ORIGINAL ARTICLE

The influence of health-improving fitness classes on the degree of fat deposition in women of the second mature age

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Contribution of authors: A - Research design; B - Data collection; C - Statistical analysis; D - Preparation of the manuscript; E-Funds Collection.

Abstract

Background and Study Aim	Purpose of the research: analysis of the influence of health-improving fitness classes of various orientations on the degree of fat deposition in women of the second mature age.
Material and Methods	Participants: group 1 – 40 women, (43.33 ± 0.93) years, group 2 – 25 women, (44.40 ± 0.93) years. The participants trained for 8 months, three times a week for 1 hour. Group 1 – classes in dance aerobics (Monday), strength fitness (Wednesday) and stretching (Friday). Group 2 – stretching only. Before the start and after the end of the program, the body weight and length were determined, the degree of fat deposition using a calipermeter at 17 points, the body mass index was calculated.
Results	In group 1, there was a significant decrease in body weight, BMI, a decrease in the thickness of skin and fat folds at all points. In group 2, a significant decrease in body weight, BMI, a decrease in the thickness of folds at 13 points in 60-96% of participants was established. At the end of the study, group 1 had a smaller size of the folds of the thighs and left forearm compared to group 2. Regular exercise leads to a decrease in body weight BMI, a decrease in body fat. Complex classes have a more pronounced effect compared to stretching. This type of training is more effective in terms of the dynamics of the criteria used and the number of participants with the established changes. The sessions provided an increase in the number of persons with a normal BMI and a decrease in the number of obese participants.
Conclusions	The applied indicators and methods can be recommended for use in health monitoring in health fitness.

Keywords: fitness program, stretching, fat deposition, caliperometry.

Introduction

Wellness fitness is an effective means of optimizing your health. Regular exercises allow to improve well-being, increase the level of basic physical qualities, positively influence the composition of the human body, and optimize the quality of life. Currently, physical activity is considered as a preventive measure against many chronic diseases [1]. A special program "Men on the Move" was developed for Irish men with physical inactivity. The program consisted of classes twice a week for 12 weeks. Confirmed a pronounced positive effect on aerobic capacity, body weight and waist circumference.

Regular exercise can prevent and correct hypertension [2]. A taekwondo training program was used for health-improving purposes. Participants worked for 90 minutes, three times a week, for 12 weeks. Improvement in body composition and physical fitness was confirmed in elderly women with hypertension compared with the control group.

Physical activity can slow down the aging process in the elderly [3]. An exercise program for four months has been shown to improve metabolic processes in elderly women.

Regular exercise counteracts motor regression and adverse changes in body composition in older adults. An 8-month training program was developed for people over 40 years old [4]. The program was based on individually selected loads with a gradual increase in the volume and intensity of classes. A decrease in body weight, a decrease in adipose tissue, an improvement in physical fitness and flexibility have been established.

The effect of exercise on body composition and cardiorespiratory capacity in obese South African women was studied in another study [5]. The participants practiced for 12 weeks 4 times a week for 40-60 minutes. A decrease in the mass of subcutaneous adipose tissue, an increase in the rate of fat oxidation, and an increase in functional capabilities were confirmed.

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Wellness fitness is inextricably linked to monitoring the health of the population. This requires the development of new original criteria for analysis and forecast. It was proposed to use the analysis of body fat as an indicator of cardiometabolic risk [6]. The presence of links between the level of fat deposits on the neck and body weight, body mass index, muscle mass, adipose and visceral adipose tissue was confirmed.

The relationship between adaptive capacity and the distribution of abdominal fat in overweight adults has been studied [7]. The indicators of the cardiorespiratory system were assessed according to the results of stress tests. An inverse relationship of these indicators with the content of visceral and subcutaneous fat has been established.

Another study [8] examined the relationship between epicardial adipose tissue volume and cardiorespiratory fitness in Japanese people of different ages and both sexes. Epicardial adipose tissue volume was significantly negatively associated with peak cardiac output and peak oxygen consumption. A strong negative correlation was found between adipose tissue and peak heart rate. Correction of adipose tissue significantly improves hemodynamics and functionality of the cardiorespiratory system.

The influence of aerobic exercise of medium and high intensity on the endocrine profile and the amount of adipose tissue in young healthy men with different phenotypic characteristics has been confirmed [9]. Lipolysis rate, hormonal and metabolic responses to aerobic exercise depend on the phenotype of the individual. The type, duration and intensity of exercise must be strictly individualized depending on the phenotype for optimal effect.

