

«BEAUTY» fitness program to improve body composition of 16-year-old girls

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Abstract:

According to the scientific literature, it is known that modern youth uses the «Hot Iron» fitness technique to reduce body weight and develop strength abilities. However, there is not enough research on this technique use in institutions of additional physical education. **Research aim:** to develop and test the «Beauty» fitness program based on the «Hot Iron» technique for correcting the body composition of girls aged 16 in an institution of additional education. **Materials and methods.** The research was conducted in Kopeysk (Russia). The project participants were two groups of girls (n=20) aged 16, 4. The annual training program in both groups was 170 hours. In each group, classes were held after school hours 3 times a week for 60 minutes. In the control group, the girls were engaged only in the gym according to the traditional program of additional education. In the experimental group, the girls trained according to the program we proposed, in which the first and third classes were held in the gym, the second lesson was held in the fitness room using the «Hot Iron» power fitness technology. We conducted high-stakes testing of anthropometric, physiometric indicators, general and strength training, calculated BMI and Ruffier index. **Results.** At the end of the research, the girls of the experimental group, compared with the control group, significantly increased the values of biceps circumference of both arms, chest circumference, decreased the values of wrist circumference, hip and waist circumference, body mass index and Ruffier index, increased the values of indicators of all general physical fitness and strength abilities tests, $p < 0.05$. In the experimental group, the increase in the values of all motor tests was higher than in the control one. **Conclusions.** The results of the approbation confirmed the effectiveness of the fitness program «Beauty» developed by us for the girls' aged 16 comfortable composition of the body formation.

Key Words: training program, fitness, «Hot Iron», body composition, sports

Introduction

In different countries of the world, scientists are engaged in research on human inactivity and its genesis (Druz et al., 2017; Osipov et al., 2017; Salin et al., 2019; Setiakarnawijaya et al., 2021). Insufficient motor activity can lead not only to deterioration in physical fitness, but also to a violation of the metabolic processes in the human body, which leads to the appearance of various diseases (Syamsudin et al., 2021). In the WHO protocol of Obesity and overweight (2018) reports an annual increase in the number of overweight and obese people with low motor activity. Despite the fact that there are a large number of reports in the scientific literature about the positive results of testing various ways to combat excess weight, it seems relevant to continue the search for effective means, methods and directions for normalizing human body weight.

It is known from scientific sources that physical activity is a necessary condition for improving health, observing the basics of a healthy lifestyle and reducing human body weight. Galan et al. (2019) report on fundamentally new approaches to wellness technologies. An analysis of the literature shows that fitness technologies of various directions are used to correct the physique, which have a positive health and preventive effect (Kolomiytseva, & Anatsky, 2017; Kudryavtsev et al., 2018; Mokrova et al., 2018).

A common cause of metabolic disorders in girls' aged 16-18 body is hypokinesia, which has a trend towards obesity, impaired functional performance and decreased physical fitness, as indicated by low results of motor and functional tests (Bakiko et al., 2020). Lack of movement on the background of obesity negatively affects the future childbearing function of girls (Broughton, & Moley, 2017). The use of fitness technologies

allows making adjustments to the physique of young people, improve their physical and somatic health indicators (Zhamardiy et al., 2020; Mazin et al., 2021).

In recent years, strength types of fitness have become popular among girls, such as athletic gymnastics, bodybuilding, body fitness and others. The use of highly effective training devices allows relatively quick adjustments to physical and somatic health to reduce fat and increase muscle components in the body (Mosina, & Aksarina, 2019). Such physical exercises improve posture and muscle relief of the body (Eliane Aparecida Franco et al., 2021). In addition to using fitness tools in educational institutions (Nenenko, & Maksimova, 2018), young students began to attend additional classes in gyms and fitness centers (Shuba, & Shuba, 2017; Zorio-Ferreres et al., 2018). This combination of motor activity has a positive effect on young people's physical condition (Jessica et al., 2020), increases the reserve capabilities of the cardiorespiratory system and is a prevention of excess body weight and obesity (Vashchuk et al., 2018). Currently, fitness programs are very popular among young people, especially girls with overweight or obesity. Girls are the most demanding to the state of their physique, of which more than 40% prefer an asthenic body type with low BMI values (Pop Cristiana Lucretia, 2018). Effective means of reducing human body weight are aerobic exercise and strength fitness. The German technique of strength fitness «Hot Iron» (Iron System, 2021) is aimed at increasing strength endurance, correcting the physique and reducing body weight and is a system of physical exercises with mini-barbells of various weights (Nenenko, & Maksimova, 2018). In the scientific literature, the issues of the effective application of the «Hot Iron» training technique in the development of strength abilities and maintaining normal body weight in educational institutions are discussed (Mokrova et al., 2018). However, there is a lack of research related to the development of methods of using «Hot Iron» in institutions of additional education for strength abilities development, weight loss and the formation of the physique of girls aged 16. This situation explains the relevance of our chosen research topic. **Research aim** is to develop and test «Beauty» fitness program based on «Hot Iron» technique for correcting the body composition of girls aged 16 in an institution of additional education.

