

al'noj Assamblee s nauchnymi prilozheniyami. [2000 UNSCEAR Report to the General Assembly with Scientific Annexes. M: RADECON, 2002; 308 (In Russ.).]

10. Kurtanov H.A. Issledovanie gena C22ORF20 u bol'nyh saharnym diabetom 2-go tipa s soputstvuyushchej pechenochnoj patologiej v Yakutii [Study of the C22ORF20 gene in patients with type 2 diabetes mellitus with concomitant hepatic pathology in Yakutia]. *Sovremennye problemy nauki i obrazovaniya* [Modern problems of science and education. 2019; 3:134 (In Russ.).]

11. Margulis U.Ya., Bregadze Yu.I. Radiacionnaya bezopasnost'. [Radiation safety]. Principy i sredstva ee obespecheniya. [Principles and means of its provision. M: Editorial URSS, 2000; 120 (In Russ.).]

12. Materialy k gosudarstvennomu dokladu o SEB RS(YA) za 2022 god [Materials for the state report on the SES of the RS(Y) for 2022] https://fbuz14.ru/gos_doklad (In Russ.).]

13. Metodika ekspressnogo izmereniya ob'emnoj aktivnosti 222Rn s poverhnosti zemli s pomoshch'yu radiometra radona tipa RRA [Method for rapid measurement of 222Rn volumetric activity from the earth's surface using a radon radiometer of the RRA type]. Rekomendacii [Recommendations. M., 2006; 3–8. (In Russ.).]

14. O sostoyanii zdorov'ya naseleniya i organizacii zdorovoohraneniya v Respublike Saha (Yakutiya) po itogam deyatelnosti za 2020 g. (rukopis') [On the state of health of the population and the organization of health care in the Republic of Sakha (Yakutia) based on the results of activi-

ties for 2020 (manuscript)] Yakutsk: Ministerstvo zdorovoohraneniya Respubliki Saha (Yakutiya) [Yakutsk: Ministry of Health of the Republic of Sakha (Yakutia), 2021;142 (In Russ.).]

15. Ob utverzhdenii regional'noj programmy «Bor'ba s serdechno-sosudistymi zabolevaniyami v Respublike Saha (Yakutiya) na 2019-2024 gody». [On approval of the regional program "Fight against cardiovascular diseases in the Republic of Sakha (Yakutia) for 2019-2024". <https://minzdrav.sakha.gov.ru/uploads/ckfinder/userfiles/files/697-%20r%20Kardio%20RP.pdf> (In Russ.).]

16. Ostroumova G.V. Opredelenie redkih i radioaktivnykh elementov v mineral'nom syr'e [Determination of rare and radioactive elements in mineral raw materials. M: Nedra, 1983; 252 (In Russ.).]

17. Opredelenie urana rentgenospektral'nym metodom [Determination of uranium by X-ray spectral method]. Ministerstvo geologii SSSR [Ministry of Geology of the USSR. M., 1983;10 (In Russ.).]

18. Ocenka individual'nykh effektivnykh doz oblucheniya naseleniya za schet prirodnykh istochnikov ioniziruyushchego izlucheniya. [Evaluation of individual effective doses of public exposure due to natural sources of ionizing radiation]. M.: Federal'nyj centr gossanepidnadzora Minzdrav Rossii [Federal Center for State Sanitary and Epidemiological Surveillance of the Ministry of Health of Russia, 2002; 22 (In Russ.).]

19. Regional'naya programma «Bor'ba s onkologicheskimi zabolevaniyami v Respublike Saha (Yakutiya) na 2021-2024 gody» [Regional

program 'Fight against cancer in the Republic of Sakha (Yakutia) for 2021-2024' (In Russ.).]

20. Rekomendacii po lecheniyu arterial'noj gipertonii [Recommendations for the treatment of arterial hypertension].ESH/ESC 2013 Rossijskij kardiologicheskij zhurnal. [SH/ESC 2013 Russian Journal of Cardiology. 2014;1 (105):79–4 (In Russ.).]

21. Khochachka I., Somero D. Biohimicheskaya adaptatsiya [Biochemical adaptation]. Izdvo MIR [Publishing house MIR. 1988; 586s (In Russ.).]

22. Duell PB, Welty FK, Miller M, et al. American Heart Association Council on Arteriosclerosis, Thrombosis and Vascular Biology; Council on Hypertension; Council on the Kidney in Cardiovascular Disease; Council on Lifestyle and Cardiometabolic Health; and Council on Peripheral Vascular Disease. Nonalcoholic Fatty Liver Disease and Cardiovascular Risk: A Scientific Statement From the American Heart Association. *Arterioscler Thromb Vasc Biol.* 2022 Jun;42(6):e168-e185. doi: 10.1161/ATV.0000000000000153. Epub 2022 Apr 14. PMID: 35418240.

