

## DYNAMIC CHANGES IN PHYSICAL DEVELOPMENT INDICATORS OF HIGH SCHOOL-AGE CHILDREN IN THE SAMARA REGION OVER A DECADE

Trubetskaya SR , Sazonova OV, Gavryushin MYu, Hamtsova RV, Tupikova DS, Frolova OV

Samara State Medical University, Samara, Russia

Physical development in adolescence is one of the key aspects of the modern society's well-being. Assessment of physical development in children and adolescents represents an essential component of the pediatric population health status estimation being a clear indicator of the impact of lifestyle, environment, and learning process on the child's body. The study was aimed to assess the dynamic changes of physical development indicators in the high school-age children in the Samara Region over a decade. The paper deals with the anthropometric data of physical development acquired in 2013 and 2023. A total of 476 children aged 14–16 years were examined (256 boys, 220 girls). Physical development assessment performed in the group of high school-age boys revealed significant changes. Boys of all ages examined in 2023 lagged behind their peers examined in 2013 in the number of individuals with harmonious physical development. Furthermore, a significantly greater number of children with disharmonious physical development due to excess body weight were revealed in 2023. The results yielded by assessing physical development in girls are slightly different: the today's 14-year-old schoolgirls lag behind girls examined in 2013 in the size of population with harmonious physical development. The body height comparative analysis results have shown that the today's schoolchildren do not lag behind their peers examined in 2013 in all gender-age groups ( $p > 0.05$ ). A significant increase in the schoolchildrens' body weight relative to 2013 is likely to result from the quarantine measures related to the COVID-19 pandemic, which made children stay at home for longer and reduced their physical activity.

**Keywords:** hygiene of children and adolescents, physical development, dynamics, anthropometry

**Author contribution:** Trubetskaya SR, Gavryushin MYu — research initiators; Sazonova OV — academic advising; Hamtsova RV — processing of the results, manuscript editing; Tupikova DS — data acquisition, preparing the results; Frolova OV — literature review, manuscript writing.

**Compliance with ethical standards:** the study was approved by the Ethics Committee of the Samara State Medical University (protocol No. 9 dated 24 September 2022). The informed consent was obtained from all participants (their legal representatives).

✉ **Correspondence should be addressed:** Sabrina R. Trubetskaya  
Chapayevskaya, 89, Samara, 443099, Russia; s.r.trubetskaya@samsmu.ru

**Received:** 18.04.2024 **Accepted:** 14.05.2024 **Published online:** 29.06.2024

**DOI:** 10.24075/rbh.2024.101

## ДИНАМИКА ПОКАЗАТЕЛЕЙ ФИЗИЧЕСКОГО РАЗВИТИЯ У ДЕТЕЙ СТАРШЕГО ШКОЛЬНОГО ВОЗРАСТА В САМАРСКОЙ ОБЛАСТИ ЗА ДЕСЯТИЛЕТНИЙ ПЕРИОД

С. Р. Трубецкая , О. В. Сазонова, М. Ю. Гаврюшин, Р. В. Хамцова, Д. С. Тупикова, О. В. Фролова

Самарский государственный медицинский университет, Самара, Россия

Физическое развитие подростков является одним из ключевых аспектов благополучия современного общества. Изучение физического развития детей и подростков — неотъемлемая часть оценки состояния здоровья детской популяции, которая служит наглядным показателем влияния образа жизни, окружающей среды и образовательного процесса на организм ребенка. Целью исследования было проанализировать динамику показателей физического развития у детей старшего школьного возраста в Самарской области за десятилетний период. В статье рассмотрены антропометрические данные физического развития, полученные в 2013 и 2023 г. Были обследованы 476 детей в возрасте 14–16 лет (256 мальчиков, 220 девочек). Исследования физического развития в группе мальчиков старшего школьного возраста выявили значимые различия. Мальчики всех возрастов, обследованные в 2023 г., отстают от своих сверстников, обследованных в 2013 г., по количеству человек с гармоничным физическим развитием, при этом 2023 г. выявлено значимо больше детей с дисгармоничным физическим развитием за счет избыточной массы тела. Результаты анализа физического развития у девочек несколько отличаются: современные 14-летние школьницы отстают от обследованных в 2013 г. по наполняемости группы с гармоничным физическим развитием. Результаты проведенного сравнительного анализа длины тела продемонстрировали, что современные школьники во всех возрастно-половых группах не отстают от их сверстников, обследованных в 2013 г. ( $p > 0,05$ ). Заметный рост массы тела у школьников по сравнению с 2013 г., вероятно, обусловлен карантинными мерами в связи с пандемией COVID-19, которые привели к увеличению времени, проводимого детьми дома, и снижению их физической активности.

