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ASSESSMENT AND SELF-ASSESSMENT OF PHYSICAL DEVELOPMENT IN HIGH SCHOOLCHILDREN IN THE REPUBLIC OF TUVA

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ABSTRACT. ***Introduction.*** Research conducted in recent years indicates negative trends in physical development indicators of the country's younger generation, but there is not enough data on the growth and development of children and adolescents in the Republic of Tyva. ***The purpose of the study*** is to assess physical development and the objectivity of its perception by adolescents of the titular nationality of Tyva. ***Materials and methods.*** The study involved 509 schoolchildren aged 15–17 years who permanently reside in the capital (Kyzyl) and settlements in the regions (kozhuuns Baryyn-Khemchik, Bii-Khem, Mongun-Taiga, Tandy and Kyzyl) of the republic. The study included an assessment of the level of physical development, characteristics of nutritional status according to the standards of "WHO Growth Reference 2007", Self-assessment survey of body weight and body composition. ***Results.*** It was revealed that in 71.1–73.6% of adolescents, standing height indicators corresponded to average values. Height above average was less common (7.5–9.5%) than height below average (16.9–21.4%). Correspondence of body weight to its length was registered in 64.4–72.9% of schoolchildren; girls more often than boys (p=0.04). Underweight was detected more often (18.0–19.1%) than overweight (9.1–16.5%). Overweight and obesity were more often identified in boys than girls (p=0.006). ***Conclusion.*** Self-assessment of physical development by schoolchildren differs significantly from the objective status. Girls are more often dissatisfied with their weight and physique than boys. Behavior aimed at weight correction is more typical for girls (especially those living in the city).

KEYWORDS: *schoolchildren, adolescents, physical development, nutritional status, indigenous population, Republic of Tyva*

ОЦЕНКА И САМООЦЕНКА ФИЗИЧЕСКОГО РАЗВИТИЯ У СТАРШИХ ШКОЛЬНИКОВ В РЕСПУБЛИКЕ ТЫВА

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РЕЗЮМЕ. ***Введение.*** Проведенные в последние годы исследования свидетельствуют о негативных тенденциях показателей физического развития подрастающего поколения страны, однако данных о росте и развитии детей и подростков в Республике Тыва недостаточно. ***Цель исследования*** — дать оценку физического развития и объективности его восприятия подростками титульной национальности Тывы. ***Материалы и методы.*** В исследовании приняли участие 509 школьников в возрасте 15–17 лет, которые постоянно проживают в столице (г. Кызыл) и населенных пунктах в районах (кожуунах Барыын-Хемчик, Бии-Хем, Монгун-Тайга, Таңды и Кызыл) республики. Исследование включало оценку уровня физического развития, характеристику нутритивного статуса по нормативам WHO Growth Reference 2007, анкетирование по самооценке массы тела и телосложения. ***Результаты.*** Выявлено, что у 71,1–73,6% подростков показатели роста стоя соответствовали средним значениям. Рост выше средних значений встречался реже (7,5–9,5%), чем рост ниже среднего (16,9–21,4%). Соответствие массы тела его длине зарегистрировано у 64,4–72,9% школьников; у девушек чаще, чем у юношей (p=0,04). Дефицит массы тела выявлялся чаще (18,0–19,1%), чем повышенная масса тела (9,1–16,5%). Избыточная масса тела и ожирение чаще определялись у юношей, чем у девушек (p=0,006). ***Заключение.*** Самооценка физического развития школьниками существенно отличается от объективного статуса. Чаще неудовлетворены своим весом и телосложением девушки, чем юноши. Поведение, направленное на коррекцию веса, в большей степени характерно для девушек (особенно проживающих в городе).

КЛЮЧЕВЫЕ СЛОВА: *школьники, подростки, физическое развитие, нутритивный статус, коренное население, Республика Тыва*

INTRODUCTION

Health state of the younger generation is one of the benchmarks of socio-economic well-being of both a particular region and the state as a whole [1, 2]. Simplicity, accessibility and high informativeness of physical development indicators allow their use in socio-hygienic and territorial-environmental monitoring of the health of children and adolescents [3, 4]. The data published in recent years indicate numerous deviations in the physical and reproductive health of adolescents, which creates a certain risk for the demographic and economic well-being of the country [5, 6].

