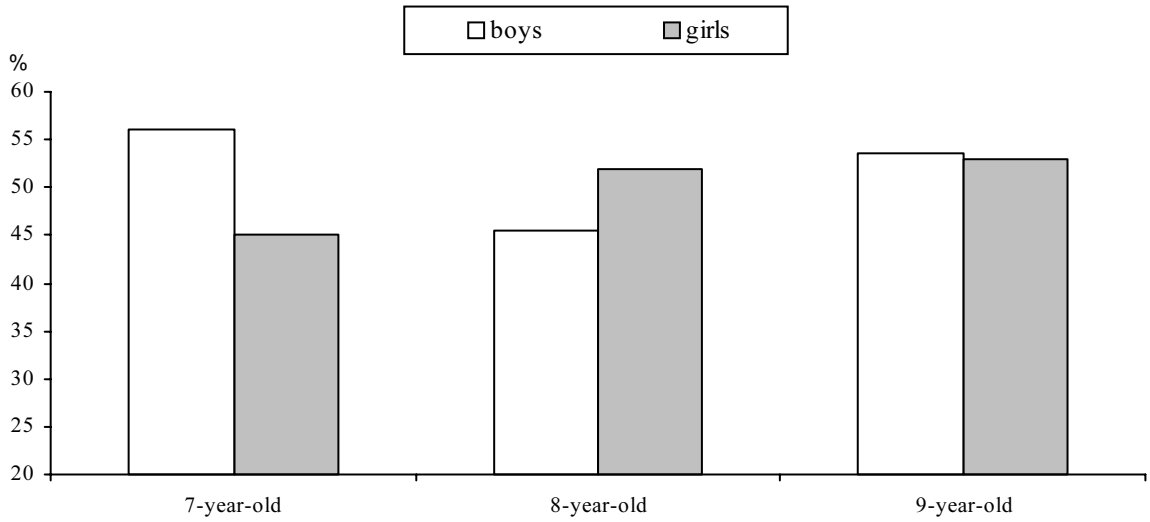

FIGURE 3. Percentage of boys and girls with C_7-S_1 line conforming to standard and marked tendency of C_7-S_1 line changes according to age.

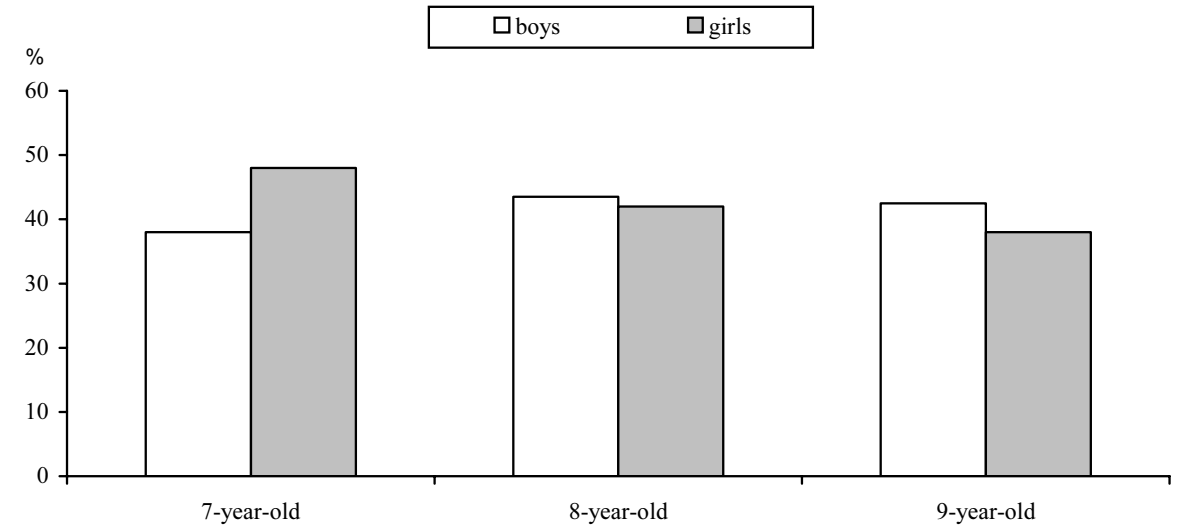

FIGURE 4. Percentage of boys and girls with group to be observed and marked tendency of C_7-S_1 line changes according to age.

