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MISCELLANEOUS

The influence of rural environment on body posture

Justyna Drzał-Grabiec[1], Sławomir Snela[1,2]

[1] *Institute of Physiotherapy, University of Rzeszów, Poland*
[2] *Department of Paediatric Orthopaedics and Traumatology, Regional Hospital No 2, Rzeszów, Poland*

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Abstract

Looking for reasons for the diversification between the populations of rural and urban children has become very popular in Polish literature. The aim of the presented study is to compare body posture and, at the same time, susceptibility to bad postures in children living in rural and urban environments. The research was conducted in selected primary schools in the Podkarpackie region in southeastern Poland. The respondents consisted of 293 first grade pupils of attending primary schools, randomly chosen, whose parents gave written consent for the participation of their children in the study. 98 children came from a rural area, mainly from families maintained by farming, and 195 children living in a town. Each tested child was set 56 parameters describing body posture, using the photogrammetric method based on the projection moire effect. 20 parameters used for the analysis, among which there were statistical significant differences in the case of UL parameter that sets the lower angles of the scapulas, where p=0.029423, and the parameters describing the pelvis setting is KNM, where p=0.012519, and KSM, p=0.001710.

Key words

body posture, photogrammetric method, rural, urban

INTRODUCTION

The progress in diagnosing and treating bad posture and new ways of therapy have not contributed to reducing their appearance. Many authors consider that the lack of exercise, sedentary lifestyle, environment, and stress create favourable conditions for new and worsening deformations of existing trunk [1, 2, 3], which is why there are many of publications aimed at introducing the subject, and facilitating the prevention and treatment of bad postures.

Looking for the reasons for the diversification between the populations of rural and urban children has become very popular in Polish literature [4, 5, 6]. Many publications have been dedicated to comparison of physical development, motor skills, or differences in the amounts of weight-growth indicators, whereas there are fewer publications on body posture and bad postures, or even on the influence of the rural environment on developing body posture.

The aim of the presented study is to compare body posture and, at the same time, susceptibility to bad postures in children living in rural and urban environments.

MATERIAL AND METHOD

The research was conducted in selected primary schools in the Podkarpackie region of in southeastern Poland. Written consent for the study was obtained from the Bioethics Commission at the Medical Department of Rzeszów University (No. 3/09/2009) and subsequently carried out between March – November 2009.

Address for correspondence: Justyna Drzał-Grabiec, Jana Pawła II 21/68, 36-100 Kolbuszowa, Poland
E-mail: justyna.drzal.grabiec@wp.pl

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The study involved a total of 293 first grade pupils in primary schools, randomly selected, whose parents gave written consent for their children to participate in the study. 98 of the children came from a rural area, from families whose source of maintenance was farming, and 195 children lived in a town. The designated group were 7-year-olds whose calendar age at the time of the study was between 6.501-7.500 years. In order to maintain the reliability of the study procedures, all tests were carried out in the morning or late morning hours, using the same test equipment operated exclusively by one researcher.

In accordance with the assumptions and the aim of the study, the criterion accepted was that all the respondents came only from the selected age group; those who did not come within the range of 7-9 years, lacked parental agreement for participation in the study, pathology of the motor organs in the interview, were excluded from the study, which was subject to final statistical analysis. Each tested child was set 56 parameters describing body posture using the photogrammetric method based on the projection moire effect. 20 parameters were used for the analysis.

Photogrammetric Method. Photogrammetry is a field technical science dealing in with obtaining information about the shape of an object, its location in relation to other objects in space, or alternatively, their movement or deformation [7, 8].

