

A.A. Martynova, I.P. Megorskaya

## EVALUATION OF PHYSICAL DEVELOPMENT OF 3-7 YEARS CHILDREN IN THE MURMANSK REGION

### ABSTRACT

The social and economic conditions that have changed dramatically in recent times have led to a change in the way of life of the indigenous peoples of the North and those who have lived there within ten generations. Such peoples in the Murmansk region include the Sami (Lovozer district) and Pomors (Tersk district). This change has a particularly strong impact on the younger generation. Evaluation of physical development of children is an external integral manifestation of the adequacy of the processes of growth and development to the changing conditions of existence of the organism. It is therefore necessary to monitor the growth and development of children and to obtain timely information on the physical development of children in changing conditions.

**Materials and methods.** Assessment of physical development of children aged 3-7 years was carried out in 2017-2018 in two districts of the Murmansk region – settlement Lovozero (Lovozer district) and Umba (Tersk district). All in all 237 children, including 116 girls and 121 boys residing and attending kindergarten were surveyed. The inclusion criterion was children with the first or the second group of health, with minor functional disorders, without chronic pathologies. All parents of the examined children were acquainted with the purpose and conditions of the study and gave their written consent to their child's participation in this study. The study of physical development parameters was carried out taking into account the requirements of the unified methodology and the use of one-dimensional centyl scales for children aged 3-17 years in accordance with the age group. To assess the contribution of socio-economic conditions, perinatal and neonatal periods, personal data provided by the parents of the surveyed children were used.

**Results and conclusions.** Analysis of physical development of children aged 3-7 years showed that the lowest rates of length and weight of the body are observed in children in Lovozero regardless of gender and age, which explains the ethnic characteristics of the Kola Saami. The largest jump in growth is observed in children aged 5.5 years. Sharply disharmonious physical development is observed in more than 30% of the surveyed children regardless of gender, age and place of residence. The main contribution to disharmonious development of the children of s. Lovozero makes the lack of mass and body length, and the children of s. Umba is overweight, and in girls it is more pronounced.

**Keywords:** physical development, children, preschoolers, length weight, body weight, centile tables, harmonious development, Murmansk region.

**Introduction.** Nowadays, the Arctic is a zone of claim of the international community, including the Arctic countries and recently the so-called "non-Arctic" countries. State policy in the field of subsoil use and the presence of industrial companies in the Arctic regions has a powerful impact on the livelihoods of the population, determining the need to adapt to changing conditions and largely to the socio-economic ones, which leads to a change in the way of life of indigenous peoples of the North and those who have lived there within ten generations. Such peoples in the Murmansk region include the Sami (Lovozer district) and Pomors (Terek district). This has the greatest impact on the child population. Evaluation of physical development of children is an external integral manifestation of the adequacy of the processes of growth and development to the changing conditions of existence of the organism [1, 4, 8, 11, 12, 15]. Any significant deviations from the norm in the physical development of children indicate a relative disadvantage in the health of the individual, subsequently determining the main features of the health of this generation in old age, including the transfer of appropriate qualities to the next generation. Social and environmental factors do not act in isolation, but in a complex interaction with biological ones, including

hereditary factors [3, 5, 9, 13, 14]. This determines the dependence of morbidity in children and adolescents both on the environment in which they live, and on the genotype and biological patterns of growth and development. Therefore, it is necessary to monitor the growth and development of children and obtain timely information about physical development as an integral indicator of morphological and functional processes in the growing body, especially in the Arctic.

**Research material and methods.** Assessment of physical development of children aged 3-7 years was carried out in 2017-2018 in two districts of the Murmansk region s. Lovozero (Lovozer district) and Umba (Tersk district). All in all, 237 children, including 116 girls and 121 boys residing and attending kindergarten were surveyed. In Lovozero, 127 children were examined, which accounted for 67% of the total number of children of this age, among them 64 boys and 63 girls; and in Umba - 110 children (50 %), among them 57 boys and 53 girls. All examined children had the first or the second group of health, with minor functional disorders, without chronic pathologies. According to the principles of medical ethics, approved by the UN General Assembly (1992), the Council of Europe Convention on Bioethics (1997) and the Council on Bioethics of the RCHAA KSC

RAS (18.01.2017), all parents of the examined children were acquainted with the purpose and conditions of the study and gave their written consent to their child's participation in this study

The study of physical development parameters was carried out taking into account the requirements of the unified methodology and the use of one-dimensional centyl scales for children aged 3-17 years in accordance with the age group. Indicators lying in the 25-75 cent range are referred to the variants of the norm, 10-25 and 75-90 are the border zones of quantitative characteristics of length and weight of the body, indicators lying outside the 90th and 10th centiles to low and very low values, while indicators lying above 97 and below 3 centiles reflect a clear pathology or disease [10]. Assessment of the degree of harmonic development was performed using the analysis of the difference of rooms and corridors (centiles) between the considered indicators, where: difference of not more than 1 corresponded to the harmonic development, 2 – moderate development there is disharmony; 3 or more points - disharmonious or heterochronic development [7]. Due to the fact that the rate of change in the indicators of physical development of the child varies in different periods of life, the age group for children 3-7 years was carried out at in-