The Republic of Tyva (RT) is a region of the Russian Federation characterized by a significant dominance of representatives of the titular nationality — Tuvinians. The demographic situation in the republic is also characterized by high birth rates, mortality, migration and low urbanization [7, 8]. Earlier studies in Tyva have revealed the peculiarities of growth, development and nutrition of schoolchildren [9–12]. However, these data need to be supplemented in accordance with modern international methods and trends, which became the prerequisite for our research.

AIM

To assess the physical development and objectivity of its perception by adolescents of the Tyva titular nationality.

MATERIALS AND METHODS

509 adolescents aged 15–17 years participated in the research after signing informed consent. They were students of public schools of Kyzyl, the capital of Tyva, as well as settlements in the Bariyn-Khemchik, Bii-Khem, Mongun-Taiga, Tanndy, and Kyzyl kyuons. All adolescents surveyed were ethnic Tuvinians, descended from mono-ethnic marriages. The group of urban schoolchildren comprised 151 girls and 105 boys, while 133 girls and 120 boys were examined in the districts of the republic (kojuns). The research included somatometry (height and body weight) and interviewing with the help of a specially designed questionnaire. A standardized anthropometric method of V.V. Bunak (1941) was used. The requirements of the Research Institute of Anthropology of Moscow State University (1982) were taken into account, and medical equipment that had passed metrological verification was used.

Physical development (PD) was assessed according to the World Health Organization (WHO) Growth Reference 2007 by means of WHO AnthroPlus program (anthropometric calculator) [13, 14]. The PD level was characterized by comparing individual height indices with age-sex norms. Depending on the number of standard deviations (SD) that distinguish the student's height value from the median index, the following variants of PD were identified: “average” (APD; ±1SD); “above average” (AAPD; from +1SD to +2SD); “high” (HPD; more than +2SD); “below average” (BAPD; from –1SD to -2SD); “low” (LPD; less than –2SD).

Nutritional status was assessed by Kettle's body mass index (BMI), the value of which was determined by dividing body weight (kg) by the square of height (m^2). The following variants were identified in accordance with the compliance of BMI and centile scale norms: harmonious ratio of body weight and length (HPD; 15th-85th percentile), malnutrition (MN; 5th–15th percentile), undernutrition (UN; below the 5th percentile), overweight (OW; 85th–95th percentile); obesity (Ob) was registered when BMI value exceeded the 95th percentile.

During interviewing, schoolchildren were asked to characterize their body, express the degree of satisfaction with their weight and body shape; to note the use of diet and/or other ways to regulate body weight.

Statistical processing of the study material was carried out by methods of variation statistics using STATISTICA v.10.0 (StatSoft, USA). The obtained indices are presented as P [CI]%, where P is the percentage, CI is the 95% confidence interval for the percentage. Significance of intergroup differences in traits was performed using Pearson's χ^2 test (with Yates correction). Differences in results were considered statistically significant at $p < 0.05$.

RESULTS

One of leading indicators of PD is the compliance of standing height with the norms of age-sex scale. 73.6% [71.0–76.2] of girls and 71.1% [68.2–74.1] of boys

showed HPD. Above-average height was less common (8.4% [6.8–10.0] of girls and 7.1% [5.4–8.8] of boys) than below-average height (15.1% [13.0–17.2] and 14.7% [12.4–17.0], respectively). Stunting requiring further clinical examination was more frequently reported in boys (6.7% [5.1–8.3]) than in girls (1.8% [1.0–2.6]; p=0.005). There were fewer schoolchildren with high stature: 1.1% [0.5–1.7] of girls and 0.4% [0.1–0.7] of boys. Distribution by PD level of senior schoolchildren living in urban and rural areas is presented in Figure 1. A statistically significant difference of indicators depending on the place of residence was revealed in boys with APD (p=0.002) and LPD (p=0.03). Whereas girls' indicators did not differ significantly.

