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LEVEL OF PHYSICAL FITNESS OF PRESCHOOL CHILDREN WITH DIFFERENT NUTRITIONAL STATUS

© Vera L. Gritsinskaya[1], Fatima U. Kozyreva[2], Inga Sh. Tuaeva[3], Fatima K. Makoeva[4]

[1] Saint Petersburg State Pediatric Medical University. 2 Lithuania, Saint Petersburg 194100 Russian Federation

[2] Pirogov Russian National Research Medical University. 1 Ostrovityanova str., Moscow 117997 Russian Federation

[3] North-Ossetian State Medical Academy. 40 Pushkinskaya str., Vladikavkaz 362019 Russian Federation

[4] National State University of Physical Culture, Sports and Health named after P.F. Lesgaft. 35 Dekabristov str., Saint Petersburg 190121 Russian Federation

Contact information:
Vera L. Gritsinskaya — Doctor of Medical Sciences, Leading researcher at the Laboratory of Medical and Social Problems in Pediatrics, Professor of the Department of General Medical Practice. E-mail: tryfive@mail.ru
ORCID: https://orcid.org/0000-0002-8290-8674 SPIN: 7966-9470

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ABSTRACT. ***Introduction.*** In the child population around the world, there is an increase in the prevalence of malnutrition, which has a negative impact on the physical development, functionality and physical performance of the growing organism. ***The purpose of the study*** is to identify the relationship between nutritional status and physical fitness of preschool children when performing the GTO complex. ***Materials and methods.*** The study involved 3,249 pupils of children's educational organizations in St. Petersburg aged 6.5 to 7.5 years. The study included somatometry (standing height and body weight) and performance of stage I exercises of the "VFSK GTO" (running at a distance of 30 m; shuttle running 3×10 m; standing long jump with a push with two legs and throwing a tennis ball at a target). The assessment of nutritional status was carried out in accordance with the standards of the WHO Growth Reference 2007. ***Results.*** It was revealed that 10.9% of study participants were underweight, and 24.0% were overweight and obese. Preschoolers, having fulfilled the standards of the "golden" badge, showed good development of speed qualities of physical fitness (distance running — 79.1% boys and 80.3% girls) and satisfactory formation of speed-strength indicators (jumping — 57.4% boys and 64 .5% girls; p=0.0004). Children are less prepared for motor coordination tests: 41.9% of boys and 62.5% of girls received a "golden" badge for throwing a ball at a target (p=0.0000); for shuttle running — 31.2% of boys and 64.5% of girls (p=0.0000). In all tests, children with a harmonious ratio of height and body weight are more successful, more often showing a valid result. Peers with obesity and malnutrition were less likely to perform well on tasks. ***Conclusion.*** Thus, the physical qualities of preschool children have great variability depending on gender and nutritional status, which must be taken into account when conducting physical education classes.

KEYWORDS: *children, preschoolers, physical development, malnutrition, obesity, physical education, GTO complex*

УРОВЕНЬ ФИЗИЧЕСКОЙ ПОДГОТОВКИ ДОШКОЛЬНИКОВ С РАЗЛИЧНЫМ НУТРИТИВНЫМ СТАТУСОМ

© Вера Людвиговна Грицинская[1], Фатима Увжикоевна Козырева[2], Инга Шамильевна Туаева[3], Фатима Константиновна Макоева[4]

[1] Санкт-Петербургский государственный педиатрический медицинский университет. 194100, г. Санкт-Петербург, ул. Литовская, д. 2

[2] Российский национальный исследовательский университет им. Н.И. Пирогова. 117997, г. Москва, ул. Островитянова, д. 1

[3] Северо-Осетинская государственная медицинская академия. 362019, г. Владикавказ, ул. Пушкинская, д. 40

[4] Национальный государственный университет физической культуры, спорта и здоровья им. П.Ф. Лесгафта. 190121, г. Санкт-Петербург, ул. Декабристов, д. 35

