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## Physical development of children of 4-7 from Ivenetsky Region

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*Tatiana L. Hurbo*

**PHYSICAL DEVELOPMENT OF CHILDREN  
OF 4 — 7 FROM IVENETSKY REGION**

In outcome of Chernobyl disaster about 25% of the territory of the Republic of Belarus has been exposed to the long-time radiative contamination. On this area more than a quarter of the population of country lived. Ivenetsky region of Vologinsky district of the Minsk province is included in monitored space. Since 1996 in the region wide-scale measures on control of health status and complex rehabilitation of living here population, first of all — children, have been systematically conducted with direct involvement of the Belarusian Committee “Children of Chernobyl”.

Within the framework of annual medical examinations in 1999-2000 the research of physical development (PD) of 221 children of 4 – 7 (106 boys and 115 girls) in the settlement of Ivenets and neighbouring villages — Kamen, Sivitsa, Pershai and Dory — was conducted. By virtue of economical, ecological and series of other reasons since the 90-ies of the XX century the phenomenon of depopulation of the population has been watched (mortality considerably exceeds birth rate) in Belarus. As a result of drop of birth rate the quantity of children of pre-preschool and preschool age has decreased. Such situation is characteristic both for cities and for villages. For this reason the number of researched sex and age groups is low-level.

The data on main indices of PD is represented in table 1.

**Table 1. Main indices of physical development of children of Ivenetsky region (research of 1999 – 2000)**

Age, years	Boys						Girls					
	n	M	m(M)	S	m(S)	V	n	M	m(M)	S	m(S)	V
Body length, cm												
4	21	104,5	0,9	4,1	0,6	4,0	18	104,6	1,1	4,8	0,8	4,6
5	26	112,4	1,0	5,0	0,7	4,4	24	110,8	1,2	6,1	0,9	5,5
6	27	116,4	1,0	5,3	0,7	4,5	47	116,8	0,9	6,1	0,6	5,2
7	31	126,9	1,1	6,0	0,8	4,7	25	123,3	0,7	3,6	0,5	2,9
Body mass, kg												
4	21	16,9	0,4	1,8	0,3	10,4	18	17,0	0,5	2,0	0,3	11,5
5	26	19,5	0,5	2,3	0,4	13,0	24	19,0	0,4	2,1	0,3	11,2
6	27	21,3	0,6	3,0	0,4	14,1	48	21,8	0,5	3,6	0,4	16,4
7	31	26,1	0,7	3,8	0,5	14,4	25	23,6	0,6	3,0	0,4	12,6
Circumference of thoracal cell, cm												
4	21	55,3	0,4	2,0	0,3	3,6	18	54,9	0,6	2,7	0,5	5,0
5	26	57,8	0,4	1,8	0,3	3,2	24	57,4	0,8	3,8	0,5	6,6
6	28	59,0	0,6	3,0	0,4	5,1	48	58,4	0,5	3,6	0,4	6,2
7	31	61,6	0,6	3,2	0,4	5,3	25	59,2	0,6	3,0	0,4	5,1

During growing from 4 to 7 years old body length (BL) has increased for boys by 22,4 cm and for girls by 18,7 cm, body mass (BM) — by 9,2 and 5,6 kg, circumference of thoracal cell (CTC) — by 6,3 and 4,3 cm correspondingly. It is necessary to mark that the annual augmentation of total sizes of body took place rather uniformly, except for an interval from 6 to 7 years, when for the boys the greatest increases on all three main indices of PD were watched.

The estimation of PD was conducted on regional standards [3] in view of the references of Y.A. Yampolskaya [7]. The analysis of allocation of the received data has shown, that only 54,8 – 73,0% of the boys and 64,0 – 83,4% of the girls had PD within the limits of the norm. Least of deviations in PD have been detected for children of 4 and 5. So, per 4 years for 66,6% of the boys and 72,2% of the girls average indices of PD were defined, per 5 years — for 73,0% and 83,4% accordingly.