Literature confirms the possibility of using wellness fitness to reduce body fatty tissue. Proceeding from this, the aim of the study was to analyze the effect of health-improving fitness of various orientations on the degree of fat deposition in women of the second mature age.

Materials & Methods

Participants.

65 women were divided into two groups. Group 1 – 40 women, average age (43.33 ± 0.93) years. Group 2 – 25 women, average age (44.40 ± 0.93) years. All the participants had no medical contraindications for training. The participants were engaged in wellness fitness for 8 months, three times a week for 1 hour. Group 1 studied according to the developed complex program. The program consisted of dance aerobics (Monday), strength fitness (Wednesday) and stretching (Friday). Participants of the 2nd group were engaged in stretching. This study was approved by the Bioethics Committee for Clinical Research and conducted according to the Declaration of Helsinki. All participants gave their written consent to research and were informed about the purpose and test procedures and about the possibility of withdrawal of consent at any time for any reason.

Study design

The design of the study involved the determination of body length and weight, the degree of fat deposition before and after the start of the program. The measurements were carried out in accordance with the requirements of the international unified method of anthropometric research [10]. Body length was measured with a medical stadiometer, body weight was measured on an Aurora AU 311 electronic balance (China).

The body mass index (kg / m2) was calculated as the ratio of body weight (kg) to body length (m) squared. The indicator was evaluated according to the following scale: less than 19 kg/m^2 – body weight deficit, 19-24 kg/m^2 – normal, 24-30 kg/m^2 – overweight, over 30 kg/m^2 – obesity.

The degree of fat deposition was determined using a mechanical caliper (China). The folds were measured at 17 anthropometric points. The biceps were measured vertically in the middle of the muscle on the right and left. Triceps were measured vertically in the upper third of the muscle on the right and left. The forearm was measured vertically on the front surface at the widest point on the right and left. The back was measured at the lower angle of the scapula vertically to the right and left. The ribcage was measured vertically along the front line at the X ribs on the right and left. The abdomen was measured vertically at the level of the navel, to the right of it, at a distance of 5 cm. The pelvis was measured at the iliac crest on the right and left. The thigh was measured in the supine position on the front of the thigh at the beginning of the sartorius muscle on the right and left. The lower leg was measured in the prone position vertically on the back surface of the lower leg at the level of the lower corner of the popliteal fossa on the right and left.

Statistical analysis.

Statistical analysis of the data obtained was carried out using licensed Excel spreadsheet packages. Descriptive statistics indicators were determined: arithmetic mean, standard deviation and mean error. The significance of differences in the groups was assessed using the parametric Student's test (t) and nonparametric tests of signs (z) and Rosenbaum (Q). The dynamics of indicators was assessed according to the t and z criteria, the groups were compared according to the t and Q criteria. Differences were considered significant at $p<0.05$.

Results

The research results are shown in Table 1.

Table 1. Somatometric and somatoscopic indicators of the participants

Indicator	1 group (n=40)		2 group (n=25)	
	Beginning of experiment	End of experiment	Beginning of experiment	End of experiment
Body length, cm	163.78±1.19	163.78±1.19	164.72±1.07	164.72±1.07
Body weight, kg	73.27±2.58	67.52±2.13	71.67±3.26	70.98±2.93
Body mass index, kg/m^2	27.30±0.88	25.18±0.74	26.56±1.10	26.33±1.00
The thickness of the skin-fat folds, mm				
Right biceps	21.23±1.421	14.50±1.03	17.17±1.65	15.98±1.42
Left biceps	22.20±1.521	15.43±1.11	17.39±1.64	16.15±1.37
Right triceps	15.43±1.391	19.93±1.17	23.30±2.00	21.28±1.61
Left triceps	26.38±1.391	19.90±1.24	22.72±1.91	21.28±1.61
Right forearm	10.64±0.701	7.28±0.51	8.87±0.90	8.01±0.72
Left forearm	11.13±0.751	7.74±0.55	8.93±0.89	8.05±0.69
Back to the right	27.50±1.781	20.43±1.63	24.70±2.76	23.07±2.44
Back to the left	28.50±1.871	20.88±1.68	24.74±2.84	22.93±2.57
Chest to the right	18.18±1.421	13.58±1.20	17.00±2.13	15.91±1.82
Chest to the left	18.45±1.471	13.90±1.23	17.41±2.19	16.04±1.84
Pelvis to the right	20.13±1.531	14.03±1.13	16.17±1.91	14.93±1.51
Pelvis to the left	19.70±1.531	14.20±1.23	16.96±2.23	15.37±1.70
Right thigh	40.60±1.671	29.90±1.422	37.65±2.20	36.17±2.04
Left thigh	40.43±1.701	30.35±1.462	36.83±2.30	35.76±2.18
Calf right	26.00±1.851	19.70±1.54	21.61±1.97	20.41±1.82
Calf left	26.23±1.791	19.33±1.52	21.52±2.04	20.39±1.86
Abdomen	35.90±2.291	23.20±1.67	31.65±3.43	29.43±2.97
The average fold thickness	14.12±0.731	8.74±0.49	12.39±0.951	9.89±0.70