Контактная информация:
Вера Людвиговна Грицинская — д.м.н., ведущий научный сотрудник-исследователь лаборатории медико-социальных проблем в педиатрии, профессор кафедры общей медицинской практики. E-mail: tryfive@mail.ru
ORCID: https://orcid.org/0000-0002-8290-8674 SPIN: 7966-9470

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РЕЗЮМЕ. ***Введение.*** В детской популяции во всем мире отмечается рост распространенности неполноценного питания, которое оказывает негативное влияние на физическое развитие, функциональные возможности и физическую работоспособность растущего организма. ***Цель исследования*** — выявить взаимосвязь нутритивного статуса и физической подготовленности детей дошкольного возраста при выполнении комплекса ГТО. ***Материалы и методы.*** В исследовании участвовали 3249 воспитанников детских образовательных организаций Санкт-Петербурга в возрасте от 6,5 до 7,5 лет. Исследование включало соматометрию (рост стоя и вес тела) и выполнение упражнений I ступени «ВФСК ГТО» (бег на дистанцию 30 м; челночный бег 3×10 м; прыжок в длину с места толчком двумя ногами и метание теннисного мяча в цель). Оценка нутритивного статуса проведена в соответствии со стандартами WHO Growth Reference 2007. ***Результаты.*** Выявлено, что 10,9% участников исследования имеют дефицит веса, а 24,0% — избыточную массу тела и ожирение. Дошкольники, выполнив нормативы «золотого» значка, показали хорошее развитие скоростных качеств физической подготовленности (бег на дистанцию — 79,1% мальчиков и 80,3% девочек) и удовлетворительное формирование скоростно-силовых показателей (прыжки — 57,4% мальчики и 64,5% девочки; p=0,0004). Хуже дети подготовлены к испытаниям на координацию движений: «золотой» значок получили за метание мяча в цель 41,9% мальчиков и 62,5% девочек (p=0,0000); за челночный бег — 31,2% мальчиков и 64,5% девочек (p=0,0000). Во всех испытаниях дети с гармоничным соотношением роста и массы тела более успешны, чаще показывая зачетный результат. Сверстники с ожирением и недостаточностью питания реже справлялись с заданиями. ***Заключение.*** Таким образом, физические качества у дошкольников имеют большую вариативность в зависимости от половой принадлежности и нутритивного статуса, что необходимо учитывать при проведении физкультурных занятий.

КЛЮЧЕВЫЕ СЛОВА: *дети, дошкольники, физическое развитие, недостаточность питания, ожирение, физическое воспитание, комплекс ГТО*

INTRODUCTION

The increasing prevalence of malnutrition and resulting health disorders in children and adolescents is a pressing problem for public health all over the world [1]. In 2016 the UN General Assembly formulated principles for an unprecedented fight against all forms of malnutrition for the next decade, which are reflected in the "Global Nutrition Monitoring Framework" [2]. Published domestic studies also highlight the significant prevalence of deviations in the physical development of the younger generation. They demonstrate how various medical and social factors influence nutritional status deviations in children [3–7].

Physical performance is one of the objective indicators of physical development, functional capabilities and health status of a growing human. It is possible to achieve the necessary and age-appropriate level of various physical qualities through physical exercises, taking into account sensitive periods of their formation [8–11]. A significant proportion of older preschool children are not ready to perform precise movements and solve motor tasks in extremely short time, and have reduced endurance to prolonged physical exertion [12–15]. It has been shown that children's motor coordination abilities can correlate with indicators of cognitive functions and, therefore, are an additional criterion of children's functional readiness for the beginning of systematic learning [16-18]. The authors have recently reported that there is a significant association between weight status categories and physical fitness in the pediatric population. Children and adolescents classified as underweight or overweight and obese had lower physical fitness scores than their normal-weight peers [19–22].