**Ключевые слова:** гигиена детей и подростков, физическое развитие, динамика, антропометрия

**Вклад авторов:** С. Р. Трубецкая, М. Ю. Гаврюшин — инициаторы исследования; О. В. Сазонова — научное руководство; Р. В. Хамцова — обработка результатов, редактирование рукописи; Д. С. Тупикова — сбор материала, подготовка результатов; О. В. Фролова — анализ литературы, подготовка рукописи.

**Соблюдение этических стандартов:** исследование одобрено этическим комитетом ФГБОУ ВО СамГМУ Минздрава России (протокол № 9 от 24 сентября 2022 г.). Добровольное информированное согласие было получено от каждого участника или его законного представителя.

✉ **Для корреспонденции:** Сабрина Рустамовна Трубецкая  
ул. Чапаевская, д. 89, г. Самара, 443099, Россия; s.r.trubetskaya@samsmu.ru

**Статья получена:** 18.04.2024 **Статья принята к печати:** 14.05.2024 **Опубликована онлайн:** 29.06.2024

**DOI:** 10.24075/rbh.2024.101

Comprehensive assessment of physical development in children and adolescents is a critically important component of the pediatric population health status estimation. This makes it possible to identify the effects of the lifestyle factors, environment, and learning process on the growing child's body [1, 2]. A considerable amount of scientific research on assessing physical development in children during various age periods

is carried out in order to monitor the pediatric population health status. The children's harmonious development, well-being, and social adaptation determine the future of our country [3, 4].

The physical development level is determined by the values of key anthropometric parameters (body height and weight), and the ratio of these parameters determines whether the child's development is harmonious. Furthermore, physiological

parameters that reflect the activity of body's structural components also play an important role in assessment of physical development [5, 6].

The results of large-scale studies confirm unfavorable trends in children and adolescent health. There is a decrease in the number of healthy children, along with the increase in the number of children with chronic disorders or disability [7]. The child's body continuously grows and develops; any deviations from normal can indicate health problems. Physical maturation follows biological patterns and reflects the general patterns of body's growth and development [8]. However, the long-term urbanization, transformation of the environment, changes in the population ethnic makeup, effects of the climatic and geographic conditions, lifestyle, as well as different quality of care provision also influence the processes of children's physical development.

The regional indicators of physical development used to assess the development of traits are based on the anthropometric assessment of homogenous groups of children. These indicators need to be continuously updated and adapted for each region of Russia. The regional standards of physical development for children and adolescents living in the Samara Region, which were updated in 2013, need to be revised. In this regard, it is relevant to assess dynamic changes in the main physical development indicators in this region considering the regional and temporal features.

The study was aimed to assess the dynamic changes of physical development indicators in the high school-age children in the Samara Region over a decade.

## METHODS

The surveyed group included 476 children aged 14–16 years (256 boys, 220 girls), who attended secondary educational institutions in Samara and had no clinical manifestations of disorders; at the time of measurement they belonged to the health status groups 1 and 2. The surveyed children had been permanent residents of Samara for more than 5 years. The children belonging to the health status group 3 or higher, who did not attend general educational institutions or lived in Samara for less than 5 years, were excluded from the study. Body height and weight were measured using standard equipment: body height using a stadiometer (Tves; Russia) with an accuracy of up to 0.5 cm, body weight using the VEM-150-Massa-K scales (Massa-K; Russia) with an accuracy of up to 60 g. The anthropometric characteristics (body height and weight) were estimated using the regional regression scales for the Samara Region in the Anthro-prof software package "Program for Assessing Physical Development in Schoolchildren" [9, 10].

The data obtained were compared with similar physical development indicators obtained in the study conducted in 2013. The study involved 496 adolescents aged 14–16 years (263 boys and 231 girls), who attended secondary educational institutions in Samara [11].