Notes: 1 - differences in the dynamics of the study are reliable ($p < 0.05$); 2 - the differences between the groups are significant ($p < 0.05$)

There were no significant differences between groups at the beginning of the experiment.

The implementation of the program provided in group 1 a decrease in body weight ($z = 2$), BMI ($z = 2$). The thickness of the skin-fat folds decreased on the right biceps ($t = 3.83$, $z = 0$), left biceps ($t = 3.60$, $z = 0$), right triceps ($t = 3.52$, $z = 0$), triceps left ($t = 3.48$, $z = 0$), right forearm ($t = 3.87$, $z = 0$), left forearm ($t = 3.65$, $z = 0$), back to the right ($t = 2.93$, $z = 0$), back to the left ($t = 3.03$, $z = 0$), chest to the right ($t = 2.47$, $z = 0$), chest to the left ($t = 2.37$, $z = 0$), pelvis to the right ($t = 3.20$, $z = 0$), pelvis to the left ($t = 2.80$, $z = 0$), right thigh ($t = 4.89$, $z = 0$), left thigh ($t = 4.49$, $z = 1$), calf right ($t = 2.61$, $z = 0$), calf left ($t = 2.94$, $z = 0$), abdomen ($t = 4, 47$, $z = 0$). The average fold thickness decreased significantly ($t = 5.18$, $z = 2$).

In group 2, there was a decrease in body weight ($z = 7$), BMI ($z = 7$). The thickness of the skin-fat fold decreased on the right biceps ($z = 4$, $n = 18$), left biceps ($z = 6$, $n = 23$), right triceps ($z = 5$, $n = 21$), right forearm ($z = 4$, $n = 18$), left forearm ($z = 5$, $n = 22$), back to the right ($z = 5$, $n = 20$), back to the left ($z = 4$, $n = 19$), chest to the right ($z = 3$, $n = 18$), chest to the left ($z = 4$, $n = 19$), right thigh ($z = 3$, $n = 21$), calf right ($z = 1$, $n = 15$), calf left ($z = 5$, $n = 19$), abdomen ($z = 4$, $n = 24$). The average fold thickness decreased significantly ($t = 2.13$; $z = 1$).

The size of folds at the end of the study on the right and left thighs, on the left forearm in group 1 was significantly less than in group 2, respectively, ($t = 2.52$), ($t = 2.06$) and ($Q = 8$).

An individual analysis of the BMI structure in groups and its dynamics was carried out. The normal indicator was in group 1 at the beginning of the program (30.00 ± 7.25)%, at the end (45.00 ± 7.87)%. The body weight deficit was, respectively, (2.50 ± 2.47)% and (5.00 ± 3.45)% of the participants. Excess weight was established, respectively, in (32.5 ± 7.41)% and (35.00 ± 7.54)% of the participants. Obesity was, respectively, (35.00 ± 7.54)% and (15.00 ± 5.65)% of the participants. The implementation of the program led to a significant reduction in the proportion of participants with obesity ($t = 2.12$).

Normal BMI was in group 2 at the beginning of the program (28.00 ± 8.98)%, at the end - in (32.00 ± 9.33)%. The body weight deficit was, respectively, (4.00 ± 3.92)% and (4.00 ± 3.92)% of the participants. Excess weight was established, respectively, in (36.00 ± 9.60)% and (36.00 ± 9.60)% of the participants. Obesity was, respectively, (32.00 ± 9.33)% and (28.00 ± 8.98)% of the participants. There were no significant changes in the specific gravity. There were no differences between the proportions in the groups after the end of the program.