The physical fitness of children is predominantly assessed by a standard set of motor tests. In recent years, the All-Russian physical culture and sports complex "Ready for Labor and Defense" [Gotov k trudu i oborone] – "GTO"[1] has been actively introduced into the physical training of the younger generation. However, most publications on preparing children to perform the GTO complex are devoted to schoolchildren, since the authors consider tests are too difficult for preschoolers. This is justified by special orientation of test tasks only, they focus on the age-sex aspect without taking into account individual-typological characteristics of children [8, 12, 23]. From our point of view, it is possible to optimize physical training of preschool children by creating an information base and developing criteria that allow dosing physical loads with regard to the peculiarities of physical development.

AIM

To reveal the relationship between nutritional status and physical fitness of preschool children while performing the GTO complex.

MATERIALS AND METHODS

A cross-sectional, observational study was conducted on the basis of children's educational organizations ('CEOs') located in different districts of St. Petersburg. After obtaining informed consent from the children's legal representatives, 3249 children (1727 boys and 1522 girls) aged 6.5 to 7.5 years participated in the study. The study included weighing children on medical scales, measuring their standing height and performing GTO exercises.

Each participant's body mass index (BMI) was calculated by dividing the child's body weight (kg) by the square of standing height (m^2). Nutritional status was assessed according to WHO standards – WHO Growth Reference 2007 using Anthro Plus anthropometric calculator [24]. Nutritional status was classified according to age-sex BMI standards as malnutrition (MN; below the 5th percentile), undernutrition (UN; 5th–15th percentile), harmonious physical development (HPD; 15th–85th percentile), overweight (OW; 85th–95th percentile), and obesity (Ob; above the 95th percentile).

Physical fitness was assessed according to the results of the GTO first level tests. Taking into account the age-related physiology, we chose the following tasks: 30 m running (s), 3×10 m shuttle run (s), long jump from a place with a push of two legs (cm) and

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throwing a tennis ball at a target (number of hits from a distance of 5 m). Grading of results included categories: “gold”, “silver”, “bronze” and “fail” (when pupils failed to complete a task).

The obtained material was summarized in spreadsheets on Microsoft Excel platform and processed by generally accepted methods of statistical analysis using IBM SPSS Statistics package. Obtained results are presented in the form of percentages (P) and limits of 95% confidence interval (95% CI). Statistical significance of the difference between the indicators was determined using Pearson's χ^2 criterion (with Yates correction). The significance of differences between groups was established at $p < 0.05$.

RESULTS

65.1% of children had a body weight corresponding to their height, which was classified as HPD and was recorded more frequently in girls (67.5[66.4–68.6]%) than in boys (63.1[62.0-64.2]%; p=0.007; χ^2=7.2). Disharmonious variants of physical development due

Table 1. Results of running at a distance of 30 meters (%[95%CI])

Таблица 1. Результаты бега на дистанцию 30 метров (%[95%ДИ])

