

THE SOMATIC AND MOTOR DEVELOPMENT OF BOYS AND GIRLS FROM BELORUSSIA AND UKRAINE AGED 7-16*

by

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Proper values of somatic and motor fitness development indicators are good measurements of health for children and youth during the school age. This phenomenon has been extensively studied in Poland (Przewęda 1994, 1998; Hulanicka et al. 1990; Szopa et al. 1985; Szopa and Arlet 1989; Mleczko 1991; Charzewski, Przewęda 1988; Szopa and Sakowicz 1987). Also well documented is the data related to the environmental influence on biological development. Results of such research project increase insignificance over the last two decades in relation to Central and Eastern European countries which are undergoing political and economical transformation.

The political changes in countries of former Soviet Union have allowed for more frequent scientific contacts, common research projects and publications. In 1995 a research project in Lvov (Ukraine) was undertaken by the staff of the Department of the Physical Education in Częstochowa. In 1998 similar research was conducted in Polish school in Grodno (Belorussia). Also evaluated was the biological state of development of children with Polish origin from country regions on Belorussia (Rodziewicz – Gruhn and Tegako 1999). The research performed in Ukraine and Belorussia indicated the significant influence of social stratification on the growth processes of children from different social groups. There was great differentiation in the level of development of pupils from Polish, Ukrainian and Belorussian schools. Significant differences were also registered in the development of school children between Belorussian Polish minorities and the children of the same age from Poland. While interpreting the results of the research projects especially those related to children and youth from Belorussia, significant attention was paid to the ecological disaster of Chernobyl and its health side effect (Rodziewicz – Gruhn and Tegako 1999).

The main goal of this paper is the comparison of somatic and motor fitness development of urban children and youth from Ukraine, Belorussia and Poland.

Key words: somatic development, motor fitness, children and youth

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Material and methods

The research project included boys and girls between the age of 7-16. All research was conducted in elementary and high schools in Lvov, Ivano-Frankovsk in Ukraine, Minsk and villages surrounding it, in Brest and Grodno on Belorussia. Antropometrical measurements were taken between the years of 1995-1999.

Table 1. The number of female and male subjects from Ukraine and Belorussia

Age	Belarus		Ukraine		Total
	Girls	Boys	Girls	Boys	
7	61	32	35	28	156
8	99	89	51	85	324
9	136	81	69	80	366
10	115	125	120	118	478
11	164	157	158	167	646
12	181	186	187	181	735
13	208	141	183	156	688
14	154	151	129	132	566
15	131	101	101	117	450
16	99	86	91	74	350
17	64	44	42	46	195
Total	1411	1193	1166	1184	4954

In this work the following variables were considered: body height, body mass, Quetelet index and BMI. Mean values and standard deviations were calculated for all data while statistical differences between groups were evaluated by the t-Student test for unpaired variables. The average results of the analyzed somatic variables were normalized in relation to children of the same age from large Polish cities (Hulanicka et al. 1990).

The level of physical fitness was evaluated through motor field tests chosen from the /Denisiuk test battery. Such a test was chosen because of the conditions in which research was performed. Only in the Polish and Ukrainian schools the measurements were performed by the physical education staff of WSP in Częstochowa while in the other areas evaluations were conducted by specially instructed physical education teachers. The following areas of physical fitness were evaluated:

- strength – overhead medicine ball throw (2 kg),
- power – vertical jump,
- speed – 60 m sprint,
- agility – envelope run.

Because of the lack of current national physical fitness data evaluated by the Denisiuk test as a control group children and youth from the Silesian region were chosen (Karkosz 1996).