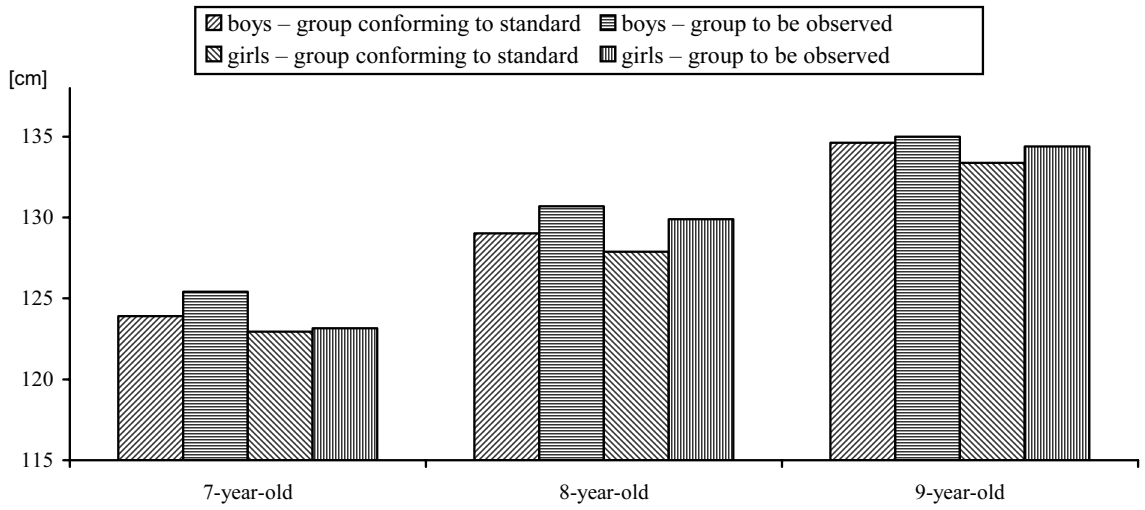

FIGURE 5. The development level of body height of boys and girls with different course of C_7-S_1 line.

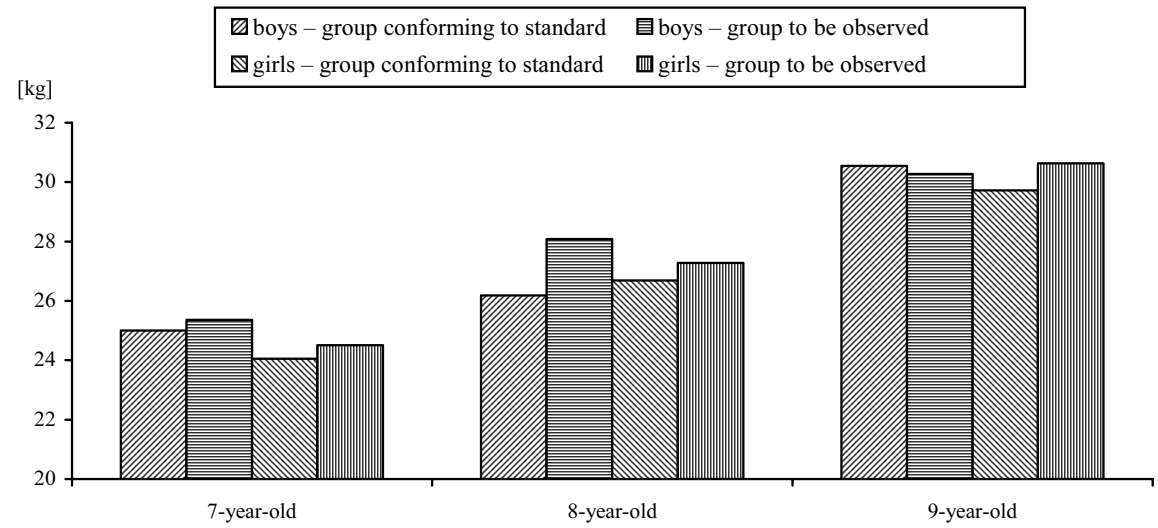

FIGURE 6. The development level of body weight of boys and girls with different course of C_7-S_1 line.