Deficit of BM was the most frequent variant of deviance from the BM norm in 18,5 – 28,6% of cases among the boys of 4 – 6-year and in 18,8 – 22,2% — among the girls of 4, 6 and 7 years.

The excess of BM is detected for children of 6- and 7. So, the surplus of BM have been met for the 6-year girls in 14,6% of cases, for 7-year girls — in 12% and for the 6-year boys — in 11,1% of cases, for 7-year — in 38,7%. Such high frequency of meeting surplus BM for the 7-year boys is stipulated by rising of share of tall people among them with greater than normal BM.

The low estimations of BL were rare and met for 5- and 6-year boys (3,7–3,9%) and 5–7-year girls (2,1–8,3%).

The outcomes of PD research of children of Ivenetsky region at the age of 4–7 years were compared to the similar data received in the second half of the 90-ies in the cities of Minsk and Vitebsk [1, 4] and in the city of Chenstokhov in the Republic of Poland [8]. We supposed that not only regional and ethnic originality of PD indices would have an effect on outcomes of the comparative analysis, but also low degree of urbanization of the settlements where researched children from Ivenetsky region lived (tab. 2, 3).

**Table 2. Age variability of main indices of physical development for the boys from different regions of the**

Age, years	Ivenetsky region 1999 – 2000		Minsk 1996 – 1997		Vitebsk 1997		Chenstokhov 1995	
	M	S	M	S	M	S	M	S
Body length, cm								
4	104,5	4,1	105,1	5,3	103,6	5,2	103,7	4,2
5	112,4	5,0	111,9	4,7	110,9	4,7	110,4	4,8
6	116,4	5,3	117,7	4,2	116,7	4,3	116,7	5,7
7	126,9	6,0	121,4	4,8			122,0	5,6
Body mass, kg								
4	16,9	1,8	18,1	2,6	16,8	2,0	16,8	1,7
5	19,5	2,5	20,5	2,3	19,3	2,7	19,4	2,7
6	21,3	3,0	22,6	2,7	21,2	2,8	23,6	1,8
7	26,1	3,8	23,9	2,6			23,8	4,9
Circumference of thoracal cell, cm								
4	55,3	2,0	55,5	2,9	55,2	2,4	55,0	1,9
5	57,8	1,8	56,8	2,5	58,1	3,6	57,0	3,7
6	59,0	3,0	59,1	2,9	59,2	3,2	57,8	3,4
7	61,6	3,2	59,6	2,9			59,6	4,4

The comparison of information on BL demonstrates that children of both sexes of 5 and 7 years and also 4-year girls in Ivenetsky region are taller than children of their age in urban samplings introduced by us. At the age of 7 years distinctions reach statistically authentic level both for the boys and for the girls. Only 4 girls and boys at the age of 4, 6 years are lower than urban children.

It is possible to distinguish some peculiarities of allocation of BM indices. At the age of 4 – 5 years the boys of Minsk had the greatest BM, at the age of 6 — the boys of Chenstokhov ( $p < 0.001$ ). A little bit smaller BM indices of the boys from Ivenets draw them together with the boys from Vitebsk. Only per

7 years the boys from Ivenets had the greatest BM (distinctions are statistically authentic).

**Table 3. Age variability of main indices of physical development for the girls from different regions of the Republic of Belarus and Poland**

Age, years	Ivenetsky region 1999 – 2000		Minsk 1996 – 1997		Vitebsk 1997		Chenstokhov 1995	
	M	S	M	S	M	S	M	S
Body length, cm								
4	104,6	4,8	104,2	4,4	102,6	4,1	103,8	6,1
5	110,8	6,1	110,2	6,0	109,5	4,9	108,7	5,0
6	116,8	6,1	116,9	4,7	116,9	4,6	114,6	5,8
7	123,3	3,6	120,3	6,1			120,8	6,5
Body mass, kg								
4	17,0	2,0	17,7	2,4	16,5	2,1	16,4	1,8
5	19,0	2,1	19,3	3,3	18,3	2,4	18,7	2,8
6	21,8	3,6	21,7	2,7	20,6	2,8	20,5	3,4
7	23,6	3,0	24,1	3,3			22,5	4,4
Circumference of thoracal cell, cm								
4	54,9	2,7	54,2	2,1	54,9	3,1	53,8	2,4
5	57,4	3,8	55,1	3,2	55,5	3,1	55,6	3,2
6	58,4	3,6	57,1	2,7	57,3	3,4	56,8	3,8
7	59,2	3,0	58,6	4,4			58,1	3,9