Table 1

**Physical development of preschool childrens settlement Murmansk region  
(Lovozero and Umba)**

Age	Lovozero				Umba			
	Body weight, kg		Body length, cm		Body weight, kg		Body length, cm	
	M±m	δ	M±m	δ	M±m	δ	M±m	δ
girls								
3,0	11.8±.7*	1.5	90.0±5.7*	11.4	13.8±0.8	1.7	95.8±1.8	3.5
3,5	13.8±0.6	1.2	93.5±1.2	3.3	14.6±0.6	1.7	96.0±1.6	4.2
4,0	13.6±0.9*	2.3	93.1±2.9*	7.7	16.7±0.4	1.0	103.7±1.3	3.1
4,5	14.9±0.6*	3.8	96.3±2.2	7.2	19.1±1.5	3.3	104.2±0.9	2.1
5,0	17.1±0.6	1.4	102.9±1.6	3.7	18.3±2.7	6.1	104.4±3.0	6.8
5,5	18.2±0.6	2.0	106.2±1.6*	5.0	20.0±0.8	1.9	114.4±1.2	2.9
6,0	19.6±2.0	5.0	109.1±3.5	8.6	23.2±2.0	4.9	118.7±1.3	3.2
6,5	19.6±2.2	5.8	110.3±3.9	10.4	24.1±2.1	6.4	118.8±2.0	6.1
7,0	21.1±1.5*	4.4	116.2±1.6*	4.9	27.7±3.6	8.0	123.6±1.5	3.3
boys								
3,0	12.3±0.4*	1.0	91.9±1.8*	4.3	13.7±0.3	0.6	95.2±1.7	3.4
3,5	14.5±0.5	1.3	95.6±1.7	4.7	14.5±0.5	1.5	95.4±1.6	4.8
4,0	13.7±0.2*	0.5	94.2±1.5*	3.2	17.7±0.9	2.4	101.4±1.3	3.4
4,5	16.4±0.5	1.7	101.7±1.5	4.9	17.9±0.9	2.3	102.8±1.9	4.9
5,0	16.4±0.6	1.2	107.7±0.6	1.1	19.1±1.5	4.1	107.9±2.0	5.4
5,5	19.9±1.8	5.5	111.7±2.0	7.1	19.2±0.8	2.0	111.6±1.7	4.2
6,0	20.1±1.0	2.1	113.1±1.2	2.8	21.4±1.5	3.0	116.3±2.2	4.4
6,5	22.6±1.3	2.9	116.1±1.8	4.1	22.6±1.5	3.9	116.7±2.1	5.5
7,0	23.3±1.5	5.1	117.2±1.5	5.1	23.4±0.7	1.5	117.9±1.8	4.0

Note. \* – The significance of the differences (Mann-Whitney test) between the Lovozero and Umba

tervals of 6 months. The group of 5 year olds included children aged 4 years and 8 months to 5 years and 2 months, and the group of children 5.5 years of children from 5 years 3 months to 5 years 8 months etc.

To assess the contribution of socio-economic conditions, perinatal and neonatal periods, personal data provided by the parents of the surveyed children were used. Statistical analysis was performed using the software package "STATISTICA 6.0". U Mann – Whitney test was used to identify the significance of intergroup differences. Criterion U is the median of possible differences between the elements of the first and the second sample, and p is the level of significance of differences, which in this paper corresponded ( $p < 0.05$ ).

**Results and discussion.** Measures of length and body weight of preschool children (3-7 years) showed that mostly regardless of gender and age of children the average length and weight of boys and girls in s. Lovozero is lower in comparison with children from Umba (table 1). The significance of differences in body length in the same age groups between girls from Lovozero and Umba was revealed only in three age groups of 4 ( $p < 0.01$ ), 5.5 ( $p < 0.001$ ) and 7 ( $p < 0.01$ ) year-old children. Boys aged 3 ( $p < 0.01$ ) and 4 ( $p < 0.002$ ) years respectively. The average body length of girls in s. Lovozero varied from 90.0±5.7 cm to 116.2±1.6 cm and from 95.8±1.8 cm to 123.6±1.5 cm in Umba. In boys, changes in body length ranged from 91.9±1.8 cm to 118.2±1.5 cm in Lovozero and from 95.2±1.7 cm to 116.9±1.8 cm in Umba, respectively. The greatest increase is observed in children aged 5.5 years, and in girls from Umba it increased by 9%. The body weight of girls living in Lovozero varied from 11.8±0.7 to 21.1±1.5 kg in Lovozero and from 13.8±0.8 to 27.7±3.6 kg in Umba. In boys, respectively, from 11.8±0.7 to 21.1±1.5 kg in Lovozero and from 13.8±0.8 to 27.7±3.6 kg in Umba (table 1).