Пол / Sex	Нутритивный статус / Nutritional status	Показатели ГТО / GTO indicators			
		«золото» / “gold”	«серебро» / “silver”	«бронза» / “bronze”	«незачет» / “failure”
Мальчики / Boys n=1727	1. НП / M n=62	79,6 [74,2–85,0]	3,7 [1,2–6,1]	7,4 [3,9–10,8]	9,3 [5,4–13,2]
	2. ПП / RN n=132	81,0 [77,4–84,6]	2,5 [1,1–3,9]	5,8 [3,7–7,9]	10,7 [7,9–13,5]
	3. ГФР / HPD n=1089	80,2 [79,1–81,4]	2,9 [2,5–3,3]	7,6 [6,8–8,4]	9,3 [8,4–10,2]
	4. ИзМТ / Ov n=191	79,5 [76,4–82,3]	3,5 [2,1–4,9]	5,8 [4,1–7,6]	11,2 [8,8–13,6]
	5. Ож / Ob n=253	73,0 [70,1–75,9]	4,3 [3,1–5,6]	10,9 [8,9–12,8]	11,8 [9,7–13,9]
Девочки / Girls n=1522	6. НП / M n=51	64,6 [57,7–71,5]	18,7 [13,1–24,3]	8,3 [4,4–12,2]	8,4 [4,4–12,3]
	7. ПП / RN n=111	78,4 [74,5–82,3]	8,8 [6,0–11,5]	4,9 [2,8–7,0]	7,9 [5,2–10,6]
	8. ГФР / HPD n=1028	82,1 [80,9–83,4]	6,3 [5,5–7,1]	5,6 [4,9–6,3]	6,0 [5,2–6,8]
	9. ИзМТ / Ov n=156	80,3 [77,1–83,5]	3,4 [1,9–4,8]	3,4 [1,9–4,8]	12,9 [10,2–15,7]
	10. Ож / Ob n=176	76,2 [73,0–79,4]	7,1 [5,1–8,9]	10,7 [8,3–13,1]	6,0 [4,2–7,8]
Примечание / Note		P_{6-8}=0,002 (χ^2=9,2) P_{6-9}=0,03 (χ^2=4,9)	P_{6-8}=0,001 (χ^2=10,9) P_{6-9}=0,0003 (χ^2=12,8) P_{6-10}=0,02 (χ^2=5,7) P_{1-6}=0,01 (χ^2=6,0) P_{2-7}=0,04 (χ^2=4,4) P_{3-8}=0,0002 (χ^2=13,5)	P_{9-10}=0,001 (χ^2=10,1)	P_{8-9}=0,002 (χ^2=9,7) P_{3-8}=0,004 (χ^2=8,2) P_{5-10}=0,05 (χ^2=3,8)

Примечание / Note: ГФР / HPD — гармоничное физическое развитие / harmonious physical development; ИзМТ / Ov — избыточная масса тела / overweight; НП / M — недостаточность питания / malnutrition; Ож / Ob — ожирение / obesity; ПП / RN — пониженное питание / reduced nutrition.

to underweight were less frequent (10.9%) than those associated with overweight (24.0%). Malnutrition was found in 3.6[3.2–4.0]% of boys and 3.3[2.9–3.7]% of girls; another 7.6[7.0–8.1]% of boys and 7.3[6.6–8.0]% of girls were underweight. Overweight was equally frequent in boys (11.1[10.4–11.8]%) and girls (10.2[9.4–11.0]%). BMI, which corresponds to diagnostic criteria for obesity, was recorded more frequently in boys (14.6[13.4–15.4]%) than in girls (11.7[10.9–12.5]%; p=0.009; χ^2=6.7), which corresponds to the results of other studies [25, 26].

We selected those tasks which preschoolers can prepare for and successfully perform in accordance with physiologists' estimation. Previous studies have shown that children in kindergartens can only fully complete the 30-metre running standard. Long jump from a place, shuttle run and throwing a tennis ball (sandbag) into a target are not fully available for preschoolers; unfortunately, children face significant difficulties in performing other tests of the complex [8, 12].

Most preschoolers showed good development of speed qualities. They coped with overcoming the distance of 30 m in time corresponding to the standards of the "gold" badge; the data are presented in Table 1. Obese boys received the "gold" badge less often than their peers with other nutritional status, but the difference is not statistically significant. Among girls, preschool girls with MN and Ob have worse results. However, only girls with MN have a statistical difference with their peers with HPD (0.002) and OW (0.03). Boys received the "silver" badge more often than girls, and children with MN, UN and HPD showed a statistically significant difference (p=0.04–0.0002). Among boys, there was no correlation between the frequency of receiving the "silver" badge and the level of nutritional status. Girls with MN more often fulfilled the standards of "silver" badge than those with HPD, OW and Ob (p=0.02–0.0003). The "bronze" badge was more often obtained by girls with Ob than by boys (p=0.001), other indicators were not statistically different. No difference was found for preschoolers who failed the test in boys; girls with Ob had a higher rate of failure than their peers with HPD (p=0.002). Gender differences were found in children with HPD and Ob (more boys; p=0.05–0.004).