Statistical processing of the results was performed using the StatTech 4.0 (StatTech; Russia) software package and MyOffice (New Cloud Technologies; Russia). Significance of differences between the values compared was determined using the chi-squared test ( $\chi^2$ ); Yates's correction was applied when necessary. The critical significance level was considered to be 0.05, when testing the statistical hypotheses. Student's t-test was used to estimate significance of differences between the mean values. The differences were considered significant at  $p \leq 0.05$ .

## RESULTS

Estimation of children's physical development throughout two assessment periods revealed no children with disharmonious physical development due to abnormal body height.

Estimation of physical development in senior school-age boys revealed significant differences in boys aged 14 and 15 years relative to their peers examined in 2013. Thus, the share of 14-year-old children with harmonious physical development was 69.5% in 2013, while in 2023 it was 50% ( $p = 0.024$ ). However, the share of children with disharmonious physical development due to excess body weight increased: it was 14.7% in 2013 and 31.5% in 2023 ( $p \leq 0.05$ ). Furthermore, the percentage of children with disharmonious physical development due to underweight increased in 2013.

The share of 15-year-old boys with harmonious physical development was 72.5% in 2013 and 68.2% in 2023. The share of children with disharmonious physical development due to excess body weight was 8.7% in 2013, while in 2023 it was 16.6%. The differences between peers assessed in two different decades were significant ( $p \leq 0.05$ ). Comparison of physical development in the 16-year-old boys assessed in 2013 and 2023 revealed no significant differences ( $p > 0.05$ ). In 2013, the share of boys with harmonious physical development was 61%, while in 2023 it was as low as 38.2%. Furthermore, the percentage of adolescents with disharmonious physical development due to underweight increased in this age group: in 2013 it was 22.0%, and in 2023 it was 47.1%. Amidst this the percentage of overweight boys decreased: it was 17% in 2013 and dropped to 14.7% in 2023 (Table 1).

Such trend was also observed in girls. By the age of 16, the share of today's children with harmonious physical development becomes the same as the share of their peers examined in 2013. Assessment of 14-year-old girls revealed significant differences in the physical development estimation results ( $p \leq 0.05$ ). The share of girls with harmonious physical development dropped to 37.5% in 2023, while in 2013 it constituted more than a half of the surveyed adolescents of the same age group (56.3%). In contrast, in 2023 the share of girls with disharmonious physical development due to excess body weight increased to 34.5%. In 2013 the value of this group was 23.1%. Despite the growing number of overweight girls, the prevalence of underweight among girls also increased relative to 2013 (to 28 and 20.6%, respectively). Physical development of the 15- and 16-year-old girls surveyed in 2023 did not differ from that reported in 2013. Harmonious physical development was reported in 51.2% of 16-year-old girls surveyed in 2013 and 61.8% of girls surveyed in 2023. No differences were also revealed in the OW and UW groups of both 15- and 16-year-old girls (Table 2).

Comparison of the mean values of major anthropometric traits of children surveyed in different decades revealed significant differences. According to the assessment results obtained in 2023, a significant increase in body height was revealed in the groups of 14- and 15-year-old-boys relative to their peers surveyed in 2013. Thus, body height of 14-year-old boys was  $157.3 \pm 0.64$  cm in 2013 and  $168.2 \pm 1.8$  cm in 2023 ( $p < 0.01$ ). In 15-year-old boys, body height was  $163.6 \pm 0.77$  cm in 2013 and  $170.3 \pm 1.1$  cm in 2023 ( $p < 0.01$ .) There were no significant differences between the values of 16-year-old boys:  $176.53 \pm 0.93$  cm in 2013,  $176 \pm 1.1$  cm in 2023 ( $p = 0.37$ ).

