

Physical education in 17-19-year-old girls with different psychological gender

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Abstract:

The study of the motor and morphofunctional qualities specifics in girls having different psychological gender to increase the effectiveness of physical culture and wellness technologies among students is an urgent problem. *Research aim:* to study the state and peculiarities of morphological, functional and motor qualities of female students having various psychological gender engaged in physical education in a special medical group. *Materials and methods.* 150 girls aged 17-19 years, university students (Russia) who had abnormalities in the state of somatic health took part in the research project. Psychological testing of the gender of all girls was carried out using a questionnaire proposed by Bem (1974). The psychological gender of girls was distinguished: masculine; feminine; androgynous. The main anthropometric parameters, functional parameters of the cardiovascular, respiratory and muscular systems and testing of motor qualities were measured in all the girls. *Results.* Significant differences in morphofunctional indicators and motor qualities of girls with different psychological gender types were established. Significantly higher values of anthropometric, functional indicators and motor qualities were established in girls of masculine psychological gender type, compared with feminine and androgynous ones. *Conclusions.* The obtained research results can be used in female students' physical education to increase the effectiveness of physical culture and wellness activities.

Key words: physical education (PE), psychological gender, morphofunctional indicators, motor qualities.

Introduction

Nowadays, it is considered that purposeful training work can have a significant impact on the personality of an athlete in sports activities. This impact can be considered as a complex of innate and acquired qualities, including within the framework of gender theory. In this case, personality can be assessed within the boundaries of such concepts as «masculinity» and «femininity» (Cardoso et al., 2016; Dougan, & Graham, 2019; Aranson, 2021). The scientific literature presents extensive data on the gender characteristics of athletes in various sports (Fernandez et al., 2019; Osipov et al., 2020; Oleynik, & Bugaevsky, 2020; Olha Borysova et al., 2020). Some sports are aimed only at men, other sports are aimed at women, although recently the smoothing of gender inequality has begun. For example: men start performing in rhythmic gymnastics, and women take part in martial arts (Sutresna et al., 2021).

It is considered that physical education is an academic discipline that includes gender stereotypes (Preece & Bullingham, 2020), which are associated with various morphofunctional characteristics of men's and women's body and the specifics of the physical exercises they perform (Ros-gamón et al., 2021). The gender difference also manifests itself at the psychological level in particular there is a greater interest of boys in physical education and a desire to increase the number of hours of classes at school than girls (Zygmunt Sawicki, 2021).

As a rule, in the scientific literature on the theory of physical culture, persons' gender characteristics of performing physical activity are considered as part of the sexual dimorphism index assessment, which is calculated by the ratio of the shoulder and pelvis width index value (Tanner, 1986) or the ratio of waist and hip sizes (Eksterowicz Jerzy, Napierała Marek, 2020). However, it seems relevant to consider this issue from the

perspective of the gender identity of a person having a certain gender through the categories of «masculinity» (masculinity) and «femininity» (femininity) using the Bem questionnaire (1974), which is recommended for use in sports practice.

The number of young people with serious health disorders is increasing among students (Gerber et al., 2017; Glazkova et al., 2020), which requires them to limit physical activity during physical education classes. There is a constant need for in-depth study of the relationship of physical activity not only with morphofunctional, typological, but also gender characteristics for more effective use of physical activity individualization principle (Ashanin et al., 2018; Gumenyuk et al., 2021). Robert Podstawski et al., (2020) describe the sexual difference of anatomical components and motor qualities of male and female students. It is known that the same gender may have signs of both male and female. The pre-possession of one of the signs denotes «masculinity» and «femininity».

The scientific press has not fully studied the relationship of psychological gender type with morphofunctional indicators of girls with serious somatic non-communicable diseases limiting such students' physical activity. Studies of the constitution gender type state are of particular importance in girls of reproductive age, which includes university students. The female body with signs of masculinization is characterized by an increased content of male sex hormones and can be considered as a predictor of negative characteristics of their somatic health (Kandel et al., 2014; Tkachuk et al., 2019).

The results of the girls' attending a special medical group psychological profile analysis allow obtaining information about their motor and morphofunctional qualities specifics, which can increase the effectiveness of physical culture and wellness technologies among students. The analysis of the relationship of motor qualities, morphofunctional characteristics with the gender type of the girls' body relates to the current scientific direction of research in the field of human physical health (Yıldız, 2018).

Research aim. Studying the state and peculiarities of morphological, functional and motor qualities of female students having various psychological gender engaged in physical education in a special medical group.