The Moire method consists in using the bending of a light beam between a screen with a net and its shadow which is projected onto the tested person standing behind the screen. Interference with the light waves interference occurred after they passed through the raster. As a result, there is a picture within the contour layout, with the so-called moire pattern (Fig. 1). The appearance of the topographical lines depends on the shape of the illuminated surface, usually the back, and the distance of the patient from the screen. By knowing the

Table 1. The characteristic of parameters used in that paper

No.	Symbol	Metric units	Name and Description
1	**Alfa α**	degrees	Inclination angle of the lumbosacral spine .
2	**Beta β**	degrees	Inclination angle of the thoraco-lumbar section of the spine.
3	**Gamma γ**	degrees	Inclination angle of the superior thoracic section of the spine.
4	**Delta**	degrees	Total curvature amount: DELTA=ALFA+BETA+GAMMA.
5	**KKP**	degrees	Thoracic kyphosis angle: KKP = 180 – (β+γ).
6	**KLL**	degrees	Lumbar lordosis angle: KLL = 180 – (α+β).
7	**DCK**	degrees	**Spine height -** the result is the distance between the points C7 and S1,which is calculated only in the vertical axis. The percentage parameter is calculated as stated above.
8	**DKP**	mm	**Length C7-KP.** The position of the kyphosis peak counted from C7.
9	**GKP**	degrees	**Depth KP-PL.**
10	**RKP**	mm	**Length C7-PL -** The kyphosis length counted between C7 and PL.
11	**DLL**	mm	**Length S1-LL -** Position of the lordosis peak counted from S1.
12	**RLL**	mm	**Length S1-PL -** the height of lordosis counted between S1 and the crossing point.
13	**GLL**	degrees	**Depth LL-PL.**
14	**KLB**	degrees	The inclination angle of the shoulder line - all data counted analogically as to the inclination of the pelvis line (parameter [15]).
15	**KSM**	degrees	Pelvis twist angle- the angle between the line going through the point ML and perpendicular to the camera axis and the straight line going through ML and MP. Pelvis twisted right , when the result is posistive „+", left, when the result is negative „-".
16	**UB**	mm	Setting up shoulders (UB) – the height difference of setting up shoulders.
17	**UL**	mm	Setting up lower scapula angles- difference in height of placing lower scapula angles.
18	**OL**	mm	Difference of lower scapula angles from the spine line- difference in the distance of lower scapula angles from the spine.
19	**UK**	mm	Ulnar styloid deviation - the biggest deviation of the ulnar styloid from the line connecting points C7 and S1. The distance is measured in the vertical axis, when a point is placed to the left from the line C7-S1 so the result is negative „-", when to the right the result is positive „+".
20	**KNM**	degrees	The pelvis inclination angle - the angle between the horizontal line and the straight line going through the points M1 and Mp. Right hip disc higher „+", left hip disc higher „-".

distance between the light source and raster, and the distance between this source and a camera and the thickness of the net, one can calculate the height of each layer and, in practice, for example, the height of the rib hump of the patient with scoliosis and the spatial arrangement of the chosen body points on different contours. The Moire method provides a 3-dimensional picture of the back or feet that allows the calculation and analysis of 93 parameters describing body posture. Moreover, the test is non-invasive and gives quick and precise evaluation of posture in 3 layers, and using computer technology allows the retention and analysis of a great deal of data. This method is applied in many countries for the evaluation of treatment results and progression of scoliosis in children [9,10, 11, 12]. However, the method does not replace the X-ray, but is very good for screening tests.

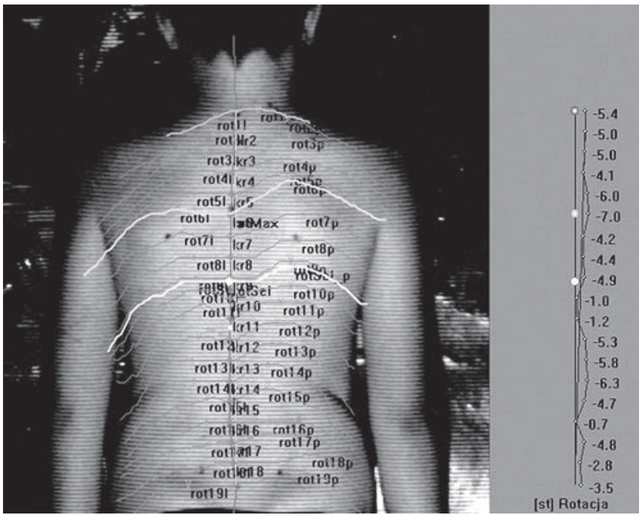

Figure 1. The back of the tested person with the contour map (own source)

Statistical methods. The non-parametric test was used for the unrelated variables – U Mann Whitney test to check the relation between the groups of children living in the rural and urban environments. This tests was used due to the distribution of variables results in each group – in the majority of cases, diverging from the normal distribution and unequal number of groups. The $p<0.05$ was adopted as the significance level.