When comparing body height in girls surveyed in 2023, a significant increase in body height at the age of 14 and 15 years relative to the peers surveyed in 2013 was reported. Thus, body height of the 14-year-old girls was  $147.3 \pm 0.64$  cm

**Table 1.** Physical development of boys aged 14–16 years

14 years					
Physical development	2023		2013		$\chi^2, p$
	<i>n</i> = 80		<i>n</i> = 87		
	Abs.	%	Abs.	%	
H(N)PD	40	50	60	69.5	$\chi^2 = 7.544^*$ $p = 0.024^*$
UW	15	18.5	14	15.8	
OW	25	31.5	13	14.7	
15 years					
Physical development	2023		2013		$\chi^2, p$
	<i>n</i> = 92		<i>n</i> = 89		
	Abs.	%	Abs.	%	
H(N)PD	56	68.2	65	72.5	$\chi^2 = 10.807^*$ $p = 0.005^*$
UW	12	15.2	17	18.8	
OW	24	16.6	7	8.7	
16 years					
Physical development	2023		2013		$\chi^2, p$
	<i>n</i> = 84		<i>n</i> = 90		
	Abs.	%	Abs.	%	
H(N)PD	32	38.2	55	61	$\chi^2 = 0.294$ $p = 0.864$
UW	40	47.1	20	22	
OW	12	14.7	15	17	

**Note:** H(N)PD — harmonious (normal) physical development; UW — underweight; OW — overweight; \* — significant results.

in 2013, and in 2023 it was  $153.9 \pm 1.1$  cm ( $p < 0.01$ ). Body height of the 15-year-old girls was  $160.8 \pm 1.1$  in 2013 and  $165.8 \pm 0.77$  cm in 2023 ( $p < 0.01$ ). The values of 16-year-old girls were as follows: 2013 —  $176.53 \pm 0.93$  cm, 2023 —  $176.0 \pm 1.1$  cm ( $p = 0.66$ ) (Fig. 1).

Physical development of the boys surveyed in 2023 was significantly different from that of girls ( $p = 0.003$ ): the

percentage of underweight children among boys (15%) was significantly lower than among girls (30%) surveyed in 2023. However, boys with harmonious physical development showed no significant differences from their female peers ( $p = 0.605$ ).

When comparing boys and girls surveyed in 2013, it was found that the share of boys with harmonious physical development (68%) was significantly higher ( $p = 0.019$ ), than

**Table 2.** Physical development of girls aged 14–16 years

14 years					
Physical development	2023		2013		$\chi^2, p$
	<i>n</i> = 78		<i>n</i> = 87		
	Abs.	%	Abs.	%	
H(N)PD	29	37.5	49	56.3	$\chi^2 = 6.098^*$ $p = 0.048^*$
UW	22	28	18	20.6	
OW	27	34.5	20	23.1	
15 years					
Physical development	2023		2013		$\chi^2, p$
	<i>n</i> = 68		<i>n</i> = 68		
	Abs.	%	Abs.	%	
H(N)PD	24	31	33	48.5	$\chi^2 = 2.499$ $p = 0.287$
UW	24	31	20	29.4	
OW	20	38	15	32.1	
16 years					
Physical development	2023		2013		$\chi^2, p$
	<i>n</i> = 74		<i>n</i> = 76		
	Abs.	%	Abs.	%	
H(N)PD	46	61.8	39	51.2	$\chi^2 = 2.354$ $p = 0.309$
UW	22	29.4	26	34.2	
OW	6	8.8	11	14.6	

**Note:** H(N)PD — harmonious (normal) physical development; UW — underweight; OW — overweight; \* — significant results.

