EFFECTS OF HIIT PROGRAMS ON THE BODY COMPOSITION OF WOMEN

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Abstract: The aim of this study was to examine the effect of a ten-week high-intensity interval training (HIIT) program on changes in body composition in women. The study involved 42 female subjects, aged 25 to 32 years, divided into an experimental (n=22) and a control group (n=20). The experimental group participated in a HIIT program three times a week for 10 weeks, while the control group did not have organized physical activity. Body composition parameters were measured using bioelectrical impedance, and statistical data processing included an ANOVA test for repeated measures. The results showed significant improvements in the experimental group in terms of reducing body mass, fat percentage and increasing muscle mass, with statistically significant values ($p<0.05$) and large effect sizes ($eta^2 > 0.14$). It was concluded that HIIT is an effective method for improving body composition in women, and is recommended as an effective form of physical activity in order to improve health and appearance.

Keywords: Interval training, health, bioelectrical impedance, adipose tissue, muscle mass, physical activity

INTRODUCTION

Current trends show that obesity is becoming an increasingly widespread health problem in almost all age groups and countries (Wu & Hao, 2021). The situation is particularly worrying for women, who are at increased risk of adipose tissue accumulation in midlife, especially in the abdominal area (Kapoor, Collazo-Clavell, & Faubion, 2017; Lizcano & Guzmán, 2014). Upon entering menopause, this risk is further intensified, as is the likelihood of developing metabolic disorders such as hypertension, dyslipidemia, and type 2 diabetes (Monteleone et al., 2018). Such changes are most often associated with changes in body composition – an increase in total fat mass, loss of muscle mass, and changes in fat distribution (Abildgaard et al., 2013). In younger, premenopausal women, abdominal and visceral fat is less pronounced, which to some extent protects them from metabolic syndrome (Palmer & Clegg, 2015). However, menopause brings with it hormonal changes, primarily a drop in estrogen, which leads to the redistribution of fat tissue towards the central regions of the body – the so-called android type of obesity – which is more often associated with chronic diseases, especially cardiovascular diseases (Kapoor et al., 2017; Karvonen-Gutierrez & Kim, 2016). For these reasons, body weight control and regulation of fat tissue in women during this period of life is an extremely important public health goal (Dolin & Kominiarek, 2018). Traditionally, programs aimed at reducing body weight often rely on diet and moderate physical activity. However, numerous studies confirm that dietary interventions alone are not effective enough, especially in the long term, if they are not combined with regular exercise (Hassan, Latif, & Yacoub, 2012; Verheggen et al., 2016). In this context, international guidelines most often recommend moderate-intensity continuous training (MICT) as the basic strategy for reducing body fat, given its duration and intensity that favors fat oxidation (Donnelly et al., 2009). However, although it has a positive impact on cardiovascular health, this regimen often results in modest or almost no reduction in body fat (Boutcher, 2011). In recent years, high-intensity interval training (HIIT) has gained increasing importance as an effective and time-efficient method of exercise. It is characterized by short, intense bursts of effort (80–100% of maximum heart rate), followed by periods of rest or lower intensity (MacInnis & Gibala, 2017; Weston, Wisløff, & Coombes, 2014). HIIT has been shown to increase fat burning after exercise, including the reduction of abdominal and visceral fat – which are considered the most dangerous to health (Maillard et al., 2018). In addition, this form of exercise significantly reduces the time it takes to achieve results,making it an attractive choice for modern women who face a chronic lack of time due to professional and family obligations (Costigan et al., 2015). In the context of the student population, it has been observed that many young women abandon the physical habits acquired in adolescence due to academic obligations and social pressures, and it is precisely "lack of time" that often represents the biggest obstacle to exercise (Trost et al., 2002; Kwan et al., 2012). This is where HIIT offers a solution, because in a shorter time frame it provides the same or even better results than traditional cardio training (Ito, 2019). However, some authors warn that the effort required by HIIT can induce negative emotional states in inactive or obese women, which may affect their long-term motivation and adherence (Bartlett et al., 2011; Kong et al., 2016). On the other hand, when properly adapted to individual fitness levels, HIIT has shown a positive impact not only on body composition, but also on psychological well-being, cardiorespiratory endurance, and cognitive abilities (Li et al., 2021; Strassnig et al., 2015; Koyuncuoğlu et al., 2021; Eather et al., 2019). However, research in this area is still not completely uniform, and studies that specifically examine the effects of HIIT in women at different hormonal stages are lacking, which is crucial, given that the drop in estrogen can affect the body's metabolic response to physical activity (Isacco & Boisseau, 2017). Therefore, more empirical data are needed to determine the extent to which HIIT can indeed contribute to the reduction of body and visceral fat in women of different ages and health status (Roy et al., 2018; Türk et al., 2017). The aim of this research was to show the effects of the hiit program on the body composition of women.

METHODS

The research was conducted with the aim of examining the effect of ten weeks of high-intensity interval training (HIIT) on changes in body composition in women. The study was of an experimental nature with the application of a pretest-posttest design with a control group.

Participants

A total of 42 participants, aged 25 to 32, participated in the research, divided into two groups - experimental (n = 22) and control (n = 20). The criteria for inclusion in the study were: regular health status, physical inactivity in the previous three months and consent to participate. The respondents voluntarily joined the research and had the right to withdraw at any time without consequences. The test subjects of the control group did not have experimental treatment, they performed standard life tasks.

Variables

To assess body composition, the Xiaomi Mi Body Composition Scale 2 bioelectrical analyzer was used, which allows for precise measurement of parameters.

