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THE IMPACT OF PHYSICAL ACTIVITY IN THE: 'KEEP YOUR BODY STRAIGHT' PROGRAM ON THE SELECTED FEATURES OF BODY POSTURE IN FRONTAL AND TRANSVERSE PLANES IN CHILDREN AGED 7-9 YEARS

WPŁYW WYSIŁKU FIZYCZNEGO STOSOWANEGO W RAMACH PROGRAMU „TRZYMAJ SIĘ PROSTO" NA WYBRANE CECHY POSTAWY CIAŁA W PŁASZCZYŹNIE CZOŁOWEJ I POPRZECZNEJ DZIECI W WIEKU 7-9 LAT

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Summary

The main causes of majority of health problems in children and teenagers include incorrect health behaviors and adverse effects of socioeconomic environment.

The purpose of this study is to determine the impact of physical activity in the 'Keep your body straight' program on incorrect body postures in children aged 7-9 years.

Material and methods. 1864 children in classes I-III of primary schools were included in the study. The assessment of posture was conducted in six half-year long editions under the 3-year program using a photogrammetric method and concerned the same group of pupils. Children participated in corrective activities as a part of the 'Keep your body straight' program.

The above mentioned program positively influenced the torso bending angle to the left and less to the right. A similar effect was observed in the size of the maximum inclination of the atlas vertebra to the left, in the spinous process and to a lesser extent, in the inclination to the right. In addition, a positive effect was noticed in pelvic rotation in the transverse plane. Other features like the angle of shoulder line, the asymmetry of waist triangle height and width, the asymmetry of shoulders, shoulder blades and pelvis in frontal plane did not reveal any significant differences in the process.

Conclusions. 1. Corrective activities of the 'Keep your body straight' program combined with education of parents are moderately effective means in the correction process of wrong postures in frontal and transverse planes in children of both sexes aged 7-9 years. 2. Physical activity applied within the program significantly influenced the vertical orientation of torso and maximum deviation of the spinous process of vertebrae in the frontal plane and the value of pelvic rotation in the transverse plane. 3. The effectiveness of the program can be enhanced by an individual approach to every 'advanced incorrect' posture in a child, which could not be achieved under the program due to insufficient funds of the school.

Streszczenie

Głównymi przyczynami większości zaburzeń w stanie zdrowia dzieci i młodzieży są nieprawidłowe zachowania i niekorzystne czynniki środowiska socjoekonomicznego.

Określenie wpływu stosowanego wysiłku fizycznego w ramach programu korekcyjnego „Trzymaj się prosto" na błędy postawy ciała 7-9 letnich dzieci. Materiał i metodyka. Badaniami objęto 1864 dzieci klas I-III. Oceny postawy ciała

dokonano w 6 półrocznych edycjach 3-letniego programu, w tej samej grupie uczniów, metodą fotogrametryczną. Dzieci uczestniczyły w programowych zajęciach korekcyjnych „Trzymaj się prosto".

Zastosowany program wpływa pozytywnie na: kąt zgięcia tułowia w lewo, mniej na kąt zgięcia w prawo. Podobny wpływ zaobserwowano w wielkości maksymalnego odchylenia kręgu szczytowego w lewo, w przebiegu linii wyrostków kolczystych kręgosłupa, mniej w odchyleniu w prawo. Wpłynął także korzystnie na wielkość skręcenia miednicy w płaszczyźnie poprzecznej. Wielkości pozostałych cech: kąta linii barków, asymetrii wysokości i szerokości trójkątów taliowych, asymetrii barków i łopatek oraz miednicy w płaszczyźnie czołowej nie wykazywały znaczących różnic w przebiegu.

W n i o s k i . 1. Zastosowane ćwiczenia korekcyjne w ramach programu „Trzymaj się prosto" połączone z edukacją rodziców jest umiarkowanie skutecznym środkiem w procesie naprawczym błędów postawy ciała w płaszczyźnie czołowej i poprzecznej dzieci obojga płci w wieku od 7 do 9 lat. 2. Zastosowany wysiłek fizyczny wpłyną znacząco na wertykalność tułowia i wielkość maksymalnego odchylenia wyrostka kolczystego kręgu w płaszczyźnie czołowej oraz wielkość skręcenia miednicy w płaszczyźnie poprzecznej. 3. Efektywność programu można zwielokrotnić, indywidualnym podejściem do każdej „zaawansowanej błędliwej" postawy dziecka, czego nie udało się zrealizować ze względu ograniczone środki finansowe szkoły.