23. Greenland Ph, Peterson E. The New 2017 ACC/AHA Guidelines "Up the Pressure" on Diagnosis and Treatment of Hypertension. *JAMA.* 2017; 318:21: 2083–2084.

24. National Academy of Sciences. Health Effects of Exposure to Radon (BEIR VI). National Academy Press, Washington, D.C., 1999.

25. WHO. Indoor air quality research: Report on a WHO meeting, 27-31 August 1984, Stockholm. World Health Organization, Copenhagen, 1986.

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PHYSICAL DEVELOPMENT OF PRESCHOOL CHILDREN IN MUNICIPAL DISTRICTS OF THE REPUBLIC OF SAKHA (YAKUTIA)

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The relevance of studying the state of children's health is closely related to the issues of their physical development, which is one of its main indicators. Our article presents data from the analysis of the anthropometric indicators of preschool children living in the regions of the Republic of Sakha (Yakutia). The study was conducted in 17 municipal districts representing 5 socio-economic zones of the republic: arctic, eastern, western, central, southern. A total of 643 pupils of preschool educational institutions aged 3 to 6 years were examined. The study group on physical development consisted of children with an actual age of 3 years in the amount of 208 people and children of 6 years old in the amount of 127 people.

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Keywords: body weight, height, body mass index (BMI), physical development, anthropometry, head circumference, subcutaneous fat, obesity, tall stature, short stature.

Introduction. The physical development of children is one of the main indicators reflecting the health of the younger generation and the nation as a whole. According to the definition of the Union of Pediatricians of Russia, physical development is understood as a dynamic process of growth (increase in body weight and length, development of organs and body systems) and biological maturation

of a child. Healthy growth and development means that children are supported to thrive in areas including physical, cognitive, language and emotional areas that play an important role in children's lives from birth to adulthood [4, 6]. Monitoring height and weight helps to correctly diagnose diseases and implement therapeutic and preventive measures.

Not only genetic predisposition, but

Table 1

Physical development of children in municipal districts of the Republic of Sakha (Yakutia), z-score, %

Соц.-эконом. зона	$z < -3$	$-3 \leq z < -2$	$-2 \leq z < -1$	$-1 \leq z \leq +1$	$+1 < z \leq +2$	$+2 < z \leq +3$	$z > +3$
	3 years, «height-for-age»						
RS(Ya)	0	4.63	17.77	63.27	8.53	3.83	1.95
Arctic zone	0	5.88	5.88	82.35	5.88	0	0
Eastern zone	0	8.33	25.00	41.66	25.0	0	0
Western zone	0	4.29	21.43	62.86	7.14	4.29	0
Central zone	0	4.65	23.23	62.79	4.65	1.55	3.10
Southern zone	0	0.00	13.33	66.67	0.00	13.33	6.67
Соц.-эконом. зона	3 years. «body mass index for age»						
	3 years. «head circumference for age»						
RS(Ya)	0.29	0.29	6.35	61.60	22.39	4.30	4.77
Arctic zone	0	0	0	70.59	23.53	0	5.88
Eastern zone	0	0	0	66.66	25.00	0	8.33
Western zone	1.43	1.43	11.42	55.71	20.00	8.57	1.43
Central zone	0	0	7.03	61.72	23.44	6.25	1.53
Southern zone	0	0	13.33	53.33	20.00	6.67	6.67
Соц.-эконом. зона	3 years. «circumference of the middle part of the shoulder»						
	6 years. «height-for-age»						
RS(Ya)	0.58	3.16	11.17	60.71	16.99	8.05	1.85
Arctic zone	0	5.88	11.76	58.82	17.65	5.88	0
Eastern zone	0	0	0	58.33	8.33	25	8.33
Western zone	1.43	1.43	27.14	68.57	14.29	0	0
Central zone	0.9	1.80	3.60	71.17	18.02	2.70	0.9
Southern zone	0	6.67	13.33	46.67	26.67	6.67	0
Соц.-эконом. зона	6 years. «body mass index for age»						
	6 years. «body mass index for age»						
RS(Ya)	0.19	1.33	3.99	44.72	16.46	8.37	4.09
Arctic zone	0	6.67	0	40.00	33.33	6.67	13.33
Eastern zone	0	0	0	50.00	25.00	25.00	0
Western zone	0	0	8.89	68.89	11.11	6.67	4.44
Central zone	0.95	0	11.43	67.62	13.33	3.81	2.86

Table 2

The results of the assessment of the physical development of rural and urban children of preschool age

Index	Urban	Rural	p
3 year			
Height	98,55 (95-102,64)	97,3(94-100,5)	0,008
Weight	15,18(14,0-16,5)	15,0(14,0-16,55)	0,574
Body mass index	15,64(14,86-16,69)	15,85(14,6-16,97)	0,993
6 year			
Height	118(114,85-121,35)	115(111,9-118,65)	0,0001
Weight	21,15(19,32-23,6)	20,55(18,7-23,1)	0,023
Body mass index	15,17(14,39-16,39)	18,05(15,91-20,5)	0,0001

also environmental factors, such as nutritional conditions, upbringing, the presence of diseases, social, climatic and other factors, have a significant impact on the process of growth and development of children [4, 5].