Participants showed satisfactory speed and strength qualities when performing a jump from a place with a push using two legs; the data are presented in Table 2. Girls more often fulfilled the "gold" badge. Moreover, the difference between children with UN and HPD was statistically significant (p=0.02–0.0004). Boys with HPD and OW were more successful, the difference with the peers with Ob is statistically significant (p=0.0009–0.0000). Girls with Ob demonstrated the minimum number of "gold" results, the difference is statistically significant in all cases (p=0.04–0.0000) except for the subgroup of children with MN. In terms of "silver" badge depending on gender, statistically significant difference of indicators was found only in children with UW (boys prevailed, p=0.03). Ob group of boys received "silver" more often than children with other nutritional status. They statistically differed from their peers with HPD (p=0.0007) and OW (p=0.03). Girls with OW and Ob received the "silver" badge more often than peers with HPD (p=0.04-0.009), and preschoolers with MN obtained the "silver" badge more often than those with UN (p=0.02) and with other levels of nutritional status. "Bronze" badge was more often received by both boys and girls with Ob, but the difference of indicators is not statistically significant. Boys did not pass this test more frequently. HPD groups had a statistically significant difference (p=0.0000). In both gender groups there are no children with MN; and there are fewer children with HPD than with other nutritional status, but the statistical difference in indicators is noted only in girls.

The results of hitting the target with a tennis ball, which characterize the development of movement coordination in children, are shown in Table 3. Girls with all types of nutritional status coped better and received the "gold" badge, the difference is statistically significant (p=0.0008–0.0000), no significant differences were found within gender groups. The "silver" badge were more often registered in boys than in girls, the difference of indicators in children with UN, HPD and Ob is statistically significant.

"Bronze" badge among boys was more often received by OW children, but the difference of indicators is statistically significant only in comparison with peers with HPD (p=0.02). In girls, "bronze" badge was more often received by children with MN, statistically significant

Table 2. Children's jump results (%[95%CI])

Таблица 2. Результаты прыжка у детей (%[95%ДИ])

Пол / Sex	Нутритивный статус / Nutritional status	Показатели ГТО / GTO indicators			
		«золото» / "gold"	«серебро» / "silver"	«бронза» / "bronze"	«незачет» / "failure"
Мальчики / Boys n=1727	1. НП / M n=62	56,4 [50,2–62,6]	37,1 [31,0–43,2]	6,5 [3,4–9,6]	0
	2. ПП / RN n=132	53,8 [49,5–58,1]	33,3 [29,2–37,4]	5,3 [3,4–7,2]	7,6 [5,3–9,9]
	3. ГФР / HPD n=1089	60,5 [59,0–61,9]	30,0 [28,6–31,4]	4,9 [4,3–5,5]	4,6 [4,0–5,2]
	4. ИзМТ / Ov n=191	60,2 [57,8–62,6]	30,9 [27,6–34,2]	5,2 [6,9–11,3]	3,7 [2,3–5,1]
	5. Ож / Ob n=253	44,3 [41,2–47,4]	41,1 [38,0–18,5]	7,1 [5,5–8,7]	7,5 [5,9–9,1]
Девочки / Girls n=1522	6. НП / M n=51	58,8 [51,9–65,7]	37,2 [30,5–43,9]	4,0 [3,4–4,6]	0
	7. ПП / RN n=111	68,5 [64,1–72,9]	20,7 [16,9–24,5]	5,4 [3,3–7,5]	5,4 [3,3–7,5]
	8. ГФР / HPD n=1028	67,9 [66,5–69,3]	26,7 [25,8–27,6]	4,0 [3,4–4,6]	1,4 [1,0–1,8]
	9. ИзМТ / Ov n=156	59,6 [55,7–63,5]	34,6 [30,8–38,4]	3,8 [2,3–5,3]	2,0 [0,9–3,1]
	10. Ож / Ob n=176	48,3 [44,6–52,4]	36,4 [32,8–40,0]	9,1 [7,0–11,2]	6,2 [4,4–8,0]
Примечание / Note		P_{3-5} =0,0000 (χ^2=22,3) P_{4-5} =0,0009 (χ^2=11,1) P_{7-10}=0,0008 (χ^2=11,2) P_{8-10}=0,0000 (χ^2=25,4) P_{9-10}=0,04 (χ^2=4,3) P_{8-9}=0,04 (χ^2=4,2) P_{2-7}=0,02 (χ^2=5,4) P_{3-8}=0,0004 (χ^2=12,5)	P_{3-5}=0,0007 (χ^2=11,7) P_{4-5}=0,03 (χ^2=4,9) P_{6-7}=0,02 (χ^2=5,0) P_{8-10}=0,009 (χ^2=6,9) P_{8-9}=0,04 (χ^2=4,2) P_{2-7}=0,03 (χ^2=4,8)	–	P_{7-8}=0,002 (χ^2=9,5) P_{8-10}=0,0000 (χ^2=17,6) P_{3-8}=0,0000 (χ^2=18,0)

