

COMPARATIVE ANALYSIS OF PHYSICAL DEVELOPMENT IN CHILDREN LIVING IN SAMARA AND NIZHNY NOVGOROD

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Analysis of physical development in children and adolescents is an integral to the monitoring of child population. Health status of children and adolescents is an essential criterion of societal welfare. Numerous studies of physical development in children indicate the heterogenous nature of growth and developmental processes in children living in various regions of Russia. The study was aimed to perform the comparative analysis of physical development between children aged 15–17 living in Samara (a total of 714 children were examined, among them 368 boys and 346 girls) and children of the same age group living in Nizhny Novgorod (a total of 689 children, among them 351 boys and 338 girls). In school students aged 16–17, significant differences in the mean height were revealed: adolescents living in Samara were taller than those living in Nizhny Novgorod ($p = 0.001$). The same trend was observed in girls of the same age group. Comparative analysis showed that girls aged 15–17 living in Samara were significantly taller ($p < 0.001$) than girls who lived in Nizhny Novgorod. Assessment of body weight showed that the weight of boys aged 15–16 who lived in Samara was significantly higher compared to boys living in Nizhny Novgorod ($p = 0.009$). No significant differences were revealed between the groups of 17-year-old boys and the groups of girls aged 15–17 ($p = 0.7$). The findings on the differences in the anthropometric indicators of children living in Samara and Nizhny Novgorod justify the need for periodic development and use in healthcare practice of the regional standards for assessment of physical development in children and adolescents.

Key words: hygiene of children and adolescents, physical development, regression scales

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Compliance with ethical standards: the study was approved by the Ethics Committee of the Samara State Medical University (protocol No. 2 dated February 24, 2021). The informed consent was obtained from all subjects (their legal representatives).

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СРАВНИТЕЛЬНЫЙ АНАЛИЗ ФИЗИЧЕСКОГО РАЗВИТИЯ ДЕТЕЙ Г. САМАРА И Г. НИЖНИЙ НОВГОРОД

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Анализ физического развития детей и подростков является неотъемлемой частью мониторинга детской популяции. Состояние детского и подросткового здоровья — это неотъемлемый критерий уровня благополучия общества. Многочисленные исследования физического развития детского населения свидетельствуют о неоднородных процессах роста и развития детей в разных регионах России. Целью исследования был сравнительный анализ физического развития детей в возрасте от 15–17 лет, проживающих на территории г. Самара, всего обследовано 714 детей (из них 368 мальчиков и 346 девочек) с данными физического развития той же возрастной группы детей, проживающих в г. Нижний Новгород, всего 689 детей (из них 351 мальчик и 338 девочек). В возрастной группе школьников 16–17 лет выявлены высоко достоверные различия в средних значениях показателя длины тела: показатель у подростков, проживающих в г. Самара, выше, чем у детей в г. Нижний Новгород ($p = 0,001$). Аналогичная тенденция наблюдалась и у девочек той же возрастной категории. В ходе сравнительного анализа было выявлено, что длина тела у девочек 15–17 лет из г. Самара достоверно выше ($p < 0,001$), чем у девочек, проживающих в г. Нижний Новгород. Результаты анализа массы тела показали, что у юношей 15–16 лет, проживающих в г. Самара, достоверно более высокая масса тела по сравнению с юношами из г. Нижний Новгород ($p = 0,009$). В возрастных группах 17 лет у юношей и 15–17 лет у девушек достоверных различий выявлено не было ($p = 0,7$). Полученные результаты различий антропометрических показателей детей г. Самара и г. Нижний Новгород обосновывают необходимость периодической разработки и использования в практическом здравоохранении региональных нормативов (стандартов) для оценки физического развития детей и подростков.

Ключевые слова: гигиена детей и подростков, физическое развитие, антропометрические показатели

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Physical development is a conventional indicator of physical capacity in children and adolescents. According to research, in the regions of our country a little over 60% of boys and about 67% of girls show the harmonious physical development. In 18% of boys and 14% of girls, disharmonious physical development results mainly from overweight [1–3]. Protecting the health of the younger generation is integral to provision health-care of the nation. Individual and collective assessment of the adolescent development is the most important method used to monitor the status of the adolescent health [4]. Considerable research on the physical development of children and adolescents indicates the growth and development heterogeneity in children living in certain cities and regions of Russia. There is evidence of the increasing number of children having poor physical development due to the increasing number of children with low weight and height. In recent years, rapid deterioration of physical development is observed in children who live in the Volga Federal District. The incidence of non-communicable diseases, such as obesity, increases, the number of healthy children decreases, and there are more and more children with chronic disorders [5]. Technogenic contaminants are the other important factor contributing to growth and development of a child. It has been found that the impact of this factor varies both within the region and between the regions of one federal district [4–6, 7]. Accordingly, the growth and developmental processes in the child population are heterogeneous.

The study was aimed to perform the comparative analysis of physical development in children of secondary school age living in Samara and Nizhny Novgorod.

METHODS

Research involved comparison of our data on the physical development of boys and girls aged 15–17 living in Samara with the data on the physical development of children of the same age group living in Nizhny Novgorod. The Samara survey sample included 714 children, among them 368 boys (51.5%) and 346 girls (48.5%), and the Nizhny Novgorod survey sample included 689 children, of them 351 boys (51%) and 338 girls (49%). Inclusion criteria: age 15–17 years, permanent residence in the territory of Samara and Nizhny Novgorod regions; compliance with the health status group I or II based on medical documentation; informed consent to the study participation submitted by parents (legal representatives). Exclusion criteria:

age at the time of examination less than 14 years 6 months and one day or over 17 years 6 months and one day; permanent residence outside of Samara and Nizhny Novgorod regions; no informed consent to participation (refusal of participation) provided by parents (legal representatives).