Results and discussion

Table 2 presents the mean values of body height, for the researched girls and boys from Belorussia and Ukraine. The analysis of data indicate higher values of body height in females from Belorussia aged: 7,8,11,12,17 yet the only statistically significant differences occurred in the group of 12 and 16 year old girls. In Belorussian females the greatest annual height increments. Occurred between the age of 11 and 12 while adolescent growth spurt for Ukrainian girls occurred between the age of 12 and 13. Body height values of Belorussian and Ukrainian females were compared to Polish female school children of the same age in normalized values (fig. 1). During the analyzed time span females from Ukraine had slightly lower values of body height in

Girls

Boys

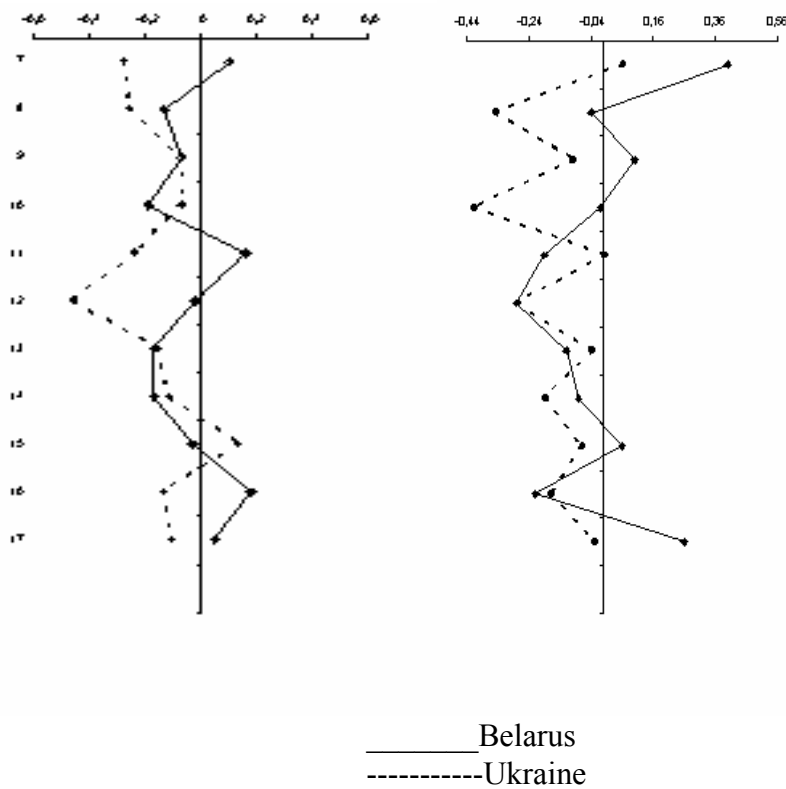


Fig. 1. Normalized intergroup differences for body height in girls and boys from Belarus and Ukraine

comparison to Polish females (Hulanicka et al. 1990), yet only in 12 year old girls, the differences exceeded 0,5 of standard deviation (fig. 1). Belorussian females aged 7, 11,16 and 17 had greater body height in comparison to the population of Polish girls (fig. 1). From the analysis of the average values of body height of the researched males one can conclude that Belorussian boys were slightly taller from the boys of Ukraine. Similarly to the results of females this body height differences were statistically significant only at the age of 11. The growth spurt for the researched boys from Belorussia occurred between the age of 13 and 15 while for those from Ukraine between the age of 14 and 15. In the considered age span males from Ukraine had lower body height in comparison to Polish males of the same age (fig. 1) while the body height

differences between Belorussian boys and Polish counterparts were smaller (at age 7 and 17 Belorussian boys were 2 cm taller than Polish boys).

Table 2. Basic statistical data for body height in boys and girls from Ukraine and Belarus

Age	Belarus				Ukraine				T _b	T _g
	Girls		Boys		Girls		Boys			
	\bar{X}	s	\bar{X}	s	\bar{X}	s	\bar{X}	s		
7	123,79	5,03	125,46	3,94	121,76	5,55	124,23	5,31	1,17	1,60
8	127,69	5,55	129,58	5,90	126,72	6,47	128,04	4,98	1,66	0,88
9	133,48	6,15	135,00	5,96	133,50	6,13	133,83	5,92	1,09	0,00
10	138,46	7,23	140,43	5,48	139,33	6,52	137,67	6,80	2,86	-0,79
11	146,93	7,72	143,98	6,50	144,01	7,10	145,23	6,64	-1,44	3,10
12	152,62	7,41	148,76	7,26	149,04	8,26	148,85	7,01	0,00	3,54
13	156,61	6,60	155,60	8,51	156,61	6,98	156,21	8,94	-0,54	0,00
14	160,80	5,80	164,00	9,27	161,04	6,48	162,87	9,41	0,83	-0,23
15	162,41	5,84	171,49	6,47	163,32	5,53	170,56	8,21	0,84	-1,08
16	164,67	6,46	173,59	7,35	162,71	5,70	173,99	7,18	-0,30	2,06
17	164,14	4,88	176,14	6,78	163,31	5,44	174,22	6,29	1,38	0,69