RESULTS

The results represent the basic statistics for all tested parameters with division into urban and rural environments (Tab. 2, 3). There were differences presented in separate parameters between the tested groups; their significant statistics were also calculated (Tab. 4). Among the 20 parameters describing body posture, there were statistically significant differences in the case of the UL parameter that set the lower angles of the scapulas, where $p=0.029423$, and the parameters describing the pelvis setting KNM, where $p=0.012519$, and KSM, $p=0.001710$. Parameters that differ significantly statistically are presented in graphs (Figs. 2-4).

DISCUSSION

The issue of urban diversification of the young generation in Poland is still present. The influence of the level of urbanization on the place of residence place, and on the biological features of a human, is of an indirect nature.

Table 2. Basic statistics for the rural group

variable	Country side					
	N	$\bar{x} \pm s$	Median	maximum	maximum	V
DCK	98	301.51±22.55	304.95	249.80	353.50	7.48
KKP	98	159.35±4.62	158.55	149.80	170.50	2.91
KLL	98	160.45±5.66	161.00	145.80	175.80	3.53
GAMMA	98	11.14±3.78	10.95	2.20	20.10	33.95
BETA	98	9.5±3.76	9.50	-0.90	18.7	39.60
ALFA	98	10±4.44	9.60	-0.70	20.70	44.31
DELTA	98	30.65±6.39	30.05	14.70	45.10	20.83
DKP	98	251.37±24.11	252.00	198.50	331.20	9.59
GKP	98	11.81±4.62	12.20	-2.90	21.10	39.14
RKP	98	183.98±20.52	185.65	133.80	238.60	11.16
DLL	98	203.27±20.67	201.25	160.60	248.60	10.17
GLL	98	7.4±4.36	6.65	-0.40	22.60	59.01
RLL	98	117.52±17.04	113.70	73.60	170.60	14.50
UK	98	5.12±2.00	6.25	-21.10	36.00	219.82
KLB	98	0.06±2.00	-0.30	-5.30	6.20	3272.86
UB	98	0.02±7.46	-1.10	-20.10	21.20	28134.36
UL	98	1.2776±6.73	1.65	-19.00	20.10	526.89
OL	98	5.84±9.35	6.70	-15.10	26.50	160.11
KNM	98	0.47±1.71	0.00	-3.30	5.10	361.62
KSM	98	0.19±10.01	1.05	-55.00	55.50	5195.17

Table 3. Basic statistics for municipal group

variable	town					
	N	$\bar{x} \pm s$	Median	Minimum	Maximum	V
DCK	195	299.82±22.63	298.80	247.50	374.60	7.55
KKP	195	159.06±159.20	159.20	141.40	172.40	3.16
KLL	195	160.33±5.32	160.40	144.30	172.60	3.32
GAMMA	195	11.96±3.92	11.60	2.30	22.30	32.81
BETA	195	8.97±4.07	9.00	0.00	25.10	45.42
ALFA	195	10.69±4.82	10.60	-3.10	23.60	45.13
DELTA	195	31.63±31.63	31.60	14.90	50.20	19.62
DKP	195	251.06±24.27	252.00	187.30	323.40	9.67
GKP	195	11.34±5.24	11.50	-2.10	33.90	46.24
RKP	195	185.10±21.67	186.20	123.80	247.50	11.71
DLL	195	201.14±18.44	198.50	165.00	274.30	9.17
GLL	195	6.74±4.29	6.50	-16.10	19.00	63.64
RLL	195	114.71±14.72	113.70	87.00	168.40	12.84
UK	195	3.80±12.75	4.80	-29.30	46.50	335.52
KLB	195	-0.21±2.03	0.00	-7.80	5.30	-946.13
UB	195	0.82±7.57	0.00	-27.90	19.00	-913.05
UL	195	-0.42±6.70	0.00	-23.40	22.30	-1565.86
OL	195	4.52±13.36	4.10	-25.10	123.80	295.21
KNM	195	-1.21±11.70	0.00	-119.40	7.10	-961.15
KSM	195	-4.00±19.74	-0.70	-169.10	35.50	-493.21