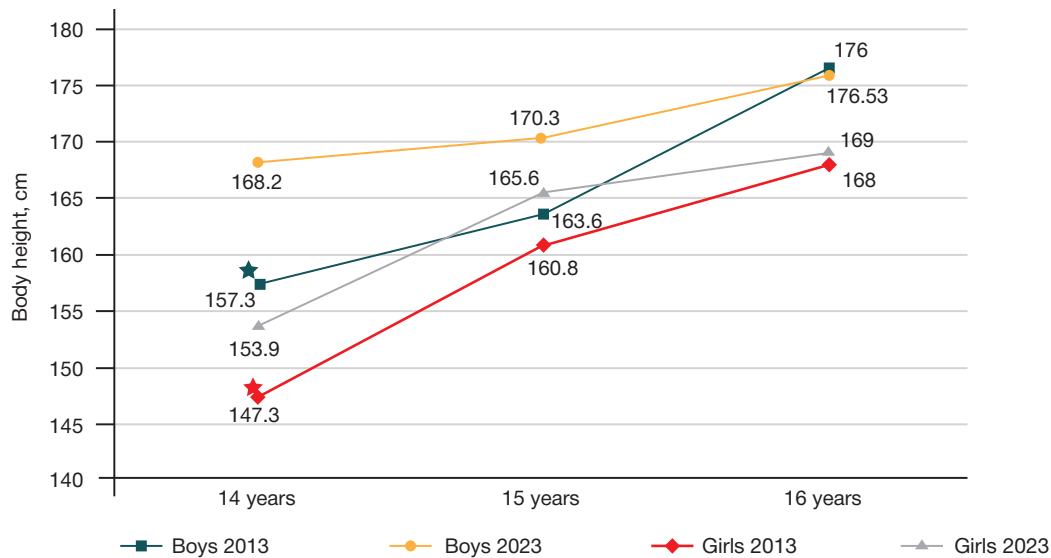


Fig. 1. Body height of boys and girls aged 14–16 years in Samara based on the body height assessment performed in 2013 and 2023

the share of girls (50%). Underweight and overweight boys were statistically the same as girls ( $p = 0.103$ ).

Comparison of body weight in the high school-age boys showed that the 14-year-old schoolboys surveyed in 2013 significantly ( $p = 0.044$ ) lagged behind their peers surveyed in 2023. Body weight values became the same by the age of 15 years. This could be due to the larger number of overweight children (Table 2). Thus, body weight of 14-year-old boys was  $46 \pm 4.08$  kg in 2013,  $50.3 \pm 0.86$  kg in 2023 ( $p < 0.01$ ). The values of 15-year-old boys were as follows:  $64.2 \pm 0.4$  kg in 2013,  $62.2 \pm 0.7$  kg in 2023 ( $p = 0.05$ ). Body weight of 16-year-old boys was  $66.73 \pm 0.3$  kg in 2013 and  $67.6 \pm 1.2$  kg in 2023 ( $p = 0.05$ ) (Fig. 2).

A similar trend was observed when comparing body weight in girls. Thus, the 14-year-old girls surveyed in 2013 had significantly lower body weight ( $p < 0.01$ ), than their peers surveyed in 2023. However, the body weight values obtained in 2013 and 2023 became the same by the age of 15 years.

Body weight of 14-year-old girls was  $49.6 \pm 1.8$  kg in 2013 and  $53.5 \pm 0.7$  kg in 2023 ( $p = 0.045$ ). The values of 15-year-old girls were as follows:  $54.27 \pm 0.6$  kg in 2013,  $54.4 \pm 1.1$  kg in 2023 ( $p = 0.91$ ). Body weight of 16-year-old schoolgirls was  $54.6 \pm 0.8$  kg in 2013,  $55.7 \pm 1.3$  kg in 2023 ( $p = 0.47$ ) (Fig. 2).

## DISCUSSION

Comparative analysis of the physical development assessment results has shown that children with harmonious physical development are significantly less common among today's schoolchildren of the Samara Region, than among their peers surveyed in 2013.

The study of the features of the indicator dynamics has revealed significant differences in the major anthropometric traits in each gender-age group. The lag in development of one anthropometric trait is not always associated with the corresponding trends of other developmental indicators in the same gender-age group. Significant differences in the number of underweight boys were revealed when comparing boys and girls. The observed decrease in the number of children with harmonious physical development resulting from the increase in the number of overweight boys and girls that was confirmed by significant differences in the average body height and weight can suggest specific features of sexual development in the discussed age groups [12, 13]. The change in the age of growth spurt was revealed when comparing the average anthropometric parameter values. In our opinion, which is in line with the other authors' opinions [14, 15], the change can result