Table 3. Basic statistical data for body weight in boys and girls from Belarus and Ukraine

Age	Belarus				Ukraine				T _b	T _g
	Girls		Boys		Girls		Boys			
	\bar{X}	s	\bar{X}	s	\bar{X}	s	\bar{X}	s		
7	21,54	3,81	23,31	3,04	23,06	3,82	23,64	3,42	-0,43	-1,65
8	24,10	4,39	24,59	3,80	24,55	4,22	24,99	3,32	-0,64	-0,53
9	26,62	4,82	28,35	4,55	27,50	5,57	28,09	4,88	0,30	-1,02
10	29,67	6,78	31,70	5,39	30,43	5,22	30,28	5,52	1,70	-0,84
11	36,02	7,89	33,55	5,26	34,23	6,80	35,53	7,67	-2,34	1,94
12	41,27	8,50	38,23	7,52	38,81	8,14	38,35	7,41	-0,14	2,28
13	44,96	8,48	43,34	7,91	44,26	7,94	43,62	8,45	-0,27	0,77
14	48,65	8,32	50,11	10,53	49,00	8,73	48,79	9,40	0,94	-0,30
15	52,09	8,99	57,45	11,15	52,08	7,68	56,96	9,88	0,30	0,00
16	54,82	8,12	60,03	9,75	53,88	6,46	61,49	10,74	-0,76	0,81
17	52,13	5,29	63,35	6,64	53,88	7,13	61,07	7,96	1,48	-1,23

In table 3 body mass of Belorussian boys and girls are presented. Up to the age of 10 and age 14 and 16 females from Belorussia possessed smaller body mass. In case of males from Belorussia lower values of body mass were

registered at age 7,8, 11-13 and 16. The comparison of normalized values of Polish girls and boys of the same age indicate that during the whole analyzed age span Belorussian and Ukrainian boys and girls reached lower values of body mass (fig. 2). The differences for females were more pronounced.