Parameters that were measured for research purposes:

- Total body weight (kg)
- Body fat percentage (%)
- Muscle mass percentage (%)
- Body water percentage (%)
- Carcass fat percentage (%)
- Arm fat percentage (%)
- Leg fat percentage (%)

Measurements were conducted under controlled conditions, always at the same time of day and according to the manufacturer's standardized instructions.

Experimental program

The experimental group was exposed to high-intensity interval training (HIIT) for 10 weeks, performed three times a week, lasting 45 minutes per session. The training consisted of short periods of high intensity (75–90% of maximum load), which were alternated with shorter intervals of active recovery. The exercises included multi-joint movements with their own weight and additional load, and the program was progressive – the load and the number of sets were gradually increased. The control group did not have any programmed physical activity during the experiment (Xiaolin, 2023).

Statistical Analysis

SPSS software, version 20, was used for data processing. Based on descriptive statistics, arithmetic means and standard deviations were calculated for all measured variables. Analysis of variance (ANOVA) for repeated measures was used to assess the effects of treatment, with the aim of determining the existence of statistically significant differences between the initial and final measurements within and between groups. The significance level was set at Sig. < 0.05, and size effects were also analyzed using eta square.

RESULTS AND DISCUSSION

According to the values shown in Table 1. At the beginning of the treatment, the experimental and control groups had almost identical values in most variables, which speaks in favor of the homogeneity of the sample. The total body weight in the experimental group was 68.4 kg (±6.2), while in the control group it was 67.9 kg (±6.5). The percentage of body fat was 31.2% (±3.5) in the experimental group, or 30.9% (±3.8) in the control group.

Table 1. Descriptive parameters of body composition between the experimental and control groups at initial measurement

Variable	Group	N	M (SD)
Total body weight (kg)	Experimental	22	68.4 (±6.2)
	Control	20	67.9 (±6.5)
Body fat percentage (%)	Experimental	22	31.2 (±3.5)
	Control	20	30.9 (±3.8)
Muscle mass percentage (%)	Experimental	22	34.8 (±2.7)
	Control	20	35.1 (±2.9)
Body water percentage (%)	Experimental	22	49.3 (±3.2)
	Control	20	49.6 (±3.1)
Carcass fat percentage (%)	Experimental	22	32.5 (±3.9)
	Control	20	32.1 (±4.0)
Arm fat percentage (%)	Experimental	22	28.8 (±4.1)
	Control	20	29.2 (±4.3)
Leg fat percentage (%)	Experimental	22	30.1 (±3.7)
	Control	20	30.3 (±3.9)

Legend: **N:** number of respondents; **Group:** group (experimental-control); **Variable:** variable; **M:** mean value; **SD:** standard deviation

Muscle mass was slightly higher in the control group (35.1%) than in the experimental group (34.8%), but the difference was minimal. Similar values were also recorded for the percentage of water (49.3% vs 49.6%), body fat (32.5% vs 32.1%), arms (28.8% vs 29.2%), and legs (30.1% vs 30.3%). Initial measurements confirm that there were no significant differences between the groups in any of the variables analyzed.

The results are shown in Table 2. After the program, the experimental group showed clear improvements. Total weight dropped to 65.0 kg (±5.8), which is a decrease from the initial 68.4 kg, while in the control group it almost did not change (67.5 kg).

Table 2. Descriptive parameters of body composition between the experimental and control groups at the final measurement

Variable	Group	N	M (SD)
Total body weight (kg)	Experimental	22	65.0 (±5.8)
	Control	20	67.5 (±6.2)
Body fat percentage (%)	Experimental	22	28.1 (±3.2)
	Control	20	30.7 (±3.6)
Muscle mass percentage (%)	Experimental	22	36.9 (±2.5)
	Control	20	35.0 (±2.7)
Body water percentage (%)	Experimental	22	51.4 (±2.9)
	Control	20	49.7 (±3.0)
Carcass fat percentage (%)	Experimental	22	29.5 (±3.7)
	Control	20	32.0 (±3.8)
Arm fat percentage (%)	Experimental	22	26.0 (±3.9)
	Control	20	29.1 (±4.2)
Leg fat percentage (%)	Experimental	22	27.2 (±3.5)
	Control	20	30.1 (±3.7)

Legend: **N:** number of respondents; **Group:** group (experimental-control); **Variable:** variable; **M:** mean value; **SD:** standard deviation

The percentage of body fat in the experimental group fell from 31.2% to 28.1%, while in the control group it was slightly reduced to 30.7%. Muscle mass increased from 34.8% to 36.9% in the experimental group, while in the control group it was 35.0%, indicating positive effects of the program.

Significant improvements were also observed in body water percentage (51.4% vs. 49.7%), body fat (29.5% vs. 32.0%), arms (26.0% vs. 29.1%), and legs (27.2% vs. 30.1%) – all parameters indicating a decrease in fat and an increase in muscle and water components.

The results of the ANOVA analysis in Table 3 show that there were statistically significant changes in almost all analyzed variables in the experimental group. The most pronounced shifts were recorded in the percentage of body fat and muscle mass - the values changed significantly, with Sig. values less than 0.01, which indicates a high level of significance. The effect of the program on muscle mass had an eta square of 0.186, which is considered a large effect in a research context. Body fat percentage showed an effect size of 0.173, while other variables, such as body water and trunk fat, had eta squares above 0.14, indicating medium to large effects. This means that the changes cannot be explained by chance, but are a direct result of the implemented program.