The majority of participants had body weight that matched their standing height. Girls were more likely to have this match (72.9% [70.3–75.5]) than boys (64.4% [61.2–67.6]; p=0.04). Disharmonic variants of PD due to body weight deficiency were detected more frequently (18.0–19.1%) than those associated with increased weight (9.1-16.5%). The incidence of MN (2.7% [1.6–3.8]) and obesity (4.5% [3.1–5.9]; p=0.006) was higher in boys than in girls (1.9% [1.1–2.7] and 0.8% [0.2–1.2], respectively). The distribution of high school students by the degree of nutritional status, taking into account the level of urbanization of their place of residence, is presented in Figure 2. HPD was more common in urban schoolchildren, but statistically significant difference of indicators was found only in urban residents (p=0.04). Malnutrition was more frequently revealed in urban high school children than in their rural peers, but the difference of indicators is not statistically significant. Undernutrition was registered equally often among urban and rural boys, but there were more girls with undernutrition in kojuns than among urban peers (p=0.02). Excessive body weight was more frequently registered in boys than in girls, but the difference was statistically insignificant. BMI indicators corresponding to obesity were found more often in the group of urban adolescents (p=0.007).

The objectivity of adolescents' perception of their body is very important for dietary control, prevention/correction of deviant forms of eating behavior [15–18]. Distribution of participants by perception of their body is presented in Table 1. The majority of schoolchildren thought that their body was normal, boys more often assessed their body as normal than girls (p=0.01-0.0008), rural adolescents more often than their urban peers (p=0.0002). Schoolchildren considered their body to be overweight more often (24.7–12.5%) than thin (10.2–12.4%), which was more typical for girls than for boys (p=0.04–0.002). Only females considered themselves as obese, even though obesity was reported more frequently in males.

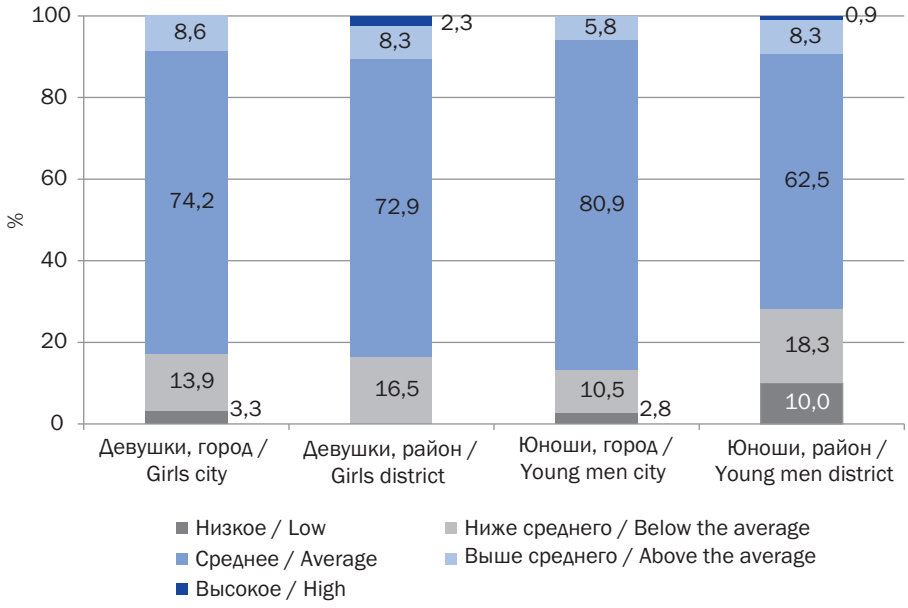

Fig. 1. Characteristics of the level of physical development of adolescents (% [95% CI])

Рис. 1. Характеристика уровня физического развития подростков (% [95% ДИ])