Material & methods

150 girls aged 17-19, students of the Technical University of Irkutsk (Russia), took part in the research project in the 2021-2022 academic year. According to the medical examination, all the girls had various somatic diseases, were assigned to a special medical group and had restrictions on physical activity in physical education classes at the university.

Psychological testing of the sex of all the girls was carried out using a questionnaire proposed by Sandra L. Bem (1974). Based on the analysis of the results of the questionnaire calculations, four psychological genders of girls were identified: A) masculine - high indicators of male traits and low -female; B) feminine – high indicators of female traits and low –male traits; C) androgynous – high indicators of both male and female traits; D) undifferentiated – low indicators and male and female traits.

The established gender role types were compared with the anthropometric, functional and motor indicators of the girls' body. Morphological parameters included the measurement of body length, cm, weight, kg and chest circumference at rest, cm. The functional parameters of the girls' body provided for the determination of maximum (systolic) and minimum (diastolic) blood pressure, mmHg; heart rate before and after exercise in the form of squats for 30 seconds; ortho- and clino- tests, beats/min; hands muscles strength, kg; hypoxic tests of the Stange and Gench, s. To characterize the systolic work of the heart at rest, the Robinson index was calculated: $IR = HRV \times SBP / 100$, conventional units, where HRV is the pulse rate at rest; SBP is systolic blood pressure (Robinson, 1967).

The strength abilities characteristics were described according to the formula for calculating the strength index (SI): hand strength, kg x 100 / body weight, kg, %. The girls' motor qualities were evaluated based on the results of using tests: «running 30 m from a high start», s; «running 1000 m», m/s; «abdominal crunch for 30 seconds», the number of times; «push-ups», the number of times; «forward bend from a sitting position», cm; «standing long jump», cm.

All the girls signed a written consent to participate in the project, according to the principles of biomedical research (Helsinki Declaration 2008).

The digital material of the project was subjected to statistical processing with the calculation of the arithmetic mean, its error and t-reliability of the values of indicators using the software package Statistica 6.1 for Windows. Differences in the values of the indicators were considered reliable at $p < 0.05$.

Results

The girls' testing using a gender-role questionnaire found that the surveyed population is dominated by the feminine type, which is registered in 112 (74.7%) people, the masculine type is established in 23 (15.3%), and androgynous in 15 (10.0%). No undifferentiated types have been identified.

The values of anthropometric and functional indicators in girls of different psychological gender are presented in Table 1.

Table 1. Values of morphofunctional indicators in girls with different psychological gender types, $M \pm m$

Indicators		Psychological gender			
		Masculine (n=23)	Feminine (n=112)	Androgynous (n=15)	
Anthropometric research					
Body length, cm		165.15±0.56*	158.6±1.83	162.18±2.15	
Body mass, kg		60.07±3.16*	54.2±3.55	56.58±0.94	
Chest circumference at rest, cm		86.0±2.18	79.8±2.24*	85.59±0.70	
Functional research					
Blood pressure, mmHg.		Systolic	106.8±5.81	114.66±3.45	112.88±4.14
		Diastolic	72.97±0.29*	77.08±2.21	76.87±3.48
20 squats for 30 s	Pulse before loading, beats /10s	14.14±0.22*	14.70±0.17	14.83±0.22	
	Pulse after loading, beats /10s	21.35±0.28*	22.12±0.32	22.32±0.56	
	Pulse recovery time, s	94.66±3.25*	111.66±12.95	126.0±12.04	
Left hand strength, kg		29.0±1.30*	22.13±1.59	23.78±1.47	
Right hand strength, kg		30.6±2.13*	23.69±1.63	24.98±0.48	
Stange's test, s		54.4±4.29*	39.58±1.83	44.84±2.46	
Gench's test, s		31.8±3.29*	20.25±1.52	24.15±2.75	
Pulse during ortho test beats/min	Lying	78.12±1.47*	82.15±1.93	81.23±1.27	
	Standing	83.29±1.76*	103.07±5.39	97.2±7.41	
	Difference	5.17±0.98*	20.92±2.96	15.97±0.57	
Pulse during clino- test, beats/min	Lying	88.48±1.65	91.2±1.87	90.4±3.87	
	Standing	83.25±1.42	84.0±4.0	82.5±4.0	
	Difference	5.23±1.04*	8.8±1.95	7.9±1.95	

We have registered that girls having the masculine psychological gender have a longer body length and weight than girls of the feminine and androgynous ones, $p < 0.05$. The value of the chest circumference index is greater in representatives of the masculine sex, compared with the feminine type, $p < 0.05$.