The assessment of the body length of children aged 3-7 years according to the centyl tables showed that mainly about 55% of children living in these settlements get into the 25-75 cent range, with the exception of girls from Lovozero 33.3% (table 2). There, about 49.2% of girls have values below 10 cents, which corresponds to low and very low body length values.

By body weight, the percentage of children corresponding to the average value (25-75 centyl range) does not exceed

40% in s. Lovozero and 50% in Umba. The lowest values (range <10 centiles) by body weight are observed in children from s. Lovozero girls - 33.3%, boys – 25%. Low values of physical development of 49.2% of girls and 25% of boys from Lovozero village are associated with ethnic specificity of body size typical for the Saami of the Kola North [6]. It is so? because physical development and physique are about 70 % determined by heredity and only 30% by environmental factors in which growth and development takes place. Analysis of the parents' sur-

vey showed that 75% of the interviewed parents were born in Lovozero and identify themselves as Sami, if not both parents, then one of them. The literature notes that the small size of the body of the Saami children is preserved throughout the period of growth and development of the child and does not exceed the 50th percentile of the all-Russian standards in body length and is typical not only for the Kola, but also for other groups of Saami. Thus, the body length of 9-year-old Sami children Inari and Kautokeino practically coincide with the

Table 2

**Evaluation of physical development of childrens 3-7 years old by centile tables, (%)**

Inhabited locality	Body length					Body weight				
	<10	10-25	25-75	75-90	>90	<10	10-25	25-75	75-90	>90
girls										
Lovozero n=63	49.2	11.1	33.3	4.8	1.6	33.3	15.9	39.7	7.9	3.2
Umba n=53	7.5	3.8	56.6	24.5	7.5	9.4	9.4	49.1	17.0	15.1
boys										
Lovozero n=64	25.0	14.1	54.7	3.1	3.1	23.4	26.6	32.8	10.9	4.7
Umba n=57	15.8	14.0	54.4	14.0	1.8	10.5	17.5	49.1	10.5	12.3

Table 3

**Evaluation of preschoolers 3-7 years old by harmonious physical development according to centile tables**

		centile on body length									
		Girls					Boys				
		<10	10-25	25-75	75-90	>90	<10	10-25	25-75	75-90	>90
centile on body weight		Lovozero									
	<10	30.2		1.6	1.6		14.1	4.7	4.7		
	10-25	11.1		1.6	1.6		12.5	6.3	9.4		
	25-75	4.8	11.1	17.5				4.7	26.6		
	75-90	3.2	3.2	7.9	1.6			1.6	7.8		1.6
	>90			1.6		1.6		4.7			1.6
		Umb									
	<10	3.8	1.9	3.8			7.0	3.5			
	10-25	1.9		3.8	3.8		3.5	3.5	8.8	1.8	
	25-75	1.9	1.9	28.3	3.8	1.9	3.5	7.0	29.8	7.0	
	75-90			11.3	11.3	1.9			8.8	1.8	1.8
	>90			11.3	5.7	1.9	1.8		7.0	3.5	

values of only the 25th percentile of US NCHS standards, as in the Sami children of Lovozero [16, 17]. At the same time, for boys after 4.5 years, the difference in growth between cities is smoothed. The length of the body height above the average prevailed at the girls Umba, and accounted for the age of 5.5 years, when they had the greatest increase in growth. The highest percentage of children with high body weight (range >90 centiles) is noted in children of Umba approximately 15.1% of girls and 12.3% of boys, which is considered the highest degree of deviation of physical development from the norm regardless of the length of the body [10]. This may be a consequence of malnutrition or lack of some components (vitamins, essential amino acids, trace elements, etc.), as chronic diseases metabolic disorders have not been identified. In the questionnaires, parents noted that the percentage of consumption of vegetables and fish in the diet of children at home has decreased; the consumption of carbohydrates (flour products, sweets) has increased. However, for a full assessment, an individual assessment of the degree of harmony of the child's development is needed.

Individual assessment of the degree of harmony of the child's development was carried out by analyzing the difference between the numbers of corridors (centiles) between the indicators (length and weight). Analysis of the degree of harmony showed that no more than 30% of the surveyed children have a harmonious physical development. The lowest percentage of 17.5% is observed in girls in Lovozero (table 3).