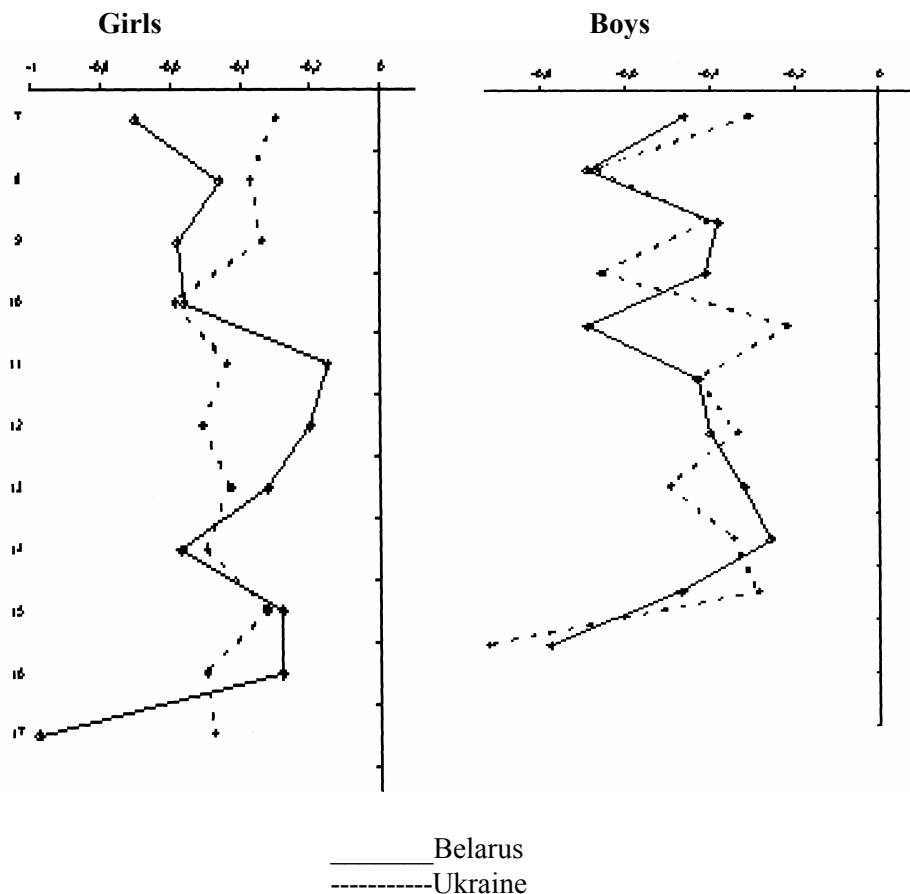


Fig.2. Normalized intergroup differences for body mass in girls and boys from Belarus and Ukraine

Very helpful in determining the relationship between body height and body mass are the weight, height indexes of Quetelet and BMI (Quetelet II). The value of the Quetelet index allows to determine body type, while the BMI index is a good indicator of body fat content. The differences in both analyzed indicator are of similar character. In Belorussian females lower values of the

Quetelet index and BMI occurred between the age of 7 and ten as well as at the age 14 and 16 (tab. 3, 4). On the other hand males from Belorussia had a weaker built body between the age of 7 to 8, 11 to 13 and 17, and a lower body fat content in comparison to Ukrainians of the same age (tab. 3,4). From the conducted intergroup analyses one can conclude that Polish males and females had significantly higher values of the Quetelet index and BMI in comparison to Belorussian and Ukrainian boys and girls (fig. 3,4). The evaluation of physical fitness in relation to social conditions (agglomeration size, parent level of education) is based on interpersonal comparisons in view of actual norms for general population (Przewęda 1998). Currently such a norm is present only for the Silesian population since most Polish scientists resigned from the application of Denisiuk test.

Table 4. Basic statistical data for the Quetelet index for boys and girls from Belarus and Ukraine

Age	Belarus				Ukraine				Tb	Tg
	Girls		Boys		Girls		Boys			
	\bar{x}	s	\bar{x}	s	\bar{x}	s	\bar{x}	s		
7	173,5	26,59	185,6	21,05	188,8	25,32	190,0	23,39	-0,84	-2,43
8	188,1	28,32	189,2	23,21	192,9	25,04	194,8	21,43	-1,43	-0,92
9	198,7	29,60	209,3	27,45	205,5	37,99	209,0	28,31	0,06	-1,22
10	212,9	38,80	225,2	33,31	217,7	30,56	219,3	33,12	1,16	-0,93
11	243,7	43,90	232,4	30,40	236,6	39,07	243,6	44,39	-2,29	1,37
12	269,2	49,55	255,8	41,78	258,8	43,55	256,6	41,48	-0,16	1,72
13	286,1	46,91	277,1	37,97	281,6	43,07	277,6	40,53	-0,10	0,90
14	301,9	46,48	303,9	53,29	303,3	46,31	297,9	45,45	0,86	-0,21
15	320,4	52,51	334,0	56,05	318,5	43,06	332,6	47,07	0,17	0,27
16	332,8	46,25	344,8	47,39	331,1	38,74	352,4	53,85	-0,80	0,24
17	317,5	30,33	359,2	30,23	329,8	40,99	350,7	42,16	1,10	-1,50

In the speed test females from Belorussia reached better results from girls of the same age in Ukraine and Poland (fig. 6). The analysis of results of the speed test in males indicate that best results between the age of 12 and 13 are reached by Ukrainian boys between the age of 14 and 15 in Polish boys while at the age of 16 in Belorussian boys (fig. 5). The results of the agility test were significantly higher in the researched females from Belorussia and Ukraine in