Functional indicators have significant differences between girls with different psychological gender. The lowest value of diastolic blood pressure was observed in girls with the masculine psychological gender (72.97 ± 0.29 mmHg), compared with other gender types, $p < 0.05$. The values of systolic blood pressure indicators in girls did not significantly differ. The best values of heart rate and pulse recovery time in the loading test «20 squats for 30 seconds», hand dynamometry of both hands, hypoxic tests, ortho- and clino- tests were found in girls of the masculine psychological gender, which indicates more pronounced reserve capabilities of their body, compared with the functional characteristics of girls of the feminine and androgynous gender, $p < 0.05$. This is confirmed by the values of the Robinson index and the strength index in girls of the masculine psychological gender, compared with the values of the indicators in girls of other gender role types, $p < 0.05$, Figure 1.

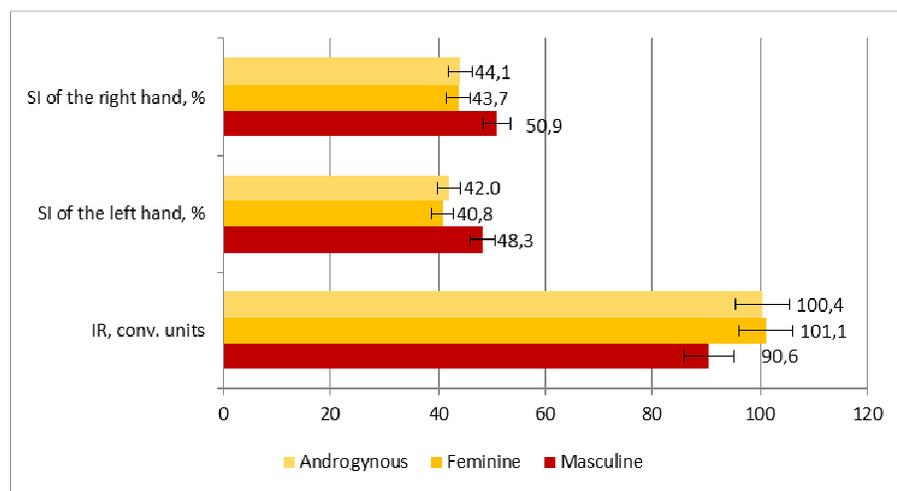


Fig. 1. Values of the Robinson index and the strength index indicators in girls of different psychological gender types

In order to study the relationship of motor qualities with various psychological gender types of girls, we tested all girls, Table 2.

Table 2. Values of motor tests indicators in girls of different psychological gender types, $M \pm m$

Test No	Tests	Psychological gender		
		Masculine (n=23)	Feminine (n=112)	Androgynous (n=15)
1	Running 30 m from a high start, s	5.82±0.08*	6.65±0.10	6.40±0.46
2	Running 1000 m, m/s	7.23±0.15*	7.86±0.31	8.14±1.55
3	Abdominal crunch for 30 seconds, the number of times	17.21±1.35	17.11±0.52	15.25±2.49
4	Push-ups, the number of times	18.62±2.88*	12.54±0.68	14.33±3.70
5	Forward bend from a sitting position, cm	13.08±1.96	13.02±0.62	10.8±3.12
6	Standing long jump, cm	163.0±2.88*	136.91±3.64	155.75±4.31

It was found that out of six motor tests in four of them, the best result was shown by girls of the masculine sexual type. In this group, the best results are recorded in speed qualities («running 30 m» test), in general endurance («running 1000 m» test), speed-strength ability of the muscles of the upper extremities («push-ups» test) and dynamic strength of the lower extremities muscles («standing long jump» test), compared with girls of the feminine and androgynous sexual type, $p < 0.05$. In two tests, a trend towards a better test result for masculine-type girls was revealed, $p > 0.05$. The percentage difference in the values of motor test indicators in girls of feminine and androgynous gender type, compared with girls of masculine type, is shown in Figure 2.