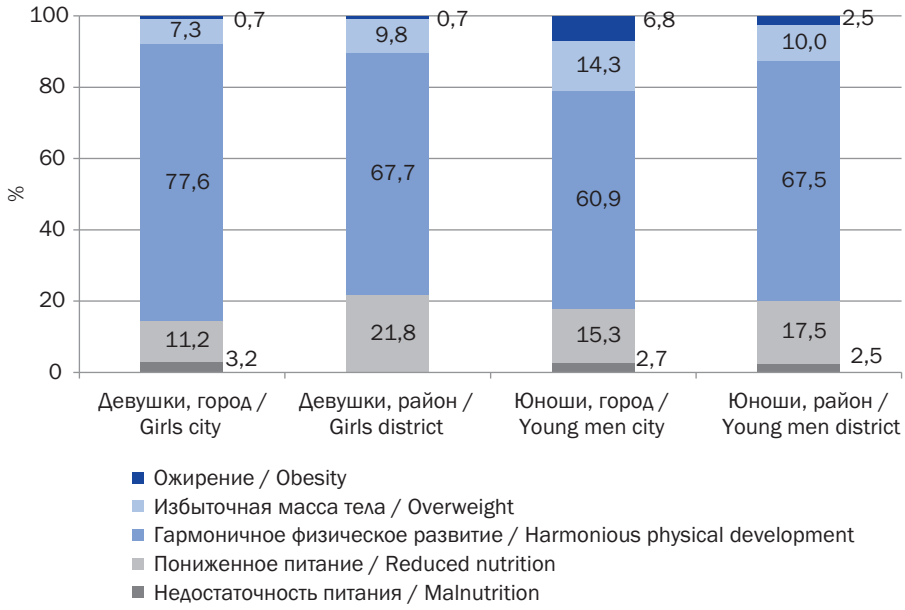

Fig. 2. Characteristics of the nutritional status of adolescents (% [95% CI])

Рис. 2. Характеристика нутритивного статуса подростков (% [95% ДИ])

Table 1. Distribution of schoolchildren according to their body perception options (% [95% CI])

Таблица 1. Распределение школьников по вариантам восприятия своего тела (% [95% ДИ])

Группа / Group		Восприятие своего тела / Perception of your body				
		очень худое / very thin	худое / thin	нормальное / normal	полное / portly	очень полное / very portly
Девушки / Girls	1. Город / City n=151	1,3 [0,4–2,2]	7,9 [5,7–10,1]	63,6 [59,7–67,5]	26,5 [22,9–30,1]	0,7 [0,1–1,2]
	2. Район / District n=133	0	11,3 [8,6–14,0]	66,9 [62,7–70,8]	18,8 [15,4–22,2]	3,0 [1,6–4,5]
	3. Всего / Total n=284	0,7 [0,2–1,1]	9,5 [7,8–11,2]	65,1 [62,3–67,9]	22,9 [20,5–25,3]	1,8 [1,0–2,6]
Юноши / Young men	4. Город / City n=105	7,6 [5,0–10,2]	12,4 [9,2–15,6]	63,8 [59,2–68,4]	16,2 [12,6–19,8]	0
	5. Район / District n=120	0	5,8 [3,7–7,9]	85,0 [81,8–88,2]	9,2 [6,6–11,8]	0
	6. Всего / Total n=225	3,5 [2,3–4,7]	8,9 [7,0–10,8]	75,1 [72,3–77,9]	12,5 [10,3–14,7]	0
Примечание / Note		P_{1-4}=0,01; P_{4-5}=0,002; P_{3-6}=0,02		P_{2-5}=0,0008; P_{4-5}=0,0002; P_{3-6}=0,01	P_{1-4} =0,05; P_{2-5}=0,03; P_{3-6}=0,002	P_{2-5}=0,05; P_{3-6}=0,04

Table 2 presents the results of schoolchildren's satisfaction with their body weight. Boys are more often satisfied with their body weight than girls (p=0.02), and this is more pronounced in adolescents living in kojuns (p=0.004). 1/3 of respondents have a neutral attitude to their weight, no difference in indicators depending on gender and place of residence was revealed. Girls expressed dissatisfaction with their body weight more often than their male peers (p=0.01); schoolgirls from rural areas are dissatisfied to a greater extent (p=0.001). Boys from urban areas were more often very dissatisfied with body weight among, whereas in rural areas girls were more often dissatisfied with body weight than their male peers;