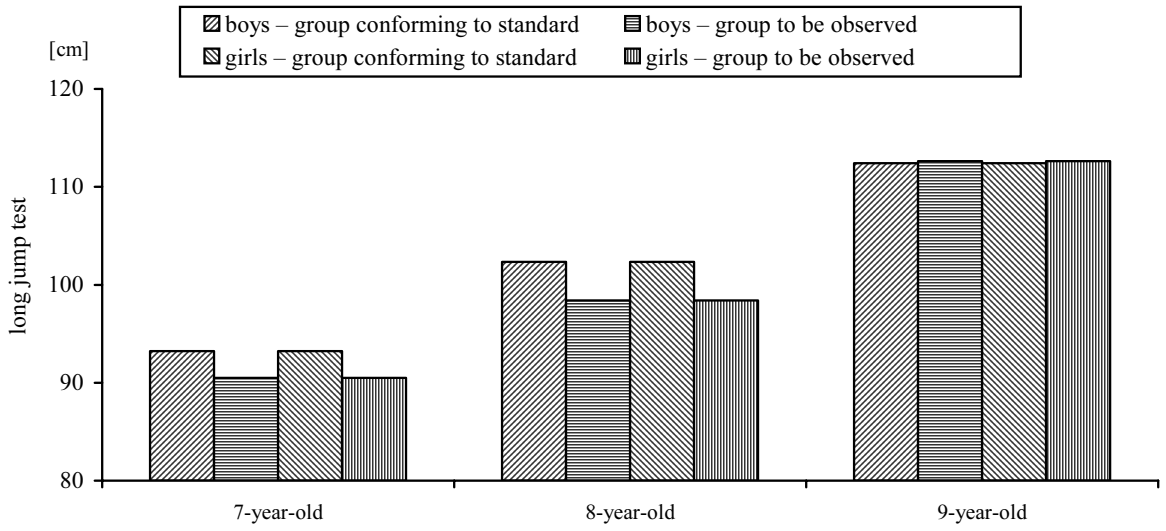

FIGURE 7. The development level of explosive power of the lower limbs of boys and girls with different course of C_7-S_1 line.

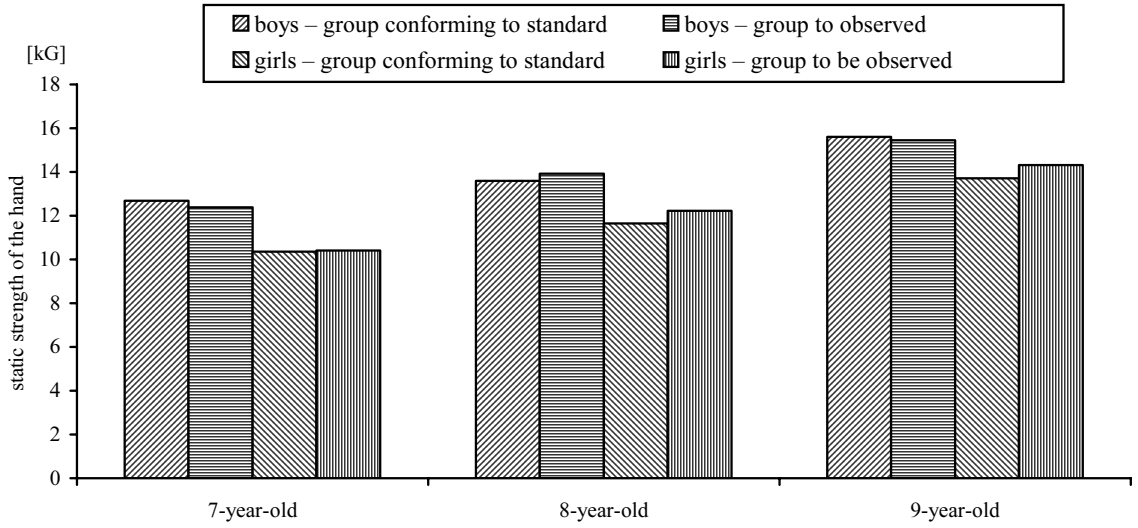

FIGURE 8. The development level of static strength of right hand of boys and girls with different course of C_7-S_1 line.

RESULTS

better result in the long jump test. In the case of the analysed groups, the children's body height is similar, for this reason this feature could not differentiate particular groups. According to the expectations, the development level of this motor abilities is similar in every analysed age class. In the groups of both boys and girls there were no statistically significant differences between the children from the groups with the correctly shaped spinous process line and from the groups to be observed (*Tables 2–7*, *Figures 7, 8*). In the case of static strength, there were also no statistically significant differences between the groups of children with standard arrangement of the spinous process line and the children to be further observed. This situation also related to both sex groups.