Both for the girls and boys the greatest BM was characteristic to the girls of Minsk (at the age of 4, 5 and 7 years). The minimum BM indices were marked for the girls from Vitebsk and Chenstokhov. The data of the girls from Chenstokhov are close to those of Minsk's girls, however they are less a little, and only per 6 years the girls from Ivenets had the highest BM among compared groups.

For Ivenets's girls in all age groups STS is higher than for the urban girls of their age. At the age of 5 and 6 the difference reached statistically significant level. Among the 4-year boys the maximum CTC is watched for Minsk's boys, at 5 and 6 — for Vitebsk's children, at 7 — for Vitebsk's boys (at 7 years distinctions are authentic).

The relevant informative feature describing proportionality of development is the correlation of CTC and BL — indice of proportionality of development. According to this, indice children under the school age proved to be the most gracil in Minsk, where the boys of the age of 4, 5 and the girls of 4 – 6 years had the least values of the given index. However, at 7 years for children of Minsk the greatest ratio CTC to BL was marked. More often the given index had maximum ratings for children of Vitebsk (boys of 4 – 6 years and 4-year girls) and for children of Ivenetsky region (6-year boys and girls of 5, 6 years).

For children from Ivenetsky region and Chenstokhov in the Republic of Poland the data on girths of a brachium, forearm, femur and anticnemion (tab. 4) were compared.

**Table 4. Sex and age variability of girths of extremities for children from Ivenetsky region and Chenstokhov**

Age, years	Boys				Girls			
	Ivenetsky region 1999 – 2000		Chenstokhov 1995		Ivenetsky region 1999 – 2000		Chenstokhov 1995	
	M	S	M	S	M	S	M	S
Girth of a brachium, cm								
4	16,5	0,9	17,0	1,0	16,7	1,3	16,6	1,2
5	17,2	1,1	17,3	1,4	16,5	1,2	17,3	1,7
6	17,3	1,2	17,4	1,6	17,2	1,7	17,4	1,8
7	18,1	1,6	18,1	2,0	18,3	1,7	17,7	1,8
Girth of a forearm, cm								
4	16,6	0,7	16,3	1,1	16,8	1,0	16,1	1,3
5	17,2	1,0	16,6	1,6	16,7	1,1	16,1	2,0
6	17,4	1,3	17,1	1,3	17,1	1,4	16,5	1,3
7	18,0	1,4	17,5	2,0	17,7	1,2	16,9	2,4
Girth of a femur, cm								
4	32,8	1,1	31,0	3,1	32,9	3,2	31,9	2,6
5	34,5	2,6	32,5	3,4	34,1	2,3	33,4	3,6
6	34,9	4,1	34,2	3,3	35,4	3,7	34,2	3,3
7	37,9	4,0	36,0	3,8	38,4	2,2	35,7	3,9
Girth of an anticnemion, cm								
4	23,0	1,2	22,5	1,4	23,3	1,5	22,5	1,6
5	24,1	1,6	23,5	2,0	24,0	1,6	23,5	1,8
6	24,3	1,6	23,9	1,8	24,4	2,0	24,3	2,4
7	25,5	2,4	25,1	2,2	25,6	1,4	24,9	2,5

The analysis of received outcomes has mirrored higher indices of girth of forearm, femur and anticnemion for children from Ivenets as contrasted to the inhabitants of Chenstokhov, though the difference has not reach statistically significant level. Only by the girth of a brachium the boys of 4 – 6 and girls of 5 and 6 from Chenstokhov exceeded the coevals from Ivenets.