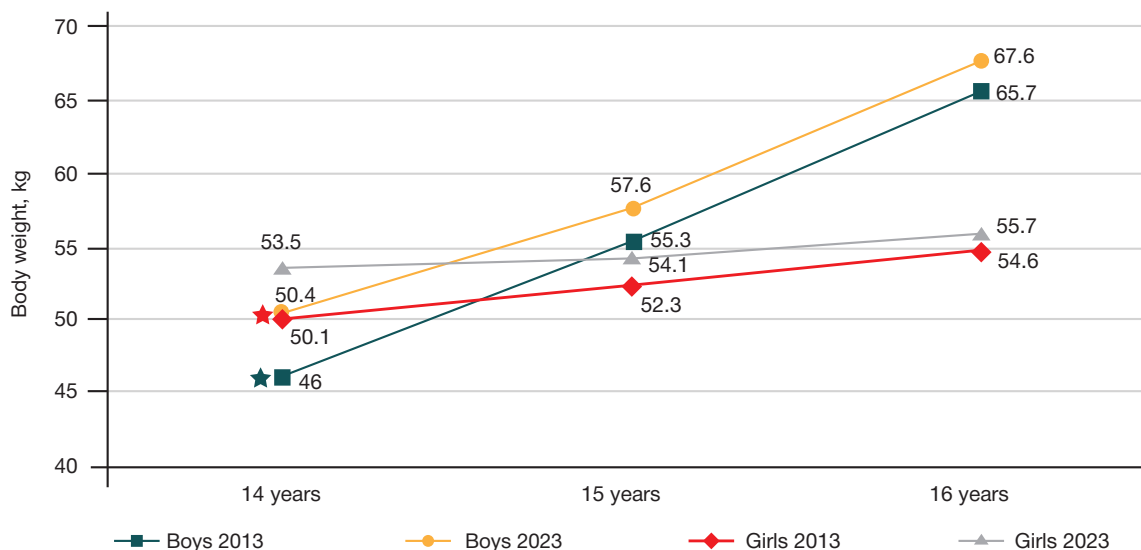


Fig. 2. Body weight of boys and girls aged 14–16 years in Samara based on the body height assessment performed in 2013 and 2023

from the features of the course of puberty and the impact of the altered diet, urbanization, and increased information load.

According to a number of researchers, the current trend is a significant increase in the number of children of this age group compliant with the basic principles of healthy lifestyle and actively involved in sports, which also has an effect on the anthropometric parameters. Thus, the authors note that body weight of the children engaged in swimming is significantly higher than body weight of their peers [16], while children engaged in tennis have body height that is significantly higher, than in children, who do not practice intense physical exercise [17].

A significant increase in the schoolchildren's body weight relative to the values reported in 2013 can be associated with the quarantine measures due to coronavirus infection (COVID-19): large amount of time spent at home, sedentary lifestyle, decreased physical activity [18].

## References

1. Bogomolova ES, Shaposhnikova MV, Kotova NV, Badeeva TV, Maksimenko EO, Kiseleva AS, et al. Charakteristika fizicheskogo zdorov'ya uchashhihsja sovremennyh obshheobrazovatel'nyh organizacij. *Gigiena i sanitarija*. 2019; 98 (9): 956–7 (in Rus.).
2. Novikova II, Gavriš SM, Romanenko SP, Sorokina AV, Serenko VV, Krejmer MA. Sravnitel'naja ocenka informativnosti metodov indikacii izbytočnoj massy tela. *Sanitarnyj vrach*. 2021; (4): 68–70 (in Rus.).
3. Valina SL, Shtina IE, Osheva LV, Ustinova OJu, Jejsfeld DA. Gigienicheskaja ocenka uchebnogo processa v shkolah s razlichnymi obrazovatel'nymi programmami. *Gigiena i sanitarija*. 2019; 98 (2): 166–70 (in Rus.).
4. Kuchma VR, Skoblina NA, Nadezhdin DS. Sravnitel'nyj analiz metodik ocenki fizicheskogo razvitija detej i podrostkov: beskonечnaja diskussija v nauke i praktike. *Pediatrija im. G.N. Speranskogo*. 2019; 98 (5): 196–201 (in Rus.).
5. Milushkina OJu, Skoblina NA, Popov VI, Sazonova OV, Gavriš MJu, Abdalova SR, et al. Ocenka fizicheskogo razvitija detej i podrostkov Rossijskoj Federacii: regional'nye shkaly regressii massy tela po dline tela (chast' 1). Samara, 2022; 220 p. (in Rus.).
6. Samarskij statističeskij ezhegodnik: stat. sbornik. Samara: Samarstat, 2023; 345 p. (in Rus.).
7. Girsh JaV, Gerasimchik OA. Rol' i mesto bioimpedansnogo analiza v ocenke sostava tela detej i podrostkov s razlichnoj massoj tela. *Bjulleten' sibirskoj mediciny*. 2018; 17 (2): 121–32 (in Rus.).
8. Koroleva SV, Kovalev VA. Vybor metoda operativnogo vmeshatel'stva pri bolezni Pejroni. V knige: Lopatkin N. A., Martova A. G., redaktory. Izbrannye lekicii po urologii. M., 2008; 473–81 (in Rus.).
9. Milushkina OJu, Popov VI, Sazonova OV, Skoblina NA, Gavriš MJu, Abdalova SR i dr. Svidetel'stvo o gosudarstvennoj registracii programmy dlja JeVM № 2022669375 Rossijskaja Federacija.