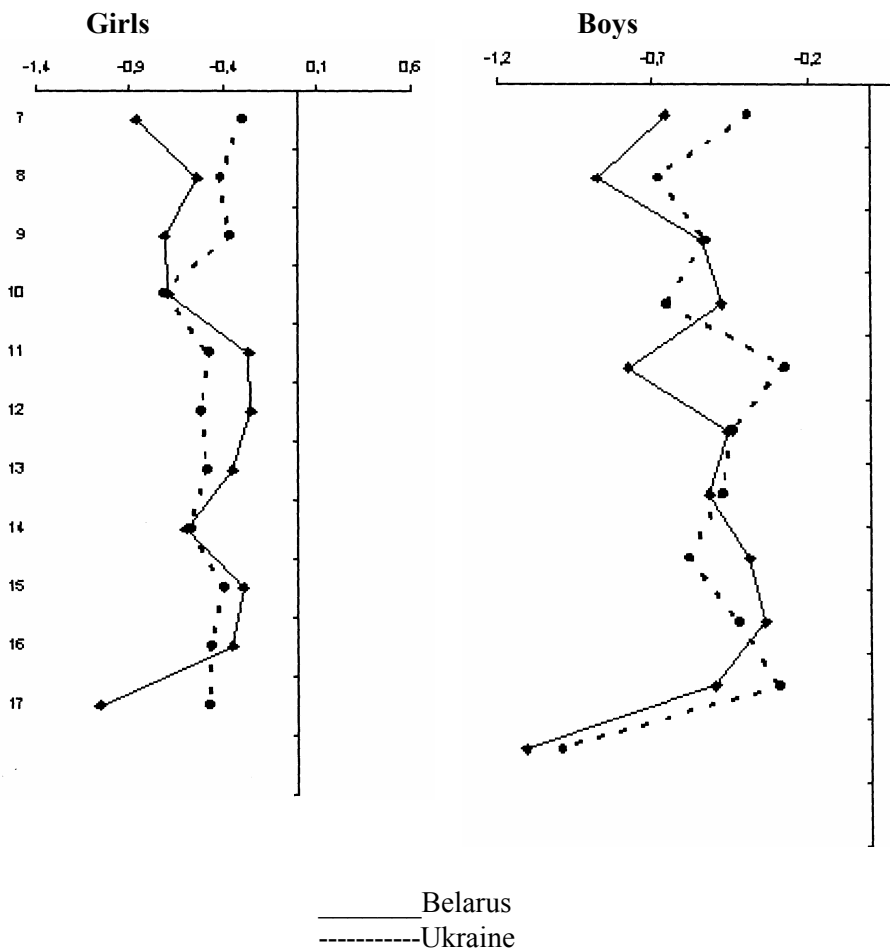


Fig. 3. Normalized intergroup differences for the Quetelet index in girls and boys from Belarus and Ukraine

comparison from girls from Silesian region. In the agility test best results by males were registered in Ukrainian boys secondly in Polish males while the lowest results were obtained by the Belorussian boys (fig. 5). The best results in the strength variable up to the age of 15 were obtained by Polish females and Ukrainian boys aged 8 and 11 to 13. In relation to power no clear tendency in results seems to appear. Females from Ukraine and Belorussia reached significantly better results than Polish ones, while in boys under the age of 14 the results were similar for all groups and in the oldest 15-16 year old boys

Belorussian boys reached significantly higher result of power than the other two populations.