Table 2. Distribution of schoolchildren by satisfaction with their body weight (% [95% CI])

Таблица 2. Распределение школьников по удовлетворенности массой своего тела (% [95% ДИ])

Группа / Group		Отношение к массе своего тела / Attitude towards your body weight			
		доволен / happy	нейтральное отношение / neutral attitude	недоволен / dissatisfied	очень недоволен / very dissatisfied
Девушки / Girls	1. Город / City n=151	31,8 [28,0–35,6]	45,0 [41,1–48,9]	21,8 [18,5–25,1]	1,4 [0,5–2,3]
	2. Район / District n=133	24,1 [20,4–27,8]	41,3 [37,1–45,5]	30,8 [25,9–34,7]	3,8 [2,2–5,4]
	3. Всего / Total n=284	28,2 [25,5–30,9]	43,3 [40,4–46,2]	26,0 [23,4–28,6]	2,5 [1,7–3,3]
Юноши / Young men	4. Город / City n=105	35,2 [30,6–39,8]	40,9 [36,1–45,7]	20,8 [16,9–24,7]	3,1 [1,4–4,8]
	5. Район / District n=120	40,8 [36,3–45,3]	44,2 [39,7–48,8]	13,3 [10,2–16,4]	1,7 [0,5–2,9]
	6. Всего / Total n=225	38,2 [35,0–41,4]	42,7 [39,4–46,0]	16,9 [14,4–19,4]	2,2 [1,3–3,1]
Примечание / Note		P_{2-5}=0,004; P_{3-6}=0,02		P_{2-5}=0,001; P_{3-6}=0,01	

Table 3. Distribution of schoolchildren's satisfaction with their body shape (% [95% CI])

Таблица 3. Распределение школьников удовлетворенности формой своего тела (% [95% ДИ])

Группа / Group		Отношение к форме тела / attitude towards the shape of body			
		доволен / happy	нейтральное отношение / neutral attitude	недоволен / dissatisfied	очень недоволен / very dissatisfied
Девушки / Girls	1. Город / City n=151	36,4 [32,5–40,3]	41,0 [37,1–44,9]	21,2 [17,8–24,6]	1,4 [0,5–2,3]
	2. Район / District n=133	25,6 [21,8–29,4]	48,9 [44,6–53,2]	21,8 [18,2–25,4]	3,7 [2,1–5,3]
	3. Всего / Total n=284	31,3 [28,6–34,0]	44,7 [41,8–47,6]	21,5 [19,1–23,9]	2,5 [1,6–3,4]
Юноши / Young men	4. Город / City n=105	32,4 [27,9–36,9]	46,7 [41,9–51,5]	18,1 [14,4–21,8]	2,8 [1,1–4,5]
	5. Район / District n=120	25,8 [21,9–29,7]	53,3 [48,9–57,8]	16,7 [13,3–20,1]	4,2 [2,4–6,0]
	6. Всего / Total n=225	28,9 [25,8–31,7]	50,2 [46,9–53,5]	17,3 [14,8–19,7]	3,6 [2,4–4,8]
Примечание / Note		P_{1-2}=0,05			

however, the difference of indicators is not statistically significant.

The distribution of respondents depending on satisfaction with their body shape is presented in Table 3. 1/3 of schoolchildren are satisfied with their body shape. Urban teenagers are more often satisfied with their body shape than those living in villages. Boys are more often than girls have both neutral and extremely negative attitude to body shape. Among those dissatisfied with body shape there are more girls than boys, but the difference is not statistically significant.