Key words: body posture, frontal plane, transverse plane, program "Keep going straight", children
Słowa kluczowe: postawa ciała, płaszczyzna czołowa, płaszczyzna poprzeczna, program „Trzymaj się prosto", dzieci

INTRODUCTION

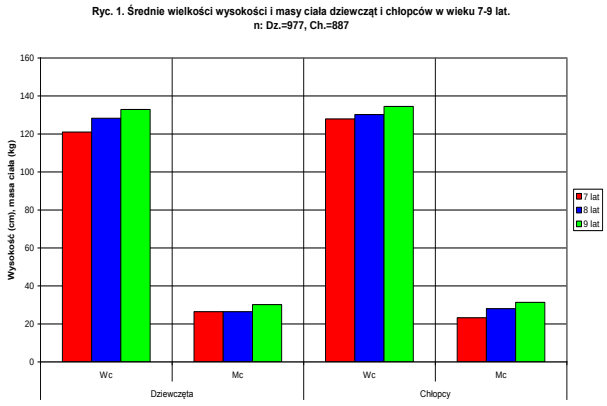
In recent years increasing attention has been paid to the issues of health and health care of a student of Polish schools. Health promoting programs have been developed as reflected in numerous publications [1, 2, 3, 4]. The main causes of most health problems in children and teenagers from towns and rural areas include incorrect health behaviors and adverse effects of their socioeconomic environment (mainly home environment). It should be emphasized that in addition to essential environmental factors, the human condition is also affected by genetic determinants [5]. According to the studies, 77% of teenagers spend more than 2 hours a day watching television, whereas 44% of boys and 31% of girls as much as 4 hours on a daily basis [3]. The research carried out in 1978-1980 among pupils in classes I-IV of primary schools in the southeast macro region showed better physical condition of children from rural areas and small towns in comparison to children from big cities, while the level of somatic development of children from cities was higher when compared to their rural counterparts [6]. Different environmental characteristics can be clearly observed in development of Polish children. This particularly refers to strength, speed and agility, which can be observed particularly among girls. As it results from surveys, about one third of 25 European schools of higher education which responded to the survey sent to them, conduct corrective activities, that is, in Belgium: University of Leuven, the Netherlands: universities in Eindhoven and Nijmegen, Germany: universities in Hamburg, Essen, Hannover, Sweden: Uppsala University and University of Gothenburg, Hungary: University of Goddollo. Polish universities did not respond to the survey, nor did the British and French ones [7].

Body posture asymmetries in frontal and transverse planes comprise a complex problem. Posture asymmetry helps distribute body weight evenly on load-bearing surfaces of the motor system; however, lack of asymmetry may lead to overload syndromes [8]. That could be treated as one of home environmental impacts. Still, the prevalence of these syndromes makes one wonder about efficiency of physical activity during school corrective exercises under the program and PE classes. Own scientific studies have shown [9] that these activities do not meet the expected requirements. In consequence, basic functions of physical education including stimulation, adaptation, compensation, correction and such targets as maintaining the natural motility of children and youth, improving physical activity, developing talents in physical activity and managing the development of movement features are not fulfilled. Krawański [10] reports that body posture stimulants consist of: development and efficiency of skeletal muscles, maintaining the optimal volume of joint movement and preserving the upright position reflex.

The purpose of the study is to determine the impact of physical activity in the 'Keep your body straight' program on incorrect body postures in children aged 7-9 years.