## Литература

1. Богомолова Е. С., Шапошникова М. В., Котова Н. В., Бадеева Т. В., Максименко Е. О., Киселева А. С. и др. Характеристика физического здоровья учащихся современных общеобразовательных организаций. *Гигиена и санитария*. 2019; 98 (9): 956–7.
2. Новикова И. И., Гавриш С. М., Романенко С. П., Сорокина А. В., Серенко В. В., Креймер М. А. Сравнительная оценка информативности методов индикации избыточной массы тела. *Санитарный врач*. 2021; (4): 68–70.
3. Валина С. Л., Штина И. Е., Ошева Л. В., Устинова О. Ю., Эйфельд Д. А. Гигиеническая оценка учебного процесса

## CONCLUSIONS

The identified differences in the anthropometric indicators of 14–16-year-old children acquired in different decades in Samara demonstrate the need for thorough investigation of the current features of physical development in the majority of children's age groups aimed to decide on the need to revise the regional standards of the physical development anthropometric traits. The features of the growth shift identified provide the context for the more thorough study of biological development in today's schoolchildren. Multiple studies suggest possible effects of the living conditions and lifestyle, including the amount of children's physical activity. In this regard, it seems necessary to assess the possibility to use the data of the children actively involved in sports and allocate the groups of children with various levels of physical activity for more thorough and reliable estimation of their physical development, when studying anthropometric indicators.

- Anthro-prof "Programma ocenki fizicheskogo razvitija shkol'nikov". No. 2022668886. (In Rus.)
10. Gavriš MJu, Borodina LM. Očenochnye tablicy fizicheskogo razvitija detej i podrostkov shkol'nogo vozrasta Samarskoj oblasti. *Metodicheskie rekomendacii*. Samara, 2018; 46 p. (in Rus.).
11. Berezin II, Gavriš MJu. Sovremennye tendencii fizicheskogo razvitija shkol'nikov g. Samary. *Voprosy shkol'noj i universitetskoy mediciny i zdorov'ja*. 2016; (2): 17–23 (in Rus.).
12. Makarova VI, Pavlova AN, Pastbina IM. Fizicheskoe razvitie podrostkov Arhangel'skoj oblasti na starte pubertata. *Bjulleten' medicinskoj nauki*. 2021; (3): 56–60 (in Rus.).
13. Chamokova AJa. Vlijanie dvigatel'noj aktivnosti na fizicheskoe razvitie shkol'nikov. *Nauchno-praktičeskij recenziruemyj zhurnal "Sovremennye problemy zdavoohranenija i medicinskoj statistiki"*. 2021; (4): 90–2 (in Rus.).
14. Popov VI, Skoblina NA, Skoblina EV. Znachenie jekonomičeskikh pokazatelej v aktivnosti processov akseleracii rosta i razvitija detej. *Volgogradskij nauchno-medicinskij zhurnal*. 2022; (1): 50–4 (in Rus.).
15. Jakimova EA, Kudrjashov AS. Vlijanie zanjatij tennisom na morfofunkcional'nye pokazateli fizicheskogo razvitija junyh sportsmenov. *Sfera znaniy: voprosy nauki v interpretacii sovremennogo obrazovatel'nogo processa, sbornik nauchnyh trudov*. Kazan': OOO "Sitivent", 2018; 225 p. (in Rus.).
16. Safarova DD, Saidmurodov SS, Hajdarov ShT. Somatotipologičeskije osobennosti fizicheskogo razvitija sportsmenov, specializirujushhihsja v skorostnyh vidah sporta. *Fan-sportga*. 2022; (4): 39–41 (in Rus.).
17. Krylova OV, Bokareva NA, Pivovarov JuP. Vlijanie dvigatel'noj aktivnosti na fizicheskoe razvitie detej i podrostkov do i vo vremja pandemii COVID-19. *Doktor.Ru*. 2022; 21 (3): 72–5 (in Rus.).
18. Aminova OS. Lifestyle-associated risk factors affecting young people. *Russian Bulletin of Hygiene*. 2023; (2): 15–20.