Table 4. The results of the comparative analysis of individual variables

variable	Test Mann-Whitney U								
	Sum. Rang. country	Sum. Rang. town	U	Z	p	Z II	P II	N country	N town
DCK	14993.50	28077.50	8967.50	0.85	0.39	0.85	0.39	98	195
KKP	14293.50	28777.50	9442.50	-0.16	0.86	-0.16	0.86	98	195
KLL	14375.00	28696.00	9524.00	-0.04	0.96	-0.04	0.96	98	195
GAMMA	13235.50	29835.50	8384.50	-1.70	0.08	-1.71	0.08	98	195
BETA	15282.50	27788.50	8678.50	1.28	0.20	1.28	0.20	98	195
ALFA	13644.00	29427.00	8793.00	-1.11	0.26	-1.11	0.26	98	195
DELTA	13739.00	29332.00	8888.00	-0.97	0.33	-0.97	0.33	98	195
DKP	14431.00	28640.00	9530.00	0.03	0.97	0.03	0.97	98	195
GKP	15070.00	28001.00	8891.00	0.96	0.33	0.96	0.33	98	195
RKP	14038.50	29032.50	9187.50	-0.53	0.59	-0.53	0.59	98	195
DLL	14962.50	28108.50	8998.50	0.81	0.41	0.81	0.41	98	195
GLL	15072.00	27999.00	8889.00	0.97	0.33	0.97	0.33	98	195
RLL	15263.50	27807.50	8697.50	1.25	0.21	1.25	0.21	98	195
UK	14823.50	28247.50	9137.50	0.60	0.54	0.60	0.54	98	195
KLB	14810.50	28260.50	9150.50	0.59	0.55	0.59	0.55	98	195
UB	14738.00	28333.00	9223.00	0.48	0.62	0.48	0.62	98	195
UL	15893.50	27177.50	8067.50	**2.17**	**0.02**	**2.17**	**0.02**	98	195
OL	15729.00	27342.00	8232.00	1.93	0.05	1.93	0.05	98	195
KNM	16099.50	26971.50	7861.50	**2.47**	**0.01**	**2.49**	**0.01**	98	195
KSM	16552.50	26518.50	7408.50	**3.13**	**0.00**	**3.13**	**0.00**	98	195

Factors such as nourishment status, physical workload, level of medical care, level of hygiene, bad quality shoes and footwear, less accessibility to screening tests, and insufficient knowledge of parents and their level of education can influence the shaping of posture in children.

Rural and urban children live diversified family models. The urban family more often has one or two children, rural families tend to have 3, while urban families have a higher income *per capita* [13]. The urban and individual groups of the rural population are still very far apart, especially in

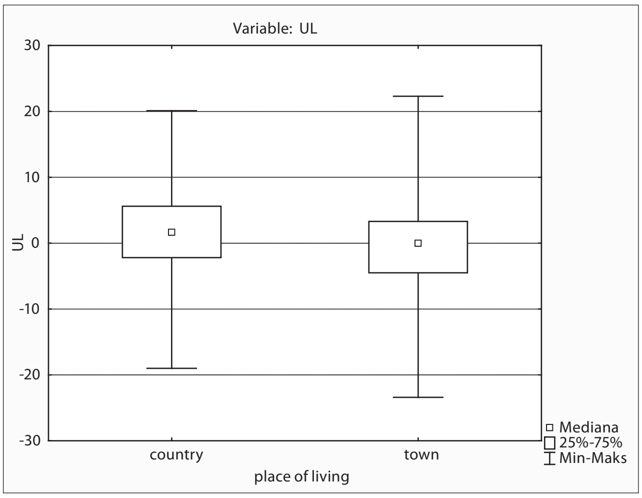

Figure 2. UL parameter. The country has higher results on average.