MATERIAL, METHODS AND SUBJECT

The research program was implemented in 2007-2010. The first edition included first class pupils from 21 randomly chosen primary schools from the Warmińsko - Mazurskie region. The study group was regarded as homogenous in terms of their place of residence as dividing children into groups from cities and rural areas would be improper and this characteristic would never determine the homogenous character of the group. From among all children qualified by a school doctor, the measurements covered those who had been diagnosed with improper body postures using Postorumeter M. Eventually the study included 1864 children (977 girls and 887 boys). Test results of girls from class I – 322, II – 383, III – 272 were eligible for the purpose of analysis and in case of boys: 316, 325, 246, respectively. The average body weight of girls aged 7 was 26.42 kg and their average height was 121.0 cm. The 8-year old girls' average weight was 26.42 kg and height: 128.28 cm and for 9-year old girls these were 30.14 kg and 132.87 cm, respectively. As far as boys are concerned, the average weight at the age of 7 was 23.21 kg and height: 127.93 cm. For age 8, these were 28.0 kg and 130.23 cm, respectively; and for age 9: 31.34 kg and 134.47 cm, see Figure 1. The children participated in the corrective activities into which a pro-health 'Keep your body straight' program was implemented [11].



The methodology used for the study used multiplane symmetries and asymmetries of the habitual spinal-pelvic posture. In order to analyze the values of selected parameters a device for computer posture assessment with mora projection was applied. The study methods and technique were in line with the established principles [12]. The results obtained in the form of spatial and graphic images ensured a numerical description of the features investigated. 20 selected features concerning body posture in frontal and transverse planes were subjected to statistical analysis, Table 1.

Table 1. *The list of measured postural features in frontal and transverse planes*

1	KNT -	degrees	Torso lateral deflection angle	The left-sided deflection of the line C7-S1 from the vertical.
2	KNT	degrees		The right-sided deflection of the line C7-S1 from the vertical
3	KLB	Mm	Shoulders line angle	
4	LBW -	Mm	Right shoulder higher	Distance measured vertically between the horizontal lines crossing points B2 and B4
5	LBW	mm	Left shoulder higher	
6	LŁW	mm	Left shoulder blade higher	Distance measured vertically between the horizontal lines crossing points Ł1 1 Łp
7	LŁW -	mm	Right shoulder blade higher	
8	LŁB	mm	Lower angle of left shoulder blade more distant	Difference in the distance between the lower angles of shoulder blades and the spinous process measured horizontally on the straight lines passing through points Ł1 and Łp
9	PŁB	mm	Lower angle of right shoulder blade more distant	
10	LTTw	mm	Left waist triangle higher	Difference in the distance measured vertically between points T1 - T2 and T3 -T4. PLTT = LTT – PTT
11	PTT w	mm	Right waist triangle higher	
12	LTT s	mm	Left waist triangle broader	Difference in the distance measured horizontally between the straight lines passing through points T1 - T2 and T3 - T4
13	PTT s	mm	Right waist triangle broader	
14	KNM	degrees	Pelvic inclination, right iliac ala higher	The angle between the vertical line and the straight line passing through points M1 and Mp
15	KNM -	degrees	Pelvic inclination, left iliac ala higher	
16	UK (dex)	mm	Maximum deviation of spinous process to the right	Maximum deviation of spinous process from the vertical going from S1. The distance is measured in the horizontal axis.
17	UK- (sin)	mm	Maximum deviation of spinous process to the left	
18	NK		Number of vertebra with maximum left or right sided deviation	Number of vertebra with maximum left or right sided deviation in the asymmetric line of spinous process, counting the first neck vertebra (C_1) as 1.
Transverse Plane				
19	KSM	degrees	Pelvic rotation to the right	Angle between the line passing through point M1 and being perpendicular to the axis of the camera and the straight passing through Ml and MP at the same time
20	KSM -	degrees	Pelvic rotation to the left	Angle between the line passing through point Mp and being perpendicular to the axis of the camera and the straight passing through Ml and MP at the same time

Source: own study

RESULTS

The results of measurements from all six half-year long editions under the 3-year research program were subjected to statistical analysis. Empirical data were quantitative features. They were presented in the description as the arithmetical mean and standard deviation. The set of features revealed a normal distribution, that is why proper parametric tests were used for the purpose of further calculations. Required statistical calculations were performed using the program Statistica StatSoft, Inc. (2005). STATISTICA (data analysis software system), version 6.3 www. statsoft. lic. no. AXAP311B316618AR.