In recent years, a significant number of overweight and underweight children have been registered, there is a tendency to disharmonious development of children, an increase in the frequency of various deviations from normal developmental parameters [1, 2, 3].

Impairment of physical development is the result of long-term exposure to inadequate nutrition, lack of child care, poor environmental and socio-cultural conditions. This is associated with higher morbidity and mortality, mental retardation, poor educational achievement, and reduced intellectual ability, all of which are strong predictors of human capital and social progress.

Childhood malnutrition is estimated to be the largest contributor to the global burden of disease, killing millions of children in developing countries and causing high health care costs [6].

In some regions of Russia, due to the diversity of climate and geographical areas, nationalities and ethnic groups, differences in the social and economic situation, regional indicators of the physical development of children have been developed. In the Republic of Sakha (Yakutia) in the 2000s. research was conducted and regional standards for the physical development of children under the age of 7 were developed.

The purpose of this work is to identify, compare and evaluate the physical development of preschool children in 5 socio-economic zones of the republic: arctic, eastern, western, central, southern.

Materials and methods. To assess the physical development of children, anthropometry was carried out, the following somatometric indicators were

measured: height, body weight, head circumference, circumference of the middle part of the shoulder, subcutaneous fat of the back and shoulder according to the AnthroWHO-2007 program guidelines. Preliminarily representatives of all identified children received informed consent.

According to the requirements, anthropometric measurements were carried out on a naked child, in the "at attention" position (the child stands upright, tucking up his stomach and straightening his shoulders, lowering his arms along the body, putting his heels together, toes apart, the head is set in the "horizontal" position - the lower edge of the orbit and the upper edge of the tragus of the ear are in the same horizontal plane) in the first half of the day, since the body length decreases by 1-2 cm by the end of the day due to the flattening of the arches of the foot, intervertebral cartilage, a decrease in muscle tone, and body weight increases on average almost per 1 kg.

Height was measured in a standing position at the height of inhalation on a vertical electronic stadiometer REP-1 Napolny, with an error of ± 2 mm. The

counting was carried out from the platform along the vertical rack.

Body weight was measured on a БМЭН-150-100-И-Д-А electronic scale. These scales are easy to use. Allow to measure the weight of people up to 150 kg. Measurement accuracy up to 100 g. Before weighing, the scales were checked and adjusted.

The data of anthropometric measurements were entered into an individual card. All anthropometric data of the subject were accompanied by mandatory information, such as: individual number, date of examination, gender, year, month and date of birth (with subsequent calculation of age on the day of the examination).

All obtained somatometric data were entered into the WHO Anthro (from 0 to 5 years old) and WHO Anthroplus for personal computers (from 5 to 19 years old) computer programs. This program allows you to calculate individual indicators of height, body weight, BMI and evaluate them in accordance with the current WHO standards on a percentile scale and on a Z-score, with the criteria of underweight, short stature -2SD, over-

Table 3

Height and weight indicators with an interval of 20 years

Indicators	Age	Data of Zakharova N.M. (1976)		Data of Zakharova N.M. (2001)		Own research (2022)	
		Д	М	д	М	д	М
Height (cm)	3.0	92.29	92.54	93.38	94.52	97.75 \pm 3.97	99.20 \pm 4.02
	4.0	98.64	99.80	99.47	100.38	104.13 \pm 4.33	103.87 \pm 3.08
	5.0	104.92	104.76	104.91	105.17	112.12 \pm 4.36	112.53 \pm 4.43
	6.0	109.98	111.36	111.01	111.80	116.15 \pm 4.77	118.03 \pm 4.18
Weight, (kg)	3.0	14.35	14.88	14.32	15.00	15.30 \pm 1.81	15.78 \pm 1.68
	4.0	15.85	16.17	15.79	16.30	17.46 \pm 2.33	17.10 \pm 1.84
	5.0	17.27	17.64	17.76	17.42	19.90 \pm 2.59	19.96 \pm 2.30
	6.0	18.94	19.40	19.33	19.67	21.4 \pm 2.86	22.5 \pm 3.19

weight +1SD, obesity, tall stature + 2SD.