Discussion

A characteristic feature of the health of middle-aged women is an increased likelihood of developing obesity. Wellness fitness is an effective means of preventing and correcting overweight and obesity. The development of health-improving programs of this orientation is widely represented in the

literature. The development of such a program was the goal of the study [11]. The authors developed a TRX training program and evaluated its effect on the amount of adipose tissue in the participants. The duration of the program was 12 months, the age of the participants was 30-40 years. A more intense reduction in adipose tissue has been confirmed compared to other health-improving activities.

Kang et al. [12] studied the effects of regular resistance exercise for 12 weeks on obese women. Regular resistance exercise is more effective in reducing weight and body fat in postmenopausal women than in premenopausal women.

The positive influence of dancing and strength fitness classes on the morphological parameters of women was confirmed in another study [13]. Expansion of the adaptive-compensatory potential of the participants was found under the influence of regular training.

The goal was to compare the effect of complex and selective health programs. This design is widely used. Ponomareva [14] compared changes in the level of physical fitness and physiological parameters of students as a result of aerobics and traditional types of exercises.

A similar design was used by Meszler et al. [15]. The authors compared the health benefits of strength training and stretching in healthy young women after 8 weeks of training.

A similar design is used by Dianatinasab et al. [16]. The authors examined the effects of aerobic exercise, resistance exercise, and combined exercise on anthropometric and metabolic performance. The duration of the training was 8 weeks. A significant increase in muscle mass and a decrease in adipose tissue were confirmed in all types of exercises.

The pronounced effect of a comprehensive health-improving program was confirmed in another study [17]. The use of classes of various orientations in the weekly cycle provided a pronounced improvement in morphological and functional indicators, an expansion of functional capabilities, an increase in adaptive potential.

The main criterion for achieving the research goal is to confirm the effect of the program. The effect depends on the duration of its application and the evaluation criteria.

The duration of the wellness program forms the effect of its implementation. The works cited above contain information about health programs lasting 8-32 weeks [1-4, 11, 12, 15, 16]. This study was designed for 8 months of sessions (32 weeks). Somatotype changes must occur during this period.

The choice of criteria for assessing the effectiveness of the classes was carried out taking into account the focus of the program. Jagiełło et al. [18] emphasize the importance of monitoring the morphological and functional indicators of athletes for the management and correction of training. The accuracy of the prediction can be increased through an integrated approach to assessing the condition. The effectiveness of the use in monitoring of biochemical tests, psychophysiological studies, indicators and indices of physical development has been confirmed [19-21].

Body weight and body fat are among the most common anthropometric criteria. Caliperometry is used to determine the degree of fat deposition along with densitometry, bioimpedance, magnetic resonance imaging. This method is considered one of the most informative and valid. Increasing the accuracy of caliperometry results is achieved by increasing the number of measurement points. The use of measurement results at 17 points significantly increases their information content.

Hong et al. [22] note the need for a combination of anthropometric studies and functional tests in the analysis of the performance of persons engaged in health-related exercises.

Body mass index is used to analyze health, nutritional status, and the effectiveness of health improvement activities. The use of indices is due to their simplicity and clarity, the possibility of using them in monitoring the condition of athletes and amateurs [19, 21]. The use of a battery of indices makes it possible to predict success in various types of martial arts.

The absence of differences between the groups at the beginning of our experiment confirms the closeness of the physical condition of the participants. This illustrates the correctness of dividing them into groups. Compliance with this condition increases the objectivity of the analysis.

Losing body weight and decreasing BMI confirms the effectiveness of wellness fitness. This effect was confirmed in both groups. All the options used for the exercise had a pronounced effect on adipose tissue.

This assumption is confirmed by the dynamics of the thickness of the skin and fat folds. Classes for 8 months led to a decrease in this indicator at all measurement points in group 1. In group 2, a decrease in the thickness of folds was found only in 13 points. All participants in group 1 had a decrease in this criterion. A decrease in the thickness of folds was confirmed in 60-96% of participants in group 2 at different measurement points.

Our data confirm the results of other studies [4, 5, 23, 24]. This proves the correctness of the chosen study design, the developed fitness program. Another study [24] aimed to analyze the effect of physical activity on body composition. Exercising for 5 months provided a significant reduction in adipose tissue and an increase in muscle mass. Reducing body fat decreases total body weight, and the difference between fat and total body weight is statistically significant.