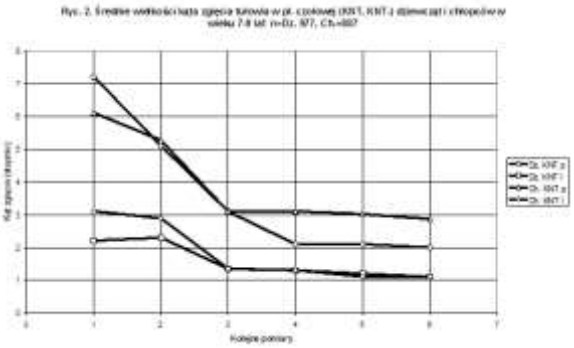
Similar influence was observed in the maxim the size of the maximum inclination of the atlas vertebra to the left, in the spinous process (UK-) and, to a lesser degree, to the right, Figure 7. In addition, physical activity under the correction program positively influenced the value of pelvic rotation in the transverse plane to the left and right, Figure 3. The values of other features including shoulders line angle, the asymmetry of waist triangle height and width, the asymmetry of shoulders, shoulder blades and pelvis did not reveal any significant differences in the process, Figure 4, 5, 6, 7. It should be assumed that (despite a strictly observed research procedure) the results obtained from measurement of these features were within the limits of individual variability. Besides, the researcher provided some information to parents of the children with pelvic asymmetry in the frontal plane highlighting the possibility of correcting the difference in limb length of every shoe after an orthopedic consultation.

Table 2. *Average values of selected postural features in frontal and transverse planes in the group of girls (n=977)*

Feature	Subsequent measurements and standard deviation											
	1	SD	2	SD	3	SD	4	SD	5	SD	6	SD
KNT p	7.22	3.7	5.11	3.21	3.1	3.41	2.1	3.39	2.1	3.5	2	3.32
KNT l	2.21	2.01	2.3	2.11	1.35	2.04	1.3	2.01	1.2	2.11	1.1	2.11
KNMwp	8.9	3.61	8	3.87	8	3.41	7.9	3.27	7.8	3.51	7.9	3.64
KNMwl	1.5	1.96	1.9	2.01	1.5	2.11	1.6	2.05	1.8	1.36	1.6	1.97
KSMwl	13.32	4.91	13.23	5.01	12.34	13.54	11.3	12.96	11.21	4.71	10.19	4.94
KSMwp	2.32	1.89	2.3	1.76	2.29	2.14	2.13	2.11	2.11	1.79	2.1	1.76
KLB	4.5	3.21	4.5	3.11	4.1	3.19	4.2	3.15	4.2	3.61	4.3	3.23
LBW	18.45	5.21	18.78	5.11	18.47	5.08	18.67	5.06	18.56	5.31	18.12	5.24
PBW	10.45	3.72	10.78	3.64	10.45	3.52	11.67	3.51	11.56	3.62	10.87	3.75
LŁW	14.05	4.76	14275	4.65	13.67	4.35	13.51	4.34	13.52	4.46	13.49	4.78
PŁW	3.87	3.21	3.97	3.11	3.87	3.04	3.94	3.03	4	3.31	3.98	3.23
LŁB	16.8	5.41	15.89	5.21	15.67	5.11	15.59	5.09	16	5.81	15.98	5.45
PŁB	8.5	3.65	8.68	3.55	8.73	3.57	8.68	3.68	8.58	3.25	8.46	3.66
LTTw	24.23	7.61	24.12	6.98	23.98	6.73	24.02	6.78	23.87	7.51	23.82	7.62
PTTw	47.37	11.34	46.34	10.76	47.12	10.57	47.32	10.71	47.12	11.24	47.02	11.14
LTTs	21.34	9.76	21.25	9.71	21.3	9.57	21.24	10.02	21.25	9.66	21.14	9.12
PTTs	45.7	8.76	45.56	8.12	45.46	8.17	44.98	9.21	45.12	8.26	45	8.16
UK wl	15.4	7.65	15.32	7.55	14.89	7.51	13.87	7.51	12.21	7.35	11.21	7.35
UK wp	6.36	3.21	6.35	3.04	6.29	3.01	6.3	3.11	6.29	3.41	6.28	3.41
NK	8	6.54	8	5.89	8	5.76	8	5.68	8	6.44	8	6.24

Source: own study

The results revealed that physical activity in the 'Keep your body straight' program had similar impact on male and female children. A positive correction was noticed in: torso left-sided deflection angle (KNT-) and, to a lesser extent, torso right-sided deflection angle (KNT-), Figure 2.