Research results. The study involved 17 municipal districts representing 5 socio-economic zones of the republic: arctic, eastern, western, central, southern. In total, 643 pupils of preschool educational institutions from 3 to 6 years old were involved, of which children with an actual age of 3 years in the amount of 208 and 6 years in the amount of 127 were included in the study group on physical development.

We carried out an assessment of physical development in the socio-economic zones of the republic in which children lived. The proportion of children meeting WHO standards in general was 88.3% at the age of 3 years, and 65.2% at the age of 6 years. The table below presents data on territorial administrative zones (Table 1).

At the age of 3 years, short stature is most often found in the regions of the Eastern zone (8.33%), and tall stature in the regions of the Southern zone (20%). Underweight is more common in areas of the Western zone (2.84%), and in this zone the largest number of overweight children (8.57%). Obese children are more common in areas of the Southern zone (6.67%).

At the age of 6 years, the prevalence of short stature is higher in the areas of the Western zone (8.51%). The proportion of tall children is higher in the regions of the Central Zone (5.72%). Overweight children are more common in areas of the Eastern zone (25%), with obesity in areas of the Arctic (13.33%) and Western zones (4.26%).

In addition, we compared the main parameters of the physical development of rural children with urban children (Table 2).

The analysis showed that rural children in both age groups lag behind in height. At the age of 6 years, the lag in physical development in rural children increases ($p < 0.0001$). At the same time, the body mass index is higher than that of urban residents, against the background of low growth and almost equal weight categories.

In order to identify the acceleration of development rates, a comparison was made of the average values of the height-weight indicators of the physical development of boys and girls aged 3 to 6 years with an interval of more than 20 years, the data are presented in table 3.

As can be seen from the table, children are now taller and larger in body weight, which shows the acceleration of their development compared to the previous generation and confirms the fact of acceleration.

Conclusion. According to the results of the study, it was revealed that the physical development of most children correspond to the WHO standard for height and body weight. However, there are a number of children with deviations towards deficiency or overweight. It is also worth paying attention to the differences in the physical development of children depending on the socio-economic zone of residence, which confirms the need to take into account this aspect. Such differences may be related to the climate, economic situation and other factors. In addition, given the dynamics of growth and weight indicators of preschool children over the past 20 years, the need to update the standards of physical development of children of this age group is obvious.

In general, the study allows us to assess the physical development of chil-

dren and identify problem areas that require additional attention and correction.

Reference

1. Grechkina L.I., Karandasheva V.O. Sravnitel'naya harakteristika fizicheskogo razvitiya detej i podrostkov – urozhencev pervogo i vtorogo pokoleniya evropeoidov magadanskoj oblasti [Comparative characteristics of physical development of children and adolescents of the 1st and 2nd generation of European natives of the Magadan region]. *Gigiena i sanitariya* [Hygiene & Sanitation (Russian Journal). 2017; 90(2):171-176 (In Russ.).]
2. Marinova L.G., Savvina N.V., Savvina I.L. Ozhirenie u detej YAKUTII: social'no-gigienicheskie aspekty i klinicheskaya harakteristika [Obesity in the Yakutia children: socio-hygienic aspects and clinical characteristics]. *Yakutskij medicinskij zhurnal* [Yakut medical journal, 2015; 3 (15): 51-53 (In Russ.).]
3. Peterkova V.A., Taranushenko T.E., Kisel'eva N.G., Tepper E.A., Terent'eva O.A. Ocenka pokazatelej fizicheskogo razvitiya v detskom vozraste [Assessment of indicators of physical development in childhood]. *Medicinskij sovet* [Medical Council, 2016; 7:28-35 (In Russ.).]
4. Savvina M.S., Burtseva T.E., Chasnyk V.G., Egorova V.B., Munkhalov A.A. Ocenka fizicheskogo razvitiya detej i podrostkov raznyh etnicheskikh grupp, prozhivayushchih v Respublike Saha (Yakutiya) [Assessment of the physical development of children and adolescents of different ethnic groups living in the Republic of Sakha (Yakutia)] *Yakutskij medicinskij zhurnal* [Yakut medical journal, 2021; 60-63 (In Russ.).]
5. Yakovleva L.V., Yudina R.A. Fizicheskoe razvitiye i zdorov'e detej 3-7 let: metodich [Physical development and health of children 3-7 years old: methodical recommend]. rekomend. Programma «Start» [program 'Start'. M.: Vlados, 2014; 315 (In Russ.).]
6. Manasova I.S., Yadgarova Sh.S. Analiz pokazatelej fizicheskogo razvitiya detej doskol'nogo vozrasta [Analysis of indicators of physical development of preschool children]. *Central'noaziatskij zhurnal medicinskih i estestvennyh nauk* [Central Asian journal of medical and natural sciences 2021; 02:154-157 (In Russ.).]