Interviews clarified their attitude to weight correction and the use of corrective methods in practice; the data are presented in Table 4. Behavior aimed at weight correction is more typical for girls than boys (p=0.0000), and for urban schoolgirls compared to their peers living in rural areas (p=0.006). They believe that body weight does not need correction, so they do not

Table 4. Distribution of schoolchildren by options for body weight correction (% [95% CI])

Таблица 4. Распределение школьников по вариантам коррекции массы тела (% [95% ДИ])

Группа / Group		Соблюдение диеты или других методов по коррекции массы тела / following a diet or other methods to correct body weight			
		нет, вес нормальный / no, normal weight	нет, но хочу снизить вес / no, but I want to lose weight	нет, но хочу повысить вес / no, but I want to gain weight	да, применяю / yes, I do
Девушки / Girls	1. Город / City n=151	46,3 [42,4–50,2]	27,1 [23,5–30,7]	4,6 [2,9–6,3]	22,0 [18,6–25,4]
	2. Район / District n=133	45,9 [41,6–50,2]	32,3 [28,4–36,2]	12,0 [9,2–14,8]	9,8 [7,2–12,4]
	3. Всего / Total n=284	46,1 [43,2–49,0]	29,5 [26,8–32,2]	8,1 [6,5–9,7]	16,3 [14,1–18,5]
Юноши / Young men	4. Город / City n=105	57,1 [52,4–61,9]	20,0 [16,1–23,9]	18,1 [14,4–21,8]	4,8 [2,7–6,9]
	5. Район / District n=120	61,7 [57,3–66,1]	20,0 [16,4–23,6]	14,2 [11,0–17,4]	4,1 [2,3–5,9]
	6. Всего / Total n=225	59,5 [56,3–62,7]	20,0 [17,3–22,7]	16,0 [13,6–18,4]	4,5 [3,1–5,9]
Примечание / Note		P_{2-5}=0,01; P_{3-6}=0,002	P_{2-5}=0,03; P_{3-6}=0,01	P_{1-2}=0,02; P_{1-4}=0,0004; P_{3-6}=0,006	P_{1-2}=0,006; P_{1-4}=0,0001; P_{3-6}=0,0000

follow a diet and/or do not increase physical activity. It is more common among boys than girls (p=0.002). Girls would like to reduce their body weight but do not make efforts to do so more often than boys (p=0.01). Boys (p=0.006) and girls from rural areas (p=0.02) wanted to increase their body weight but did not use any correction methods more often than urban girls.

CONCLUSION

The structure of PD level in the examined schoolchildren shows that the majority (62.5-80.9%) have height indices that correspond to the average values of international norms. At the same time, it should be noted that the proportion of adolescents with below-average height (16.9-21.4%) exceeds the proportion of peers with above-average height (7.5–9.5%), which may be due to both ethnic constitutional features and the influence of environmental factors. This circumstance creates prerequisites for further advanced research.

Regional peculiarities of nutritional status were revealed as well: a share of pupils with body weight deficiency is rather high (11.2–21.8%). The data coincide with the results of a study of schoolchildren in Erzin kojun (11–27%) [19]. Other studies in schoolchildren of the Mongoloid race in the Republic of Tyva (Toora-Khem village, Toju kojun) and the Republic of Sakha (Yakutia) reported a much lower proportion of underweight adolescents (1.9–3.9%) [20, 21]. In total, the proportion of overweight and obese adolescents in our study is lower (9.1–16.5%) than in Tozhu and Erzin (13.5–17.6%) [19, 20]. It is necessary to analyze actual nutrition of adolescents in detail to clarify the causes of disharmonious physical development.

Schoolchildren's self-assessment of physical development differs significantly from our objective characterization. Girls (28.5%) are more often dissatisfied with their weight and body shape than their male peers (19.1%). Girls are more frequently engaged in weight correction (16.3%; especially those living in the city — 22%) than boys (4.5%). It should be noted that the overall proportion of schoolchildren controlling their weight through diet and/or physical activity is lower than the proportion of students at Tuva State University [22]. Our results correspond with the data of other authors, which also indicate that the proportion of adolescents taking measures of weight correction is lower than the WHO recommendation [23, 24].

ADDITIONAL INFORMATION

Author contribution. Thereby, all authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

Competing interests. The authors declare that they have no competing interests.

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Consent for publication. The authors received written consent from the respondents to publish the data.

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Вклад авторов. Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

Информированное согласие на публикацию. Авторы получили письменное согласие анкетируемых на публикацию данных.

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