Material & methods

The pilot project was carried out from September 2020 to May 2021 in Kopeysk (Russia). The participants of the project were 20 girls aged 16.4 who were engaged in strength fitness in the institution of additional education «Children's Sports School» and had no medical contraindications. Of these, the control (CG, n=10) and experimental (EG, n=10) groups were formed by randomized selection. The traditional program of annual training load in both groups was 170 hours. In each group, classes were conducted by the method of circular training outside of school hours 3 times a week for 60 minutes.

The girls of the control group were engaged only in the gym according to the traditional program of additional education. The girls of the experimental group were engaged in «Beauty» program proposed by us, which provides for the first and third training sessions in the gym, the second lesson was held in the fitness room using the «Hot Iron» power fitness technology. The first training of the weekly microcycle in both groups was carried out by a separate method and was aimed at improving the overall physical fitness of the girls. The third training in both groups was conducted by the interval method. The second lesson in the control group was conducted by the interval method, and in the experimental group it was conducted by the variable method. In the preparatory and final part of each lesson, stretching exercises were performed in both groups.

The location and methods of the second lesson differed from each other. The girls of the control group continued to study according to the traditional program in the gym. The girls of the experimental group were engaged 1 time a week in the fitness studio according to an experimental program based on «Hot Iron» technique (Dusseldorf, Germany). According to this method, basic physical exercises were performed with a mini-barbell and a weight of 2 kg. Under rhythmic musical accompaniment, the girls performed lunges, lifting the neck from the chest in a standing and lying position, twisting biceps, squats in various techniques with the mandatory participation of certified specialists in the training process. Physical exercises, methods and directions of training changed every 1.5-2 months. Additionally, equipment was used: step platform, stuffed balls, dumbbells, kettlebells, fitball and skipping rope. EG girls performed 3-5 laps of supersets with a rest between laps of 1.5-2 minutes. The program proposed by us was used for the formation of a physical and mental comfortable composition of the body and the development of strength abilities. Anthropometric methods were used to perform boundary measurements of the length (cm) and body weight (kg) of the girths of the right wrist, left and right shoulder (cm), chest circumference (cm) and waist (cm), right hip (cm). The functional parameters of the cardiovascular system were determined: heart rate (beats per minute), Ruffier index (conventional units). BMI (kg/m^2) was calculated.

The level of general physical fitness development was determined by testing the motor qualities of all girls before and after the experiment. To do this, we used tests: running 100 m, s; running 2000 m, m, s; modified pulling up on a low crossbar, the number of times; abdominal crunch, the number of times in 1 m; leaning forward from the standing position on the bench, cm; standing long jump, cm. We conducted a high-stakes testing of strength abilities. To do this, control exercises were used: jumping squat, the number of times; the «plank» exercise, s; hanging on the crossbar on straight arms, s; jumping rope for 1 m, the number of times;

the basic crossfit exercise «burpee», the number of times; squatting with a bodybar 10 times, points; lifting a bodybar weighing 7 kg over your head for 1 m, the number of times; deadlift 10 times, points; «chair for the wall», s. The work was carried out in compliance with international ethical standards and rules of scientific research. The parents' consent to the children's examination was obtained. The research materials were processed using the licensed software package Statistica 6.0. According to the Shapiro-Wilk criterion, the normality of the distribution of parameter values was determined. The reliability of the differences in the studied features was assessed using the Wilcoxon matched pairs test and Mann-Whitney U-test criteria.

Results

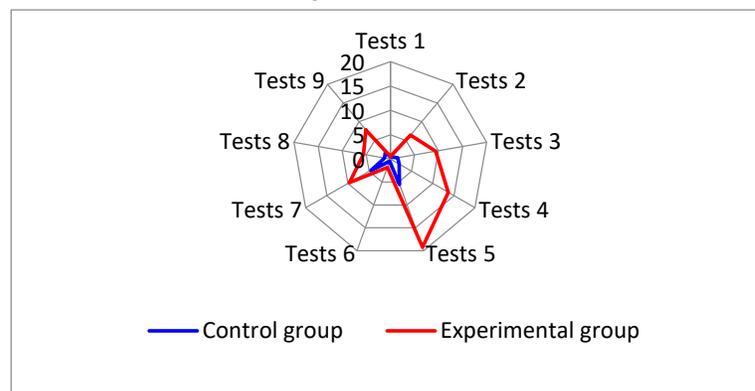
At the beginning of the experiment, there were no significant differences between the anthropometric indicators values and the Ruffier index in the girls of the control and experimental groups (Table 1).