- v shkolah s razlichnymi obrazovatel'nymi programmami. *Gigiena i sanitarija*. 2019; 98 (2): 166–70.
4. Кучма В. Р., Скоблина Н. А., Надеждин Д. С. Сравнительный анализ методик оценки физического развития детей и подростков: бесконечная дискуссия в науке и практике. *Педиатрия им. Г.Н. Сперанского*. 2019; 98 (5): 196–201.
5. Милушкина О. Ю., Скоблина Н. А., Попов В. И., Сазонова О. В., Гаврюшин М. Ю., Абдалова С. Р. и др. Оценка физического развития детей и подростков Российской Федерации: региональные шкалы регрессии массы тела по длине тела (часть 1). Самара, 2022; 220 с.

6. Самарский статистический ежегодник: стат. сборник. Самара: Самарстат, 2023; 345 с.
7. Гирш Я. В., Герасимчик О. А. Роль и место биоимпедансного анализа в оценке состава тела детей и подростков с различной массой тела. Бюллетень сибирской медицины. 2018; 17 (2): 121–32.
8. Королева С. В., Ковалев В. А. Выбор метода оперативного вмешательства при болезни Пейрони. В книге: Лопаткин Н. А., Мартова А. Г., редакторы. Избранные лекции по урологии. М., 2008; 473–81.
9. Милушкина О. Ю., Попов В. И., Сазонова О. В., Скоблина Н. А., Гаврюшин М. Ю., Абдалова С. Р. и др. Свидетельство о государственной регистрации программы для ЭВМ № 2022669375 Российская Федерация. Anthro-prof «Программа оценки физического развития школьников»: № 2022668886.
10. Гаврюшин М. Ю., Бородина Л. М. Оценочные таблицы физического развития детей и подростков школьного возраста Самарской области. Методические рекомендации. Самара, 2018; 46 с.
11. Березин И. И., Гаврюшин М. Ю. Современные тенденции физического развития школьников г. Самары. Вопросы школьной и университетской медицины и здоровья. 2016; (2): 17–23.
12. Макарова В. И., Павлова А. Н., Пастбина И. М. Физическое развитие подростков Архангельской области на старте пубертата. Бюллетень медицинской науки. 2021; (3): 56–60.
13. Чамокова А.Я. Влияние двигательной активности на физическое развитие школьников. Научно-практический рецензируемый журнал «Современные проблемы здравоохранения и медицинской статистики». 2021; (4): 90–2.
14. Попов В. И., Скоблина Н. А., Скоблина Е. В. Значение экономических показателей в активности процессов акселерации роста и развития детей. Волгоградский научно-медицинский журнал. 2022; (1): 50–4.
15. Якимова Е. А., Кудряшов А. С. Влияние занятий теннисом на морфофункциональные показатели физического развития юных спортсменов. Сфера знаний: вопросы науки в интерпретации современного образовательного процесса, сборник научных трудов. Казань: ООО «СитИвент», 2018; 225 с.
16. Сафарова Д. Д., Саидмуродов С. С., Хайдаров Ш. Т. Соматотипологические особенности физического развития спортсменов, специализирующихся в скоростных видах спорта. Fan-sportga. 2022; (4): 39–41.
17. Крылова О. В., Бокарева Н. А., Пивоваров Ю. П. Влияние двигательной активности на физическое развитие детей и подростков до и во время пандемии COVID-19. Доктор.Ру. 2022; 21 (3): 72–5.
18. Аминова О. С. Факторы риска для здоровья, связанные с образом жизни молодежи. Российский вестник гигиены. 2023; (2): 15–21.