The problem of reaching "school maturity" by children is one of the major in depicted period of life (4 – 7 years). Under "school maturity" a level of psychophysiological and morphological maturity sufficient for the beginning of systematic training at school is implied [2]. The estimation of morphological maturity is grounded on accelerated in this period change of proportions of a body: growth of a head and upper segment of a body (head and neck) is retarded and growth of extremities is simultaneously accelerated [5]. For defi-

nition of morphological maturity the Philippine test and three indices are utilized. The Philippine test is, that a right hand of the child at a vertical position of a head is put on sinciput and his/her fingers are drawn out toward the left ear. Positive variant of the Philippine test (if the finger tips reaches the ear) testifies to biological maturity of the child [6]. Index 1 — ratio of an upper segment of a body to BL; index 2 — ratio of girth of a head to BL; index 3 — ratio of an physionomical altitude of a face to BL. All indexes are expressed in percents.

For children of 4 – 7 from Ivenetsky region the Philippine test was conducted and three indices of “school maturity” were calculated (tab. 5).

**Table 5. Sex and age variability of indices of “school maturity” for children of Ivenetsky region (in %)**

Age, years	Index 1		Index 2		Index 3	
	M	Min – Max	M	Min – Max	M	Min – Max
Boys						
4	22,9	21,5—25,2	49,2	46,0—53,4	14,6	13,6—15,6
5	22,6	20,6—30,0	46,3	42,4—49,2	13,9	13,3—15,2
6	21,1	19,1—22,3	44,7	42,3—48,3	13,4	12,2—14,7
7	19,5	17,8—21,8	40,6	38,2—43,8		
Girls						
4	22,8	21,0—25,8	48,8	42,7—53,1	14,0	12,9—14,7
5	21,6	20,2—23,3	46,0	41,3—52,4	14,0	12,8—15,9
6	20,3	16,2—23,1	43,9	39,6—52,1	13,4	12,6—14,8
7	19,8	18,6—22,1	42,4	39,5—45,1		

According to our data the average age of performance of the Philippine test (age at which test is fulfilled by 50% of researched children), both for the boys and for the girls has been 5 years 4 months. However, by 6 years 83,3% of the girls and only 66,7% of the boys fulfilled the Philippine test.

Analysis of indices of “school maturity” testifies to intensifying of growth intensity of the girls in this period of development. So, at the age of 5 71,4 – 76,9% of the boys have been referred to immature, while among the girls the immature have compounded 33,3 – 50,0%. Per 6 years 70,6 – 80,0% of the boys have been referred to average mature and mature type, among the girls similar degrees of maturity have been reached by 71,9 – 92,8%.

Thus, on the basis of the analysis of PD indices of children from Ivenetsky region one can made the following outputs:

- The majority of researched children of 4 – 7 years had PD in limits of the norm.

- Among PD deviations the most frequently met was the variant connected with BM deficit.
- The PD indices of the Ivenets's girls in comparison to the similar data of coevals from the cities of Belarus and Poland were characterized by higher values of BL and BM and the majority of girth sizes of a trunk and extremities. It is possible to suspect that such PD characteristics were influenced by the features of country way of life, as it is known that for agricultural children altitude and girth sizes are usually larger.
- A little bit diverse PD tendency took place for the boys from Ivenets. As well as the girls they are a little bit higher than their coevals, they have larger girths of extremities (except for a girth of a brachium). However their BM is low-level and CTC is lower than for urban coevals. It is possible to explain this lag on the most relevant PD indices by the greater ecosensitivity of a man's organism, i.e. its greater sensitivity to influencing of unfavourable both ecological and economic factors. The group of 7-year boys from Ivenets proved to be an exception, as according to all signs of physical development they anticipated their coevals.
- The analysis of performance by children of the Philippine test and indices of "school maturity" has shown that, as a whole, the girls from Ivenets at the given stage of development anticipated the boys in intensity of processes of growth and maturing.

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