The main anthropometric indicators (height, body weight) were measured. Then the following parameters were calculated based on the anthropometric measurements: mean values (M), standard deviation (σ), standard error of the mean (m), minimum and maximum values (min and max). The data were compared with the data obtained when studying the groups of school students of the same gender and age (aged 15–17) living in Samara and Nizhny Novgorod [5, 7]. The raw data were acquired and stored using the Microsoft Excel 2013 software (Microsoft, USA). Statistical processing of the results included the analysis of variance performed using the Statistica 13.1 software package (StatSoft Inc., USA). Statistical significance of the differences was analyzed using the Pearson's χ^2 test. The differences were considered significant at $p < 0.05$.

RESULTS

The findings have revealed no significant differences in height between the groups of 15-year-old boys living in Samara and Nizhny Novgorod ($p=0.2$).

It should be noted that in school students aged 16–17, significant differences in the mean height have been revealed: adolescents living in Samara are taller than those living in Nizhny Novgorod ($p=0.001$).

The same trend is observed in girls of the same age group.

Comparative analysis has shown that the girls aged 15–17 living in Samara are significantly taller ($p < 0.001$) than those living in Nizhny Novgorod (Table 1).

Analysis of our data on body weight has revealed the following: body weight of boys aged 15–16 living in Samara is significantly higher compared to boys living in Nizhny Novgorod ($p = 0.009$). At the same time, no significant differences have been revealed between the groups of 17-year-old boys and the groups of girls aged 15–17 ($p > 0.05$). Perhaps it has something to do with the fact that modern teenagers are more and more concerned about their appearance, tend to maintain good physical shape and are engaged in sports. This could also result from the influence of mass media presenting movies and programs, claiming the slim boys and girls are successful and attractive, as a fashion trend (Table 2).

Table 1. Height of boys and girls aged 15–17

Age, City	Height, boys, cm M + m					Height, girls, cm M + m				
	N	Samara	N	Nizhny Novgorod	P	N	Samara	N	Nizhny Novgorod	P
15	138	170.1 ± 0.7	116	168.8 ± 0.81	0.2	111	165.8 ± 0.6	123	161.8 ± 0.45	$P < 0.001$
16	123	176.3 ± 0.8	102	171.1 ± 0.87	0.001	120	166.5 ± 0.8	112	162.8 ± 0.54	0.001
17	107	179.6 ± 1.1	133	174.7 ± 0.57	0.001	115	167.3 ± 1.3	103	163.5 ± 0.37	0.005

Table 2. Body weight of boys and girls aged 15–17

Age, City	Body weight, boys, cm M + m					Body weight, girls, cm M + m				
	N	Samara	N	Nizhny Novgorod	P	N	Samara	N	Nizhny Novgorod	P
15	138	62.2 ± 1.1	116	58.6 ± 0.82	0.009	111	54.4 ± 1.1	123	55.1 ± 0.76	0.6
16	123	67.7 ± 1.5	102	62.6 ± 0.88	0.009	120	55.7 ± 1.3	112	56.1 ± 0.87	0.7
17	107	67.1 ± 2.1	133	66.8 ± 0.76	0.89	115	57.3 ± 2.1	103	57.9 ± 0.77	0.7

DISCUSSION

The regional approach to assessment of physical development in children and adolescents is used in many regions [3, 6, 8, 9]. The sources are scientific papers on the hygiene of children and adolescents and developmental physiology, teaching resources, scientific and practical experience of hygienists [10–12]. Our study, focused on the comparative analysis of physical development in school students, revealed the significant differences in height between boys aged 16–17 living in Samara and Nizhny Novgorod. The same was observed when studying body weight: boys aged 15–16 who lived in Samara had a significantly higher weight compared to boys living in Nizhny Novgorod. The differences observed are in line with the data of other studies conducted in the Volga Federal District [6, 13]. The decrease in the mean body weight in the 17-year-old boys living in Samara by 0.6 kg compared to the 16-year-old boys, along with the increase in the mean height by 3.3 cm, are consistent with the results of similar studies [14, 15]. Here we could endorse the views of the authors that in boys the increase in body height stops at the age over 18–19 years, along with the changes in the body proportions and limb length. At the age of 17 years, the percentage of individuals actively and systematically engaged in physical exercise and sports also increases, which is reflected in the variable trait of body height. Thus, based on the major anthropometric indicators, physical development of children aged 15–17 living in the

same region varies, which could be due to the environmental impact, lifestyle, as well as climatic, geographical, and social factors [10–13]. Consequently, correct assessment of physical development as a stage in the premorbid diagnosis of pediatric disorders, performed during the routine check-ups, should be based on the regional anthropometric indicators. Assessment based on the regional regression scales for body weight and height taking into account the ratios between the major anthropometric indicators is considered the most appropriate method, which meets not only the requirements of modern legislation on the essential reports, but also the challenge of assessing the physical development of the individual child and the child population as a whole [13]. In turn, anthropometric data, acquired by studying the homogeneous groups of children, are the representative material for the establishment of standards for physical development and construction of regional regression scales for prediction of body weight from height [6].

CONCLUSION

The study of physical development in school students aged 15–17 living in two regions of the Volga Federal District revealed the significant differences in the major anthropometric indicators. The findings justify the need for the development and use in healthcare practice of the regional standards for assessment of physical development in adolescents of this age group.

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