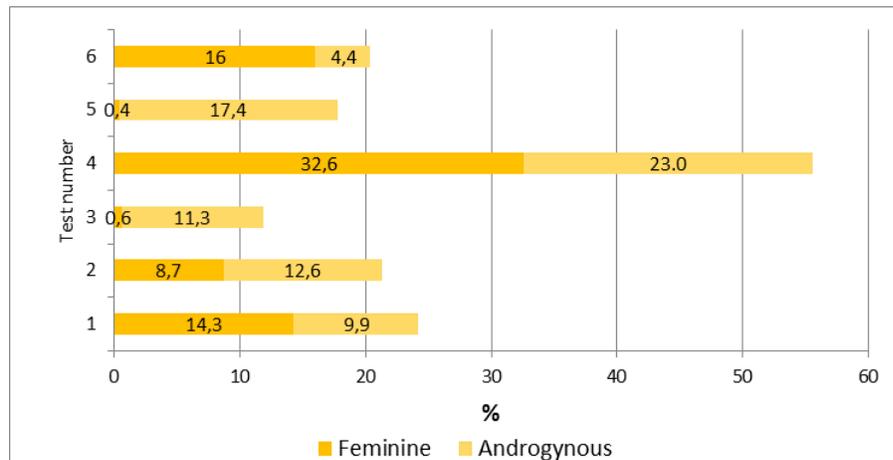


Fig. 2. The percentage difference in the motor tests values of girls having feminine and androgynous sexual type, compared with the masculine type

The greatest percentage difference in the motor tests values was found in girls of the feminine and androgynous sexual type, compared with the masculine in test No. 4 («push-ups»). The smallest difference was found in tests No. 3 («abdominal crunch for 30 seconds») and test No. 5 («forward bend from a sitting position»).

Dicussion

The study of the relationship between morphofunctional and motor qualities in female students with various psychological gender types refers to the current direction associated with improving the level of a person's physical health (Yildiz, 2018). Such studies are especially significant among girls with somatic health abnormalities and classified as a special medical group with limited physical activity (Gerber et al., 2017; Glazkova et al., 2020).

In our research project, the relationship of morphofunctional parameters of the girls' body with their psychological gender type has been reliably confirmed. According to our data, anthropometric and functional characteristics are most pronounced in girls of masculine sexual type. According to Kandel et al. (2014) and Tkachuk et al. (2019), signs of masculinization in women are caused by an increased content of male sex hormones, which leads to the development of an organism with pronounced signs of the male sex, which has higher values of anthropometric and functional indicators (Eksterowicz Jerzy, & Napierała Marek, 2020). A comparative study of the sexual dimorphism state in adolescent girls with an interval of 10 years has shown in

the last decade an increase of more than 50% in the number of girls with signs of masculinization, which is considered as a negative factor affecting the girls' health (Kolokoltsev et al., 2021). We believe that, despite the more pronounced morphofunctional indicators, such a gender role type in girls makes it possible to attribute the masculine type of girls to the risk group for reproductive function and somatic health, which is consistent with the opinion of other authors (Kandel et al., 2014; Tkachuk et al., 2019).

The higher tolerance to physical loads of girls with the masculine sexual type registered by us is due to the sufficiently high reserve capabilities of their body. This fact is indicated by significantly better functional capabilities of the cardiovascular and respiratory systems. These girls have lower values of heart rate at rest and after exercise, systolic heart function (Robinson index), hypoxic tests of Stange and Gench, which ensures high resistance of the body to aerobic and anaerobic loads. This is confirmed by higher indicators of motor tests for speed qualities and overall endurance.

An important characteristic of the masculine psychological gender type is the higher power abilities of their body. The reliably high values of both hands strength dynamometry indicators and the strength indices of both arms in girls of the masculine type indicate their superiority in some motor tests. According to our data, girls with signs of masculinization had significantly higher indicators values in strength tests of the muscles of the upper, lower extremities and trunk, compared with the results of girls of other psychological gender types.

The information we have received about the specifics of motor and morphofunctional qualities allows organizing more individualized physical education classes for university students and to increase the effectiveness of physical culture and wellness technologies among students.

Conclusions

Our research project has established that among the surveyed girls, the most common psychological gender type is the feminine psychological type, to which 74.7% of girls are attributed, 15.3 % are attributed to the masculine type and to androgynous type - 10.0%.

The research results analysis reliably confirmed the relationship of morphofunctional and motor qualities with the girls' psychological gender type. The highest values of anthropometric indicators were found in girls of masculine sexual type. They register the best values of heart rate and pulse recovery time in the stress test «20 squats for 30 seconds», hand dynamometry of both hands, hypoxic tests, ortho- and clino- tests. The higher values of morphofunctional qualities found in girls of the masculine psychological gender indicate more pronounced reserve capabilities of their organism, compared with the functional characteristics of girls of the feminine and androgynous sex, $p < 0.05$. Higher characteristics of morphofunctional indicators of girls with masculine sexual type provide significantly better values in most motor tests, compared with the results of girls of other psychological gender types, $p < 0.05$.

The obtained research results of the relationship of morphofunctional and motor qualities of girls with different psychological gender types can be used in the organization of physical education of students to improve the effectiveness of health-saving technologies of physical education.

Conflicts of interest. The authors declare no conflict of interest.

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