Sharply disharmonious physical development is observed in more than 30% of the surveyed children regardless of gender and age. Moreover, in children from the village of Lovozero, the main contribution is made by the lack of weight and length of the body. While in children from Umba disharmonious development is manifested in excess body weight, and in girls it is more pronounced, which differs from the structure of the contribution to the deviations of the Russian Federation, where more boys are overweight, and girls have lack of weight [2].

**Conclusion.** Thus, the analysis of physical development of children aged 3-7 years showed that the lowest rates of length and weight of the body are observed in children in Lovozero regardless of gender and age, which explains the ethnic characteristics of the Kola Saami. The largest jump in growth is observed in children aged 5.5 years. Sharply disharmonious physical development is observed in more than 30% of the surveyed children regardless of gender, age and place of residence. The main contribution to disharmonic physical development in children from Lovozero village is the lack of body weight and length, and in children from Umba this contribution is overweight, and in girls it is more pronounced.

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#### The authors:

**Martynova Alla Aleksandrovna**, PhD (Biol.) senior scientific researcher, head of research department Research Centre for Human Adaptation in the Arctic - Branch of the Federal Research Centre "Kola Science Centre of the Russian Academy of Sciences (RCHAA KSC RAS). g. Apatity, Murmanskaja obl., ul. Fersmana 41a, 184209. e-mail: [martynovaalla@medknc.ru](mailto:martynovaalla@medknc.ru);

**Megorskaya Inna Pavlovna**, Deputy Head Doctor, Pediatrician Research Centre for Human Adaptation in the Arctic - Branch of the Federal Research Centre "Kola Science Centre of the Russian Academy of Sciences (RCHAA KSC RAS). g. Apatity, Murmanskaja obl., ul. Fersmana 41a, 184209. e-mail: [megorskaya@medknc.ru](mailto:megorskaya@medknc.ru).

A.I. Yakovleva, E.D. Okhlopko, L.D. Olesova,  
Z.N. Krivoschapkina, L.I. Konstantinova, A.A. Grigorieva,  
E.I. Semenova, A.V. Efremova, G.E. Mironova

## INFLUENCE OF CEMENT PLANT EMISSIONS ON MEDICINAL PROPERTIES OF MEDICINAL PLANTS IN CENTRAL YAKUTIA

### ABSTRACT

The work is devoted to the study of the influence of cement dust on the medicinal properties of plants, namely the content of flavonoids in plants of Central Yakutia. Flavonoids being evolutionarily adequate to the human body, cause antioxidant, angioprotective, hepatoprotective, choleretic, diuretic, neurotropic, anti-oncological and other important pharmacological properties. The plants were collected in areas of high and medium pollution with cement dust. The study found that the plants of each species collected in different environmental conditions, different levels of flavonoids. In the zone of severe pollution with cement dust (at a distance of 500 m from the plant), the most pronounced decrease in the content of flavonoids in plants than in other study areas was noted. From the above data it can be seen that the spectrum of the content of substances of secondary synthesis varies in plants growing in conditions of atmospheric pollution, depending on the zone of influence of cement dust emissions. All species we study collected in the technogenic zone produce fewer flavonoids than plants collected in the control area. That is connected, in all probability, with the need to develop adaptive systems to change the cement environment. This fact is a consequence of the response to stress factors of plant organisms.

Consequently, it can be assumed that the content and accumulation of flavonoids depends on the presence and concentration of anthropogenic impurities in the atmosphere. According to the literature data, it was found that at a distance of 20 m from the plant there was the excess of biogenic elements B, Zn, Cu. Their high concentration in the soil is manifested in inhibition of growth, increase of lipid peroxidation and permeability of plant membranes.

**Keywords:** flavonoids, dietary supplement, cement dust.

**Introduction.** One of the directions of development of the pharmaceutical industry is to increase the range of new medicines, which include medicinal plant materials and products dietary supplemented on it. Currently, out of hundreds of thousands of medicines used in world medical practice, medicinal preparations from plants make up over 30%.

It has been established that with increasing extremes of climatic growing conditions in the tissues of a number of plant species, a greater number of bio-

logically active substances (DIETARY SUPPLEMENT) are synthesized [5, 7].

Intensive industrial development of natural resources has a negative impact on natural ecosystems. Due to emissions of solid particles, especially ash, soot, cement dust into the atmospheric air, dust layers are formed, which slow down the processes of photosynthesis. Cement dust, penetrating through the stomata during the gas exchange of leaves into plants, affects not only the surface, but also the cells inside the plant. The more

available moisture reserves from the soil are consumed, the earlier the plants experience a water deficit [3]. Photosynthetic activity decreases with an increase in leaf temperature and the onset of water deficiency [6].

"Yakutcement" is the largest cement plant of republican significance in Yakutia. The plant is located in the village of Mokhsogollokh Khangalassky district. Currently, the plant produces up to 300 thousand tons of cement per year, over 500 thousand tons of crushed stone.