Table 1. Boundary indicators of the girls' anthropometric and functional examination of (M±m)

Test number	Indicators	CG (n=10)		EG (n=10)	
		At the beginning of the experiment	At the end of the experiment	At the beginning of the experiment	At the end of the experiment
Anthropometric indicators					
1.	Body length (cm)	164,5±5,22	165,3±5,22	165,2±2,29	166,3±5,28
2.	Body weight (kg)	64,9±2,42	64,5±2,47	67,6±2,58	63,3±2,29
3.	Girth of the right wrist, (cm)	13,8±0,63	13,6±0,72	13,9±0,49	12,6±0,36*
4.	Girth of the left wrist (biceps), (cm)	19,8±1,25	20,2±1,64	19,7±1,19	22,4±1,09*
5.	Girth of the right shoulder (biceps), (cm)	19,9±1,27	21,0±1,29	19,8±1,32	23,6±1,19*
6.	Chest circumference (cm)	86,2±2,24	86,6±2,32	86,4±2,38	88,0±2,58
7.	Waist circumference (cm)	75,5±2,09	72,0±2,14	76,4±2,27	69,0±1,87*
8.	Right hip circumference (cm)	98,4±2,39	97,2±2,36	99,6±2,41	94,0±2,19*
9.	BMI, (kg/m ²)	23,89±1,14	23,5±1,24	24,73±1,49	22,8±1,09*
Cardiovascular system efficiency indicator					
10.	Ruffier index (conventional units)	7,0±1,19	6,0±1,35	8,0±1,45	4,0±1,64*

Note.* the difference is significant (p < 0,05)

Analysis of the initial individual BMI results showed that 50% of CG girls and 60% of EG girls are overweight, the rest of the girls had a normal BMI index. By the end of the experiment, excess body weight was registered only in two girls in the control group. At the end of the pedagogical experiment, an increase in the value of anthropometric indicators and an improvement in the Ruffier index were found in both groups. At the end of the experiment, the values of biceps circumference of both arms significantly increased in EG girls, values of wrist circumference, hip circumference and waist circumference significantly decreased, p < 0.05. The body mass index significantly decreased by 7.8% and the Ruffier index by 2 times, p < 0.05 (Table 1). This may indicate the high efficiency of the fitness program «Beauty» proposed by us, based on the «Hot Iron» method, compared with the workouts that were conducted in the control group according to the traditional program. The increase in the values of the indicators is shown in Figure 1.



Note: 1, 2, 3, 4, 5, 6, 7, 8, 9 - test numbers

Fig. 1. The increase in the anthropometric indicators values in girls at the end of the pedagogical experiment (%)

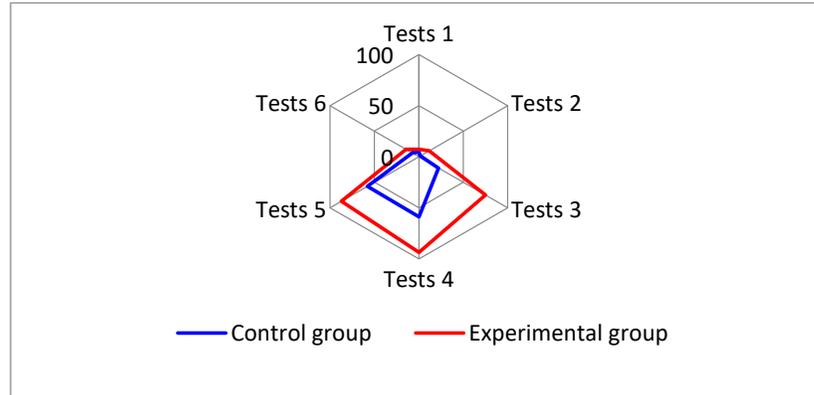
The physical loadings experienced by the girls of both groups in the classroom led to an increase in their overall physical fitness, as indicated by the results of motor testing (Table 2).