Примечание / Note: ГФР / HPD — гармоничное физическое развитие / harmonious physical development; ИзМТ / Ov — избыточная масса тела / overweight; НП / M — недостаточность питания / malnutrition; Ож / Ob — ожирение / obesity; ПП / RN — пониженное питание / reduced nutrition.

level of indicators with peers with HPD was confirmed. Gender differences of indicators were revealed in children with HPD and Ob (boys more often fulfilled the "bronze" standard). Boys failed the test more often than girls. Statistical significance of differences was found in children with MN, HPD and Ob (p=0.02–0.0000). No statistically significant difference of indicators was found within gender groups.

The most difficult test for preschoolers in our study was shuttle run, which allows us to assess simultaneously the degree of development of speed qualities and coordination of movements, the results are shown in Table 4. Girls coped better and won the "golden" badge more often than boys. Excluding children with MN, the difference is statistically significant (p=0.03–0.0000). As for the gender groups, boys with

Table 3. Children's ball throwing results (%[95%CI])

Таблица 3. Результаты броска мяча у детей (%[95%ДИ])

Пол / Sex	Нутритивный статус / Nutritional status	Показатели ГТО / GTO indicators			
		«золото» / "gold"	«серебро» / "silver"	«бронза» / "bronze"	«незачет» / "failure"
Мальчики / Boys n=1727	1. НП / M n=62	38,5 [32,3–44,7]	23,1 [17,9–28,3]	18,5 [13,7–23,3]	19,9 [15,0–24,8]
	2. ПП / RN n=132	36,9 [32,7–41,1]	28,5 [24,6–32,4]	16,1 [12,9–19,3]	18,5 [15,1–21,9]
	3. ГФР / HPD n=1089	43,7 [42,2–45,1]	26,6 [25,4–27,8]	15,8 [14,7–16,9]	13,9 [12,8–14,7]
	4. ИзМТ / Ov n=191	38,4 [34,9–41,8]	27,4 [24,3–30,2]	22,6 [19,5–25,4]	11,6 [9,3–13,9]
	5. Ож / Ob n=253	39,9 [36,8–43,0]	28,6 [25,7–31,5]	18,1 [15,7–20,5]	13,4 [11,2–15,6]
Девочки / Girls n=1522	6. НП / M n=51	70,0 [63,5–76,4]	12,0 [7,4–16,6]	12,0 [7,4–16,6]	6,0 [2,7–9,3]
	7. ПП / RN n=111	58,1 [53,3–62,9]	17,1 [13,5–20,7]	20,0 [19,1–20,9]	4,8 [2,7–6,9]
	8.ГФР / HPD n=1028	63,2 [61,9–64,5]	17,3 [16,1–18,5]	12,6 [11,7–13,6]	6,9 [6,1–7,7]
	9.ИзМТ / Ov n=156	59,7 [55,8–63,6]	19,5 [16,3–22,7]	14,3 [11,5–17,1]	6,5 [4,4–8,3]
	10.Ож / Ob n=176	61,2 [57,5–64,9]	19,1 [16,2–22,0]	13,3 [10,7–15,9]	6,4 [4,6–8,2]
Примечание / Note		P_{1-6}=0,0008 (χ^2=11,3) P_{2-7}=0,001 (χ^2=10,5) P_{3-8}=0,0000 (χ^2=79,3) P_{4-9} =0,0000 (χ^2=15,5) P_{5-10}=0,0000 (χ^2=18,6)	P_{2-7}=0,04 (χ^2=4,1) P_{3-8}=0,0000 (χ^2=25,8) P_{5-10}=0,02 (χ^2=5,0)	P_{3-4}=0,02 (χ^2=5,3) P_{7-8}=0,03 (χ^2=4,5) P_{3-8}=0,03 (χ^2=4,4) P_{4-9}=0,05 (χ^2=3,9)	P2-7=0,001 (χ2=10,1) P3-8=0,0000 (χ2=27,4) P5-10=0,02 (χ2=5,2)