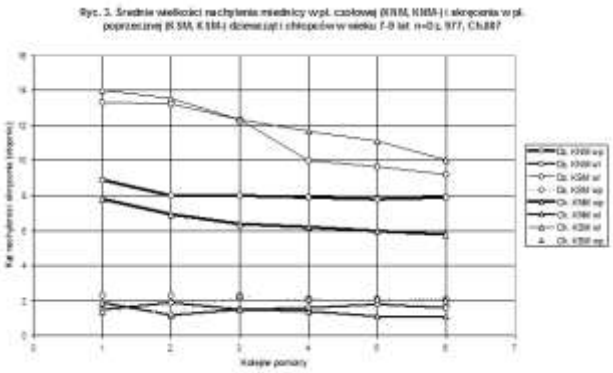
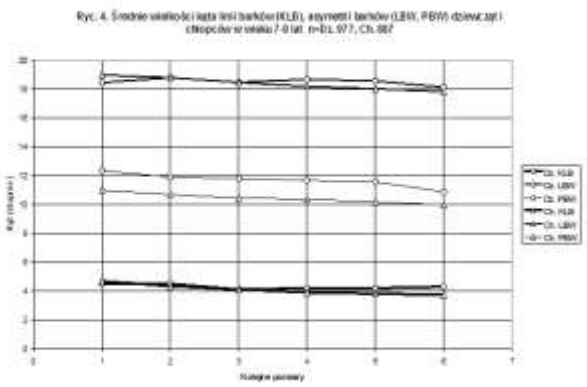
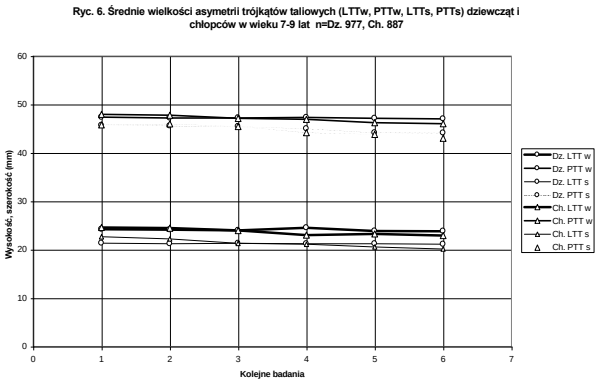


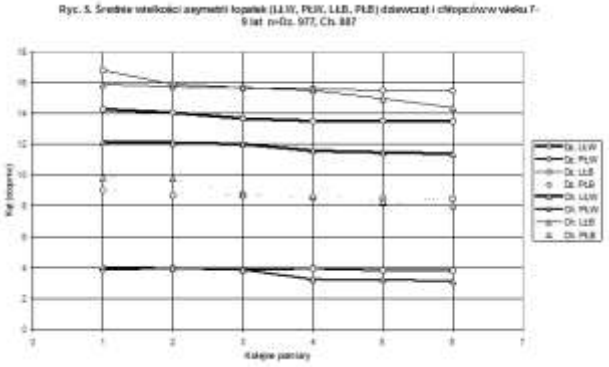
Table 3. *Average values of selected postural features in frontal and transverse planes in the group of boys (n=887)*