Table 2. High-stakes testing of the girls' general physical fitness (M±m)

Test number	Indicators	CG (n=10)		EG (n=10)	
		At the beginning of the experiment	At the end of the experiment	At the beginning of the experiment	At the end of the experiment
1.	Running 100 m,(s)	18,9±0,32	18,0±0,12*	18,8±0,29	17,4±0,31*
2.	Running 2000 m, (m, s)	11,59±0,32	11,42±0,25	11,58±0,39	10,21±0,19*
3.	Modified pulling up on a low crossbar, (number of times)	9,0±1,19	11,0±1,45	8,0±1,48	14,0±1,68*
4.	Abdominal crunch, (number of times in 1 m)	17,0±1,74	27,0±2,60*	16,0±1,49	31,0±3,21*
5.	Leaning forward from the standing position on the bench, (cm)	7,6±1,59	12,0±1,49*	8,0±1,68	15,0±2,57*
6.	Standing long jump, (cm)	164,4±10,21	176,6±11,19	163,7±10,31	187,1±12,33*

Note.* the difference is significant ($p < 0,05$)

At the end of the pedagogical experiment, the EG girls registered a significant increase in the values of general physical fitness indicators in all tests, and the CG girls only in three tests, $p < 0.05$. Figure 2 shows the increase in the values of these indicators for all participants of the experiment.



Note: 1, 2, 3, 4, 5, 6 - test numbers

Fig. 2. The increase in general physical fitness indicators values in girls at the end of the pedagogical experiment (%)

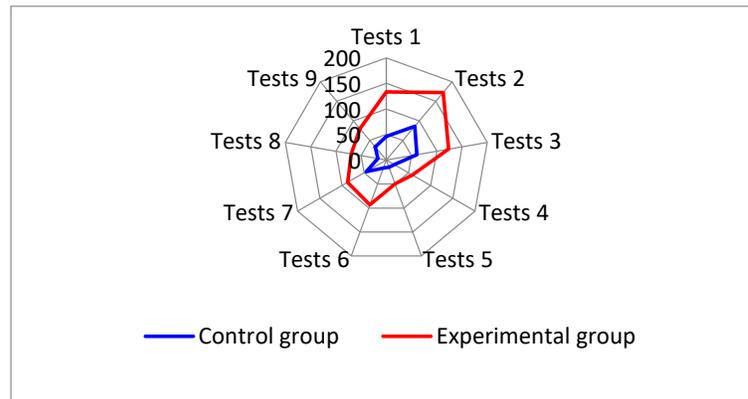
In the experimental group, the increase in the indicators of all general physical fitness tests of girls was higher than that of girls in the control one. High-stakes testing of the girls' strength abilities was carried out in both groups (Table 3).

Table 3. High-stakes testing of the girls' strength abilities (M±m)

Test number	Indicators	CG (n=10)		EG (n=10)	
		At the beginning of the experiment	At the end of the experiment	At the beginning of the experiment	At the end of the experiment
1.	Jumping squat, (number of times)	13,0±1,42	19,0±2,23*	12,0±1,37	28,0±2,31*
2.	«Plank» exercise (s)	24,6±2,35	45,8±3,58*	23,8±2,27	64,9±4,27*
3.	Hanging on the crossbar on straight arms, (s)	16,8±2,25	26,9±3,54*	17,2±2,38	38,4±3,89*
4.	Jumping rope for 1 m (number of times)	48,4±3,35	57,2±4,21*	49,2±4,48	78,2±5,11*
5.	Basic crossfit exercise «burpee», (number of times)	5,4±0,74	6,2±1,23	5,2±0,71	7,8±1,25*
6.	Squatting with a bodybar 10 times, (points)	4,8±0,13	5,6±1,28	4,6±0,11	8,9±2,41*
7.	Lifting a bodybar weighing 7 kg over your head for 1 m, (number of times)	18,4±2,21	26,8±4,74*	19,0±1,29	35,6±3,29*
8.	Deadlift 10 times, (points)	4,8±0,34	5,6±1,14	4,6±0,21	7,8±1,51*
9.	«Chair by the wall», (s)	43,8±3,32	58,6±4,62*	44,4±4,54	79,9±5,79*

Note.* the difference is significant ($p < 0,05$)

At the end of the pedagogical experiment, the values of all strength tests indicators significantly increased in the EG girls. In CG girls, the values of indicators significantly increased only in six tests, $p < 0.05$. The increase in the values of the girls' strength indicators by the end of the experiment is shown in Figure 3.



Note: 1, 2, 3, 4, 5, 6, 7, 8, 9 - test numbers

Fig. 3. The increase in the girls' strength training indicators values at the end of the pedagogical experiment (%)

The greatest increase in the strength fitness indicators values is observed in the girls of the experimental group, compared with the results in the girls of the control one. At the end of the pedagogical experiment, a summary analysis of the girls' fitness training results in the annual macrocycle was carried out (Table 4).