Примечание / Note: ГФР / HPD — гармоничное физическое развитие / harmonious physical development; ИзМТ / Ov — избыточная масса тела / overweight; НП / M — недостаточность питания / malnutrition; Ож / Ob — ожирение / obesity; ПП / RN — пониженное питание / reduced nutrition.

Ob performed worse. They had statistically significantly lower results than their peers with HPD and MN. Girls with Ob and MN performed worse. Boys more often than girls received "silver" badges, the performance was statistically significantly different among children with HPD, OW and Ob (p=0.007–0.0000), no statistically significant difference was found within gender groups. Boys showed results corresponding to "bronze" more often than girls, but the difference of indicators is not statistically significant. More "bronze" badges were obtained by boys with MN, their indicators were statistically higher than those of their peers with HPD, OW and Ob (p=0.02–0.005). In girls, children with MN also more often fulfilled the "bronze" standard; the difference is statistically significant when compared to their peers with HPD and OW. More than 1/3 of participants failed the test. Boys with MN and HPD were less likely to fail. Girls were less likely to fail if they had UN or HPD. The difference of statistical significance between boys and girls was found only in the group of children with MN (p=0.05).

Table 4. Shuttle run results (%[95%CI])

Таблица 4. Результаты челночного бега (%[95%ДИ])