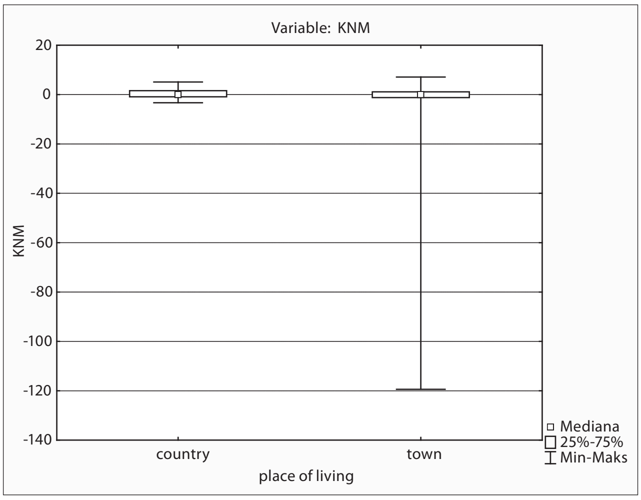

Figure 3. KNM parameter. The country has higher results on average

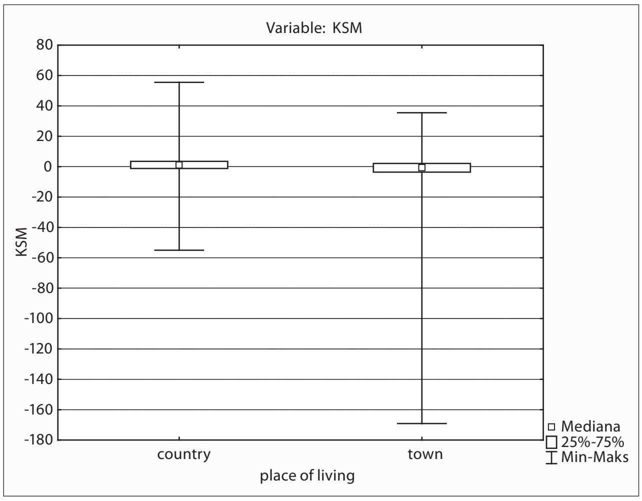

Figure 4. KSM parameter. The country has higher results on average

educational, cultural circles and personal hygiene. In rural households with a lower standard of living there are essential expenses, mainly for food and clothes, and they spend less from the family budget on services, health care, cleaning agents, education, leisure activities, transport and living [14].

The presented study shows that the body posture of rural and urban children is significantly different in the case of the UL parameter describing asymmetry of the scapulas. In the case of the urban children this is -0.4282, which means that, on average, the left scapula is set about 0.4 mm higher than the right, whereas in the group or rural children the UL parameter was about 1.3 mm, which is in favour of the urban children. This is because the described parameter defines the asymmetry, and many authors have unanimously stated that the asymmetries within the trunk are one of the earliest symptoms of scoliosis, that often outdistances the changes in the shaping of the spine [11, 15].

There were also statistically significant differences in the parameters describing the pelvis, that is the KNM (urban -1.2174; rural -0.4735) and KSM (urban -4.0026; rural -0.1929), which is in favour of the rural children. The reasons for such a distribution of the results can be found in the greater number of movements performed by children from the rural environment, compared with the urban children remaining longer in a static position, which can contribute to the asymmetric setting of the pelvis or its distorted setting. Other parameters do not show statistically significant differences.

Apart from the presented study, to date, there have been no comparable studies on particular parameters describing body postures. Few publications treat on a worldwide scale bad postures, and which include the place of residence, nor do they analyse particular elements. Moreover, these publications rarely compare the posture of rural and urban children; they mainly describe only the posture of one of these groups. Kluszczyński [16] has estimated bad postures in rural children at 1-14%, depending on gender and age, which is small percentage. Śliwa and others, in comparing the posture of children from 2 environments, state that defects and posture errors or bad posture are present more often in urban children, and concern asymmetries of both shoulders, hips, scapulas, and spinal defects, both in the sagittal and coronal planes. Rural children came out weaker only in the test of chest deformities as a result of rickets [17].

Moreover, the authors point out that in the health problems diagnosed there is a very big relationship between gender, age, and living environment of children. Urban children more often have sight defects, body statics disorders, bad postures and abnormalities in somatic development. Medical examinations show that changes in the motor system concern urban children aged between 6–4-years-old, and in 18-year-old rural young people [18].

The subject of bad posture in children and young people is still present and often raised in publications, yet few tests have concentrated on the population of rural children, and the screening tests that are often organized are rarely carried out done in the rural areas. Even if they are conducted in these areas, due to the costs, not many parents decide on them because of lack of knowledge of parents concerning the consequences in mature life which can resultg from untreated bad postures.

REFERENCES

1. Bjornson Kristie F. Physical activity monitoring in children and youths. Pediatr Phys Ther. 2008; 20: 347-355.
2. McMillan A, Auman N, Collier D, et al. Frontal plane lower extremity biomechanics during walking in boys who are overweight versus healthy weight. Pediatr Phys Ther. 2009; 21:194-200.

3. Penha PJ, Joao SM, Casarotto RA, et al. Postural assessment of girls between 7 and 10 years of age. Clinisc (Sao Paulo) 2005; 60: 9-16.
4. Huk-Wieliczuk E, Wdowiak L. State of health of adolescents in eastern regions of Poland Podlasie Region child. Ann Agric Environ Med. 2006; 13: 39-43.
5. Pauline M, Selvam S, Swaminathan S, Vaz M. Body weight perception is associated with socio-economic status and current body weight in selected urban and rural South Indian school-going children. Public Health Nutr. 2012; 10:1-9.
6. Machado-Rodrigues AM, Coelho-E-Silva MJ, Mota J, Padez C, Ronque E, Cumming SP, Malina RM. Cardiorespiratory fitness, weight status and objectively measured sedentary behaviour and physical activity in rural and urban Portuguese adolescents. J Child Health Care. 2012; 22: 130-136.
7. Porto F, Gurgel JL, Russomano T, Farinatti Pde T. Moiré topography: characteristics and clinical application. Gait Posture. 2010; 32(3): 422-424.
8. Aroeira RM, Leal JS, de Melo Pertence AE. New method of scoliosis assessment: preliminary results using computerized photogrammetry. Spine 2011; 1;36(19): 1584-1591.
9. Zubari JA. Applications of computer-aided rastereography in spinal deformity detection. Image Vision Comput. 2002; 20: 319-324.
10. Iunes D, Cecílio M, Dozza M, Almeida P. Quantitative photogrammetric analysis of the Klapp method for treating idiopathic scoliosis. Revista Brasileira de Fisioterapia 2010; 14(2):133-140.
11. Minguez M, Buendia M, Cibrian R, Salvador R, Laguia M, Martin A, Gomar F. Quantifier variables of the back surface deformity obtained with a noninvastive structured light method: evaluation of their usefulness in idiopathic scoliosis diagnosis. Eur Spine J. 2007; 16: 73-82.
12. Pazos V, Cheriet F, Song L, Labelle H, Dansereau J. Accuracy assessment of human trunk surface 3D reconstructions from an optical digitizing system. Med Biol Engon Comp. 2005; 43: 11-15.
13. Nowacka-Dobosz S. Urbanisation-induced changes in the somatic and motor development of schoolchildren. Phys Educ Sport. 2006; 50(1): 45-51.
14. Półtorak W. Biological development of urban and rural adolescents. Phys Educ Sport. 2005; 49:47-51.
15. Nissinen M. Trunk asymmetry and scoliosis. Anthropometric measurements in prepuberal school children. Acta Pediatr Scand. 1993; 78(5): 747-753.
16. Kluszczyński M. Częstość występowania wad postawy i asymetrii grzbietu w populacji dzieci wiejskich. Fizjoterapia Pol. 2007; 7: 71-79.
17. Śliwa W, Bugajski A, Czamara A. Analiza postawy ciała dzieci ze środowiska miejskiego i wiejskiego. Med Sport. 2005; 43: 13-15.
18. Górniak K. Rozwój biologiczny dzieci wiejskich z wadami postawy Studia i Monografie nr 106. Akademia Wychowania Fizycznego Józefa Piłsudskiego. Warszawa, 2006.