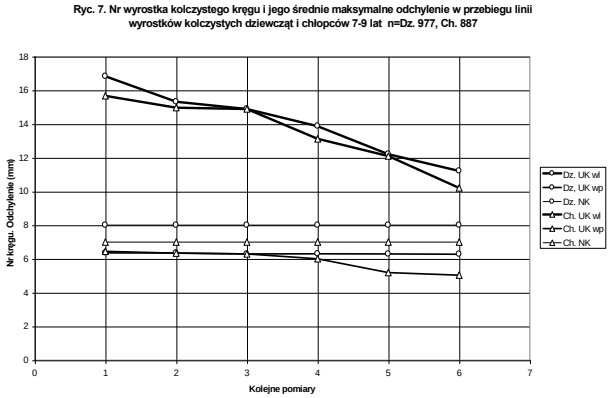
Feature	Subsequent measurements and standard deviation											
	1	SD	2	SD	3	SD	4	SD	5	SD	6	SD
KNT p	6.12	3.6	5.28	3.41	3.1	3.21	3.11	3.49	3.02	3.51	2..87	3.32
KNT l	3.11	2.11	2.89	2.11	1.35	2.64	1.31	2.41	1.11	2.13	1.11	2.41
KNMwp	7.81	3.51	6.94	3.67	6.39	3.31	6.21	3.57	5.98	3.55	5.79	3.54
KNMwl	1.9	1.86	1.18	2.51	1.5	2.21	1.4	2.65	1.11	1.37	1.1	1.77
KSMwl	11.32	4.61	10.02	5.71	12.34	13.84	12.13	12.86	11.11	4.72	10.04	4.84
KSMwp	1.42	1.39	1.31	1.86	2.29	2.15	2.1	2.14	2.12	1.54	2.01	1.66
KLB	3.5	3.21	3.11	3.41	4.1	3.25	3.91	3.12	3.82	3.64	3.73	3.63
LBW	15.21	5.51	14.98	5.21	18.47	5.14	18.17	5.32	18.02	5.38	17.82	5.44
PBW	8.36	3.82	8.28	3.84	10.45	3.43	10.37	3.54	10.16	3.69	9.97	3.65
LŁW	12.13	5.56	12.15	4.25	13.67	4.36	13.11	4.38	13.12	4.49	12.92	4.48
PŁW	2.12	4.31	2.97	3.31	3.87	3.51	3.24	3.41	3.21	3.34	3.8	3.73
LŁB	13.51	4.51	13.19	5.81	15.67	5.28	15.49	5.48	14.96	5.88	14.38	5.95
PŁB	6.95	4.15	6.68	3.95	8.73	3.49	8.68	3.66	8.28	3.28	8.01	3.36
LTTw	22.11	6.51	22.12	6.68	23.98	6.21	23.02	6.73	23.27	7.57	22.94	7.52
PTTw	4129	10.84	41.34	9.23	47.12	10.1	46.92	10.21	46.22	11.52	46.02	11.44
LTTs	19.28	9.78	19.15	8.72	21.3	9.39	21.14	10.12	20.55	9.43	20.14	9.28
PTTs	41.28	9.16	40.16	7.92	45.46	8.48	44.18	9.26	43.82	8.29	43.03	8.36
UK wl	13.42	6.55	13.12	7.65	14.89	7.32	13.12	7.41	12.1	7.37	10.21	7.43
UK wp	6.16	4.11	6.11	3.14	6.29	3.28	6.01	3.81	5.19	3.48	5.04	3.27
NK	7	6.14	7	5.29	7	5.77	7	5.38	7	6.49	7	6.23

Source: own study









DISCOURSE

Weber [13, 14] believes that physical activity focused on postural correction cannot impact on structural changes or bone growth. The central European model appears to be more logical as opposed to the American system in terms of using corrective exercises at schools. However, the whole point of these exercises is that they should be effective. It has been found that the time preceding the first menstrual period in girls and mutation in boys is a critical moment in preventive therapy [15, 16, 17]. Hence, corrective exercises to straighten posture, performed during that period, reduce a thoracic kyphosis, increase a lumbar lordosis and, in consequence, lead to increased rotation and subsequent progression of postural curvature with scoliotic changes. Malawski [18] and Karski [19] emphasize that improper exercises are used in order to strengthen long dorsal muscles running along the scoliosis chord and causing an auxotonic pressure on the curvature which can strengthen hypertonic tension of soft tissue affected by scoliosis. Torell [20] reported that early therapy using focused exercises preceded by early diagnosis leads to reduced occurrence of scoliosis above 40 degrees by 63%.

CONCLUSIONS

1. Corrective activities of the ‘Keep your body straight’ program combined with education of parents are moderately effective means in the correction process of wrong postures in frontal and transverse planes in children of both sexes aged 7-9 years.
2. Physical activity applied within the program significantly influenced the vertical orientation of torso and maximum deviation of the spinous process of vertebrae in the frontal plane and the size of pelvic rotation in the transverse plane.
3. The effectiveness of the program can be enhanced by an individual approach to every ‘advanced defective’ posture in a child, which could not be achieved under the program due to insufficient funds of the school.

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