The results of the conducted analysis concerning the children's morphofunctional development point out that none of the groups considerably differs from the others in respect of the somatic and motor development. This situation was observed during the whole examined growing-up period and occurred in both the group of boys and that of girls. However, it was observed that in the girl's explosive strength the medium results obtained in the explosive power are the lowest in the groups with UK deviation value bigger than 10 mm. This dependence did not occur in the case of the static strength of the hand and forearm muscles as well as in the examined somatic features (height and body weight) in the groups of both boys and girls.

It can be concluded that the faint connection between morphofunctional development level and the size of the lateral curvature refers to the phenomenon of the abilities occurring in this age period at the lower dynamic development of the muscular strength. This fact could cause that the small posture deformities observed in the young children cannot be defined in terms of physical fitness level and they had no influence on the motor abilities examination result. However, the children that exhibit faults in body posture going beyond the physiological standard should be especially taken care of. Early intervention in case of proven asymmetry or postures leading to scoliosis could, to a large degree, prevent the formation of scoliosis.

The results:

1) As a result of the carried out analysis, no vertebral curvatures were found in the frontal plane in 52% of boys and 54% of girls.
2) On the basis of the conducted body posture assessment it was concluded that 41% of boys exhibit certain tendencies to lateral spine curvature and 7% were qualified for a specialist diagnosis, and respectively 39% and 7% of girls in the female group.
3) In both sex groups there was no dependence between the spinous process value from the C7-S1 line (UK) and the morphofunctional development level of the boys and girls at the age between 7 and 9.
4) The pictures from the three analysed groups did not differ from each other in respect of morphofunctional development.

REFERENCES

ADAIR I., 1977: Moire topography in scoliosis screening. *Clin. Orthop.* 129: 165–171.

CIESLIK J., KACZMAREK M., KALISZEWSKA-DROZDOWSKA M., 1994: *Dziecko poznańskie '90*. WNB, Poznań.

DARUWALLA J. S., BALASUBRAMANIAM P., 1985: Moire topography in scoliosis. Its accuracy in detecting the site and size of the curve. *J. of Bone Joint Surgery Br.* 67,2:211–213.

GÓRNIAK K., 1999: Postawa ciała dzieci wiejskich. *Rocznik Naukowy*, IWFiS I: 27–30.

KASPERCZYK T., 1994: *Wady postawy ciała. Diagnostyka i leczenie*. Kasper, Kraków.

KUTZNER-KOZIŃSKA M., 1992: *Korekcja wad postawy*. WSZiP, Warszawa.

LAULUND T., SOJBJERG J. O., HORLYCK E., 1982: Moire topography in school screening for structural scoliosis. *Acta Orthop. Scand*. 53: 765–768.

LIZIS P., ŻAK M., CAŁKA-LIZIS T., JANKOWICZ W., 1997: Postawa ciała oraz jej związki z wybranymi cechami morfologicznymi u dziewczynek w wieku 5 lat z Nowej Huty. *Postępy rehabilitacji* IX,1:134–138.

MILANOWSKA K., DEGA W., 2001: *Rehabilitacja medyczna*. PZWL, Warszawa.

NOWOTNY J., 1992: Fototopografia z wykorzystaniem rastra optycznego i komputer jako sposób oceny postawy. *Postępy rehabilitacji* VI,1: 15–26.

RÓŻAŃSKI P., 1998: Postawa ciała siedmiolatków. *Wychowanie fizyczne i zdrowotne* 1: 27–30.

SKOLIMOWSKI T., BIBROWICZ K., SIPKO T., 1993: Siła i wytrzymałość mięśni posturalnych w skoliozach idiopatycznych. In: Nowotny T. (Ed.): *Wczesne wykrywanie i zapobieganie progresji bocznych skrzywień kregosłupa. Diagnostyka i terapia*. Pp 301–317, AWF, Katowice.

SKOLIMOWSKI T., 1991: Kształtowanie się parametrów czynnościowych narządu ruchu w przebiegu idiopatycznych bocznych skrzywień kręgosłupa. *Studia i monografie* 26, AWF, Wrocław.

SLAWINSKA T., IGNASIAK Z., 2002: Częstość występowania bocznych skrzywień kręgosłupa u dzieci polkowickich w świetle poziomu siły mięśniowej. *Materiały XI Międzynarodowej Konferencji Naukowej*, Legnica: 54.

Katarzyna Kochan-Jacheć
Department of Human Anatomy, University of Physical Education in Wrocław
al. I. J. Paderewskiego 35
51-612 Wrocław, Poland
E-mail: kkochan2@wp.pl