In our study, it was established that the average

size of folds in both groups decreased significantly. The magnitude of the decrease in group 1 was 38.1% of the initial value. The amount of fold reduction in group 2 was less and amounted to only 20.17% of the initial value. The results obtained are explained by the peculiarities of the organization of classes. Participants of the 1st group used a complex version of the lessons. These included aerobic, strength and stretching exercises. Various activities significantly enhance the effect, provide a complex effect on the body. Classes in group 2 belonged to the so-called "mental fitness". They are aimed at improving flexibility, increasing the range of motion in the joints. The fat burning effect of stretching is less pronounced.

Our results confirm the data of the review by Rao et al. [25]. The review evaluates the effectiveness of exercise and pharmacotherapy for reducing visceral fat. Exercise has been shown to reduce visceral fat more effectively than body weight.

Interesting facts were established by comparing the size of the skin and fat folds at the end of our experiment. Participants in group 1 had a smaller number of folds on the thighs. This can be explained in terms of age-related changes. The greatest deposition of fat is observed in the thighs and pelvis in women in this age group. A decrease in the size of folds on the thighs reflects the pronounced fat burning effect of exercises, the greater effectiveness of complex exercises for reducing body fat. Perhaps the decrease in the thickness of the folds on the forearm is due to the increase in these muscle groups. Group 1 was engaged in strength fitness. This option provided an impact on all muscle groups. Group 2 participants performed stretching exercises. They practically do not affect muscle volume. These results are corroborated by data from Chambers et al. [26]. The authors examined the effects of lifelong aerobic exercise on skeletal muscle size, function, and body fat. Aging and prolonged aerobic exercise affect muscle size, function, and fat infiltration. Higher training intensity throughout life provided better muscle condition and protection against obesity.

Nankam et al. [27] evaluated the effect of 12-week combined resistance training and aerobic exercise on inflammatory and oxidative status of abdominal and gluteal subcutaneous adipose tissue in obese black South African women. Changes in markers of systemic oxidative stress correlated with a decrease in body fat.

In our study, an individual analysis of BMI also allows us to assess the effectiveness of health-improving activities. At the beginning of the experiment, more than half of the participants in group 1 were overweight and obese. This allows them to be attributed to the risk group. An increase in body weight above normal significantly increases the risk of developing metabolic syndrome, the formation of chronic non-infectious diseases. The number of participants with normal body weight increased by 1.5 times at the end of the experiment. The number of obese participants decreased 2.3 times. These changes occurred due to a decrease in the fat component of body weight under the influence of exercise. Overweight participants moved to the normal weight group. This led to an increase in this subgroup. The size of the subgroup of obese participants decreased due to the transition of participants to the overweight subgroup. Therefore, the size of the overweight subgroup did not change significantly.

Our results are consistent with those of Nayor et al. [28]. The authors confirmed that metabolic changes are related to exercise. An increase in body mass index in women leads to adverse metabolic changes.

BMI changes in group 2 were less pronounced. The number of participants with a normal score at the end of the study increased by 4%. The size of the overweight subgroup remained virtually unchanged. The number of obese people has decreased by 4%. These changes confirm once again the assumptions made earlier. Stretching exercises have less fat burning effect.

The study of the characteristics of the somatotype makes it possible to assess the specificity of the influence of various activities on the human body. The somatotype allows you to distinguish people depending on the regularity of the exercise [Jagiello et al., 2014]. The use of various methods allows evaluating the effectiveness of training in various sports. In this study, the dynamics of body weight, body mass index and the results of caliperometry were used to assess the effectiveness. This made it possible to significantly increase the information content of the results obtained.

Conclusions

The influence of health-improving fitness on body weight and the degree of fat deposition in women of the second mature age has been confirmed. Regular exercise for 8 months leads to a decrease in body weight and BMI, and a decrease in body fat. Complex classes have a more pronounced effect compared to stretching. This type of training is more effective in terms of the dynamics of the criteria used and the number of participants with the established changes. The sessions provided an increase in the number of persons with a normal BMI and a decrease in the number of obese participants. The applied indicators and methods can be recommended for use in health monitoring in health fitness.

Conflicts of Interest

The authors declare there are no competing interests.

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