Пол / Sex	Нутритивный статус / Nutritional status	Показатели ГТО / GTO indicators			
		«золото» / “gold”	«серебро» / “silver”	«бронза» / “bronze”	«незачет» / “failure”
Мальчики / Boys n=1727	1. НП / M n=62	28,3 [22,2–34,4]	20,7 [15,2–26,1]	7,5 [3,9–11,1]	43,5 [36,7–50,3]
	2. ПП / RN n=132	32,8 [28,5–37,1]	22,7 [18,9–26,5]	18,5 [15,0–21,9]	26,0 [22,1–29,9]
	3. ГФР / HPD n=1089	32,6 [31,1–34,0]	23,4 [22,1–24,7]	10,0 [9,1–10,9]	34,0 [32,5–35,4]
	4. ИзМТ / Ov n=191	26,1 [22,6–29,5]	23,0 [19,7–26,3]	9,1 [6,9–11,3]	41,8 [38,0–45,6]
	5. Ож / Ob n=253	20,5 [17,8–23,2]	28,8 [25,9–31,8]	8,2 [6,4–9,9]	42,5 [39,2–45,8]
Девочки / girls n=1522	6. НП / M n=51	49,0 [42,1–55,9]	13,7 [8,9–18,5]	5,9 [2,6–9,2]	31,4 [24,9–37,8]
	7. ПП / RN n=111	40,5 [35,9–45,1]	13,5 [10,3–16,7]	8,1 [5,5–10,7]	37,9 [33,3–42,5]
	8. ГФР / HPD n=1028	51,7 [50,2–53,2]	12,7 [11,7–13,6]	4,0 [3,4–4,6]	31,6 [30,2–33,0]
	9. ИзМТ / Ov n=156	48,1 [44,1–52,0]	11,5 [9,0–14,1]	2,6 [1,3–3,9]	37,8 [33,9–41,7]
	10. Ож / Ob n=176	44,1 [40,4–47,8]	13,5 [10,9–16,1]	3,9 [2,4–5,4]	38,5 [34,9–42,1]
Примечание / Note		P_{2-5}=0,01 (χ^2=6,2) P_{3-5}=0,0004 (χ^2=12,3) P_{8-10}=0,05 (χ^2=3,8) P_{1-6}=0,03 (χ^2=7,7) P_{3-8}=0,0000 (χ^2=74,9) P_{4-9}=0,0000 (χ^2=16,7) P_{5-10}=0,0000 (χ^2=25,3)	P_{3-8}=0,0000 (χ^2=39,2) P_{4-9}=0,007 (χ^2=7,3) P_{5-10}=0,0003 (χ^2=13,2)	P_{2-5} =0,005 (χ^2=7,8) P_{2-3} =0,005 (χ^2=7,9) P_{2-4} =0,02 (χ^2=5,4) P_{7-8} =0,04 (χ^2=4,1) P_{7-9} =0,04 (χ^2=4,3)	P_{1-2} =0,02 (χ^2=5,1) P_{2-4} =0,006 (χ^2=7,5) P_{2-5} =0,003 (χ^2=8,9) P_{2-7}=0,05 (χ^2=3,7)

Примечание / Note: ГФР / HPD — гармоничное физическое развитие / harmonious physical development; ИзМТ / Ov — избыточная масса тела / overweight; НП / M — недостаточность питания / malnutrition; Ож / Ob – ожирение / obesity; ПП / RN — пониженное питание / reduced nutrition.

CONCLUSION

Physical performance of children and adolescents can be determined in most cases by assessing speed, strength, agility, flexibility, endurance and velocity-force qualities by means of control exercises — tests. In our country, the All-Russian physical culture and sports complex “Ready for Labor and Defense” has been developed, which allows to unify the assessment of physical training and ensure the continuity of physical education in schools [27]. The most widely used analogues of the “GTO” abroad are the European Physical Fitness Test (EUROFIT) and the California Physical Fitness Assessment Test

[28]. The GTO complex, as well as the EUROFIT test, is proposed to assess motor skills of children from 6 y.o. However, according to physiologists, preschool children are not mature enough to perform a number of tests of the first stage of the "GTO" (for the age group from 6 to 8 years), which reduces the test results [8, 12, 29]. It might be explained by the period of intensive physical ("half-growth" spurt) and active mental development.

Taking into account this circumstance, we used only 4 tests that allowed us to assess the level of development of speed, speed-force and coordination qualities of physical development. The level of children's physical development appeared to be ambiguous. Girls coped with all tests better than boys. Except for throwing a tennis ball into the target, there was no difference in the results of the test depending on nutritional status. In all other tests, children with a harmonious ratio of height to body weight were more successful, more often showing the standard of the "gold" badge. Peers with disharmonious variants of physical development (especially with obesity and malnutrition) coped with the task less often and their results were lower than the scores. Our results correlate with the data of other authors [27, 29–32].

Summarizing the above, it is possible to conclude that physical qualities of the participants are irregularly developed and have a great variability depending on gender and nutritional status, which stipulates the need for a differentiated approach when conducting physical training sessions and admission to participation in the "GTO" tests.

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.

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ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

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.

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