Table 4. Comparative characteristics of the experiment results using fitness programs

Program	Traditional program for CG			Experimental program for EG using		
	Circuit training					
Lesson number	1	2	3	1	2	3
Training method	Independent	Interval	Interval	Independent	Variable	Interval
Training location	Gym	Gym	Gym	Gym	Fitness studio	Gym
	Training performance					
BMI decrease	+	+	+	+	++	+
Muscle mass increase	+	+	+	+	++	+
Strength abilities increase	+	+	+	+	++	+

The results of our experiment show that training in the fitness studio by a variable method using the «Hot Iron» technology turned out to be much more effective for increasing muscle and strength characteristics, reducing body weight in girls of the experimental group, compared with the results of girls of the control group who were engaged in the traditional method.

Dicussion

In the medical and sports environment, the body mass index is considered as an indicator of the state of metabolic processes and the work of various functional systems of the human body (Syamsudin et al., 2021; Gryaznykh et al., 2021). In this regard, a deviation from the norm of body weight is an indirect evidence of deterioration in health. The reasons for the increase in body weight are considered to be a high-calorie diet and a decrease in physical activity (Denisova, 2019). Compliance with the correct dietary regime and refusal of physical inactivity will help a person to correctly form and correct the image of his/her body (Kolokoltsev et al., 2021). The use of traditional forms and methods of physical culture may not always lead to positive results of physique correction. Physical activity in adolescence should not be limited only to compulsory PE classes in an educational institution. Therefore, additional physical activity is required, which they can receive in institutions of additional sports education and training (Iermakov et al., 2012). The psychophysical foundations of physique correction are especially pronounced in girls (Pop Cristiana Lucretia, 2018). Therefore, the use of modern fitness technologies for the formation of a healthy and attractive body figure is an acute problem in the modern world.

Currently, additional classes in various fitness institutions are very popular among young people, especially among overweight or obese girls. Fitness training is recommended to be used from school age, which provides a higher wellness effect (Mehmeti, & Halilaj, 2018). The results of our research project are in consensus with the conclusions of these authors. The aerobic and strength orientation of «Hot Iron» training system, which we used in the experiment, corresponds to the authors' conclusions that physical activity of this orientation is the most effective (Kolomiytseva, & Anatsky, 2017; Kudryavtsev et al., 2018; Mokrova et al., 2018). At the end of the research project in the experimental group, reliable results of weight loss and BMI of girls were obtained, which is consistent with the data of other authors (Mazin Vasyl et al., 2021). They also significantly increased the size of the girth of the upper shoulder girdle muscles and the chest circumference,

decreased the size of the waist, hips and wrists circumferences. The relationship between anthropometric indicators and the value of BMI is reported by other researchers (Zerf Mohammed et al., 2017), with whom we agree. At the same time, the values of physical fitness indicators and the Ruffier index, as a marker of the degree of cardiovascular system performance, improved. There was a significant increase in the indicators values in all general and strength physical fitness tests, compared with the values of the girls' in the control group indicators, which is consistent with the results of a research by other authors (Mokrova et al., 2018).

We believe that during our pedagogical research, the girls' of the experimental group body composition process was more successful than that of girls' in the control group, which is consistent with the results of the Nenenko, Maksimova (2018) research. Our research results indicate a high effectiveness of methods of physique correction using a proposed fitness program «Beauty», based on the method of «Hot Iron», so it can be recommended for other secondary institutions sports profile and fitness centers.

Conclusions

In the institution of additional physical education, «Beauty» fitness program was tested using the «Hot Iron» technique to correct the body image of girls aged 16. At the end of the pedagogical project, the girls of the experimental group significantly increased the values of the biceps circumference of both arms, chest circumference, decreased the values of the wrist circumference, hip circumference and waist circumference. The body mass index significantly decreased by 7.8% and the Ruffier index by 2 times. The values of the general physical and strength fitness indicators were significantly higher than in the girls of the control group. The increase in the values of indicators of anthropometric and all physical fitness tests in the girls of the experimental group was significantly higher than in the girls of the control one. The results of our experiment indicate that conducting fitness training according to the «Beauty» program proposed by us using the «Hot Iron» technique turned out to be significantly more effective for reducing body weight, forming a comfortable composition of the body image of girls aged 16 than the results of a year training macrocycle in the control group, where classes were held according to the traditional method. The effectiveness of the «Beauty» program is reliably confirmed by the results of our research project. This allows us to recommend such fitness technology for use in institutions of additional physical education and sports sections. Modern fitness technologies require constant testing and scientific analysis.

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

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