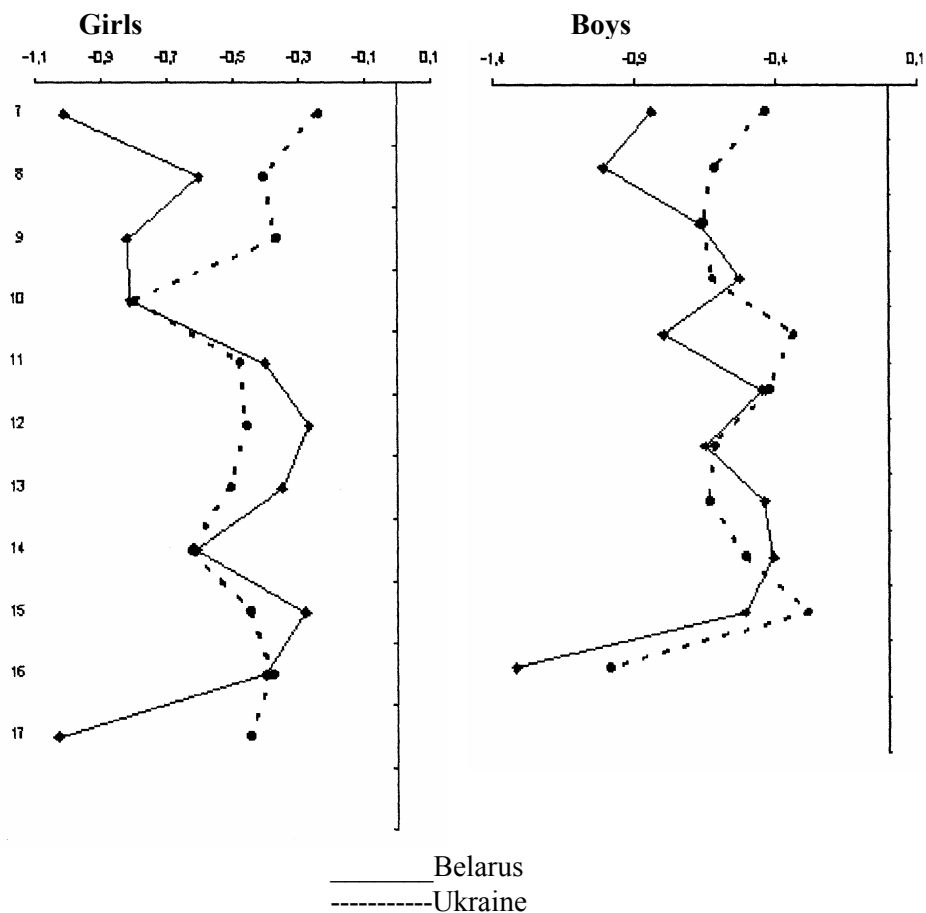


Fig. 4. Normalized intergroup differences for BMI in girls and boys from Belarus and Ukraine.

The conducted evaluation of the biological state of children and youth from Poland, Belorussia and Ukraine showed no significant differences in the area of body height. Earlier anthropometric research that included children and youth of the country regions from Poland and Belorussia indicated similar level of physical development in the compared groups (Rodziewicz - Gruhn et al. 1998). The differences in the time occurrence of the greatest annual body

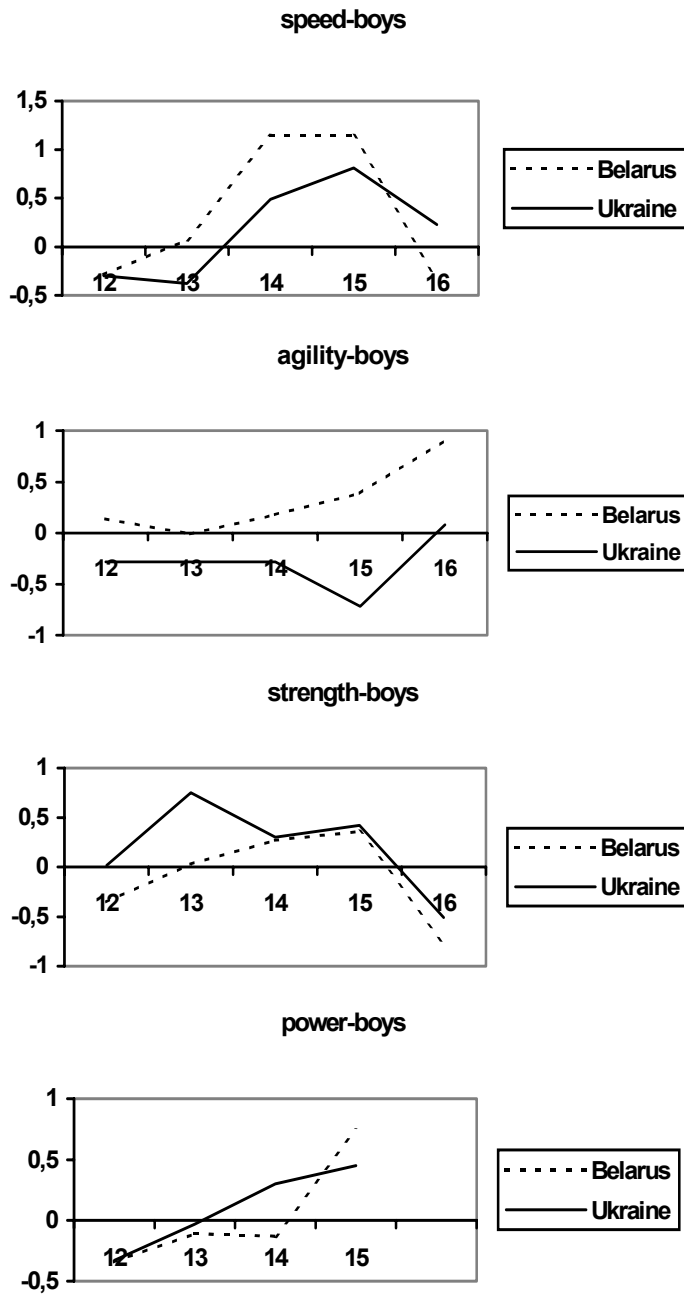


Fig. 5. Normalized intergroup differences for physical fitness tests for boys and girls from Belarus and Ukraine

height increase may be attributed to the different rate of biological development of Belorussian, Polish and Ukrainian children and youth (Alioszina 1999; Rodziewicz - Gruhn. and Tegako 1999; Rodziewicz – Gruhn and Baczyński 1999).

Table 5. Basic staistical data for the BMI index for girls and boys from Belarus and Ukraine

Age	Belarus				Ukraine				Tb	Tg
	Girls		Boys		Girls		Boys			
	\bar{X}	s	\bar{X}	s	\bar{X}	s	\bar{X}	s		
7	13,99	1,92	14,79	1,54	15,49	1,77	15,30	1,80	-1,29	-3,32
8	14,70	1,88	14,59	1,53	15,20	1,54	15,21	1,51	-2,33	-1,46
9	14,86	1,88	15,49	1,74	15,38	2,75	15,58	1,63	-0,29	-1,38
10	15,32	2,25	16,02	2,15	15,61	1,92	15,87	2,07	0,46	-0,94
11	16,54	2,48	16,13	1,89	16,39	2,33	16,73	2,64	-2,04	0,47
12	17,61	3,05	17,16	2,41	17,32	2,37	17,21	2,42	-0,18	0,80
13	18,24	2,68	17,77	1,83	17,95	2,42	17,73	1,99	0,16	1,01
14	18,76	2,70	18,49	2,81	18,81	2,54	18,25	2,28	0,67	-0,12
15	19,74	3,21	19,45	2,88	19,50	2,56	19,46	2,30	-0,02	0,55
16	20,23	2,85	19,84	2,39	20,38	2,56	20,23	2,80	-0,80	-0,35
17	19,36	1,91	20,40	1,61	20,20	2,50	20,16	2,38	0,56	-1,68

In Belorussia the phenomenon of biological acceleration is still visible (Ljalikow and Orechow 1999). Lower weight-height indexes (Quetelet, BMI) in females and males from Belorussia and Ukraine may result from the secular tendency to leanness or this results may be the effect of difficult economical conditions (food deficit) in which these populations live. In interpreting the results of somatic and motor development of children from Belorussia and Ukraine one must consider the environmental devastation that resulted from the nuclear disaster in Chernobyl. The results of biological development of populations highly influenced by nuclear radiation indicate a significant deficits and body mass (Nowickij 1999, Rodziewicz – Gruhn et al. 1999, Rodziewicz – Gruhn and Tegako 1999).

The determined differences in the level of somatic and motor development of children and youth of this particular regions have a strictly documentary character and the reasons for such differences are difficult to justify. These

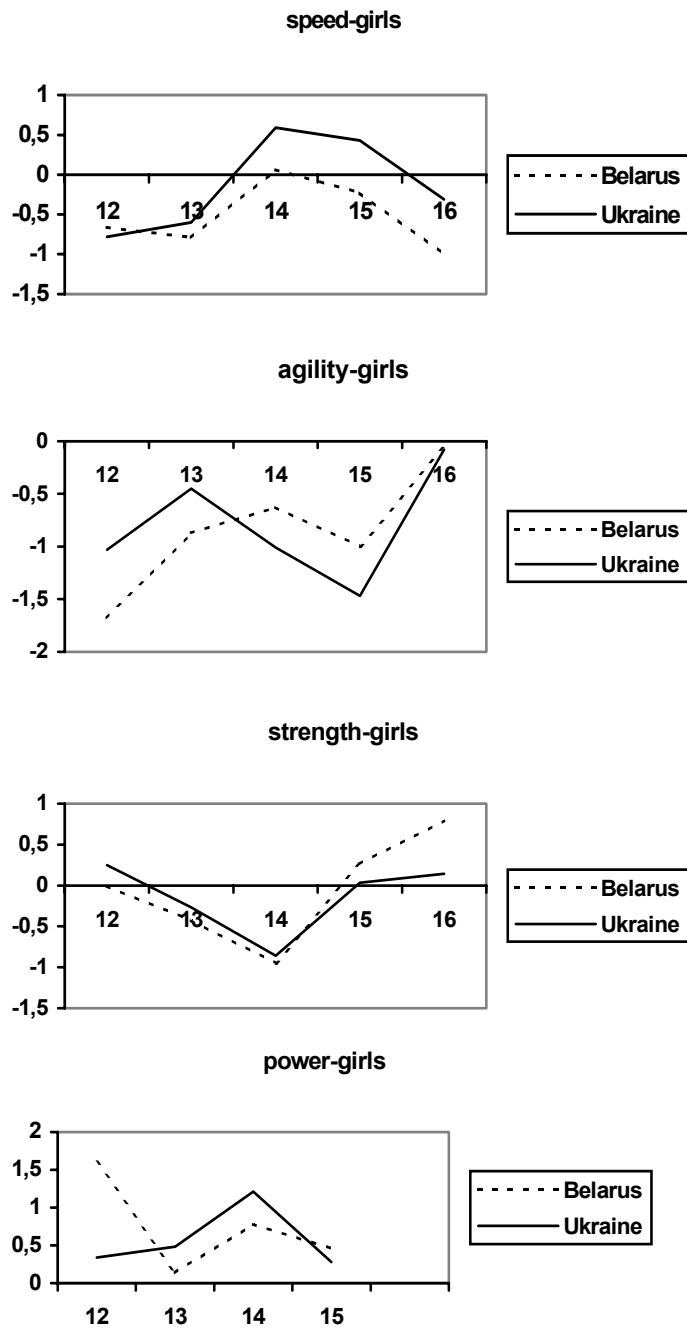


Fig. 6. Normalized intergroup differences in physical fitness test for girls and boys from Belarus and Ukraine

results are not consistent with the evaluation of physical fitness conducted in different school types in Belorussia and Ukraine (Rodziewicz – Gruhn et al. 1998; Rodziewicz – Gruhn 1999). In the above mentioned analysis the level of physical fitness and the accompanied differences can be interpreted in light of material condition for conductance of physical education classes, school types, social and economical conditions of pupils. The results confirm the opinions of many authors which state that physical fitness of 11-13 year old children and youth is highly influenced by the lifestyle of their families which is significantly correlated with environmental conditions, parental education and social and economical conditions (Bielicki et al. 1997; Charzewski and Przewęda 1988; Przewęda 1994, 1998; Szopa and Sakowicz 1987).

Conclusions

1. The level of body height development in boys and girls from Belorussia and Ukraine does not differ significantly from the values of urban populations of the same age in Poland.
2. Significantly lower weight-height indexes of children and youth from Belorussia and Ukraine can be attributed to lower economical and social status.
3. The level of physical fitness evaluated by Denisiuk test indicates greater intergroup differences in a females than in males.
4. Girls from Belorussia and Ukraine reached better results than Polish females in tests evaluating speed, power and agility.
5. The highest level of physical fitness was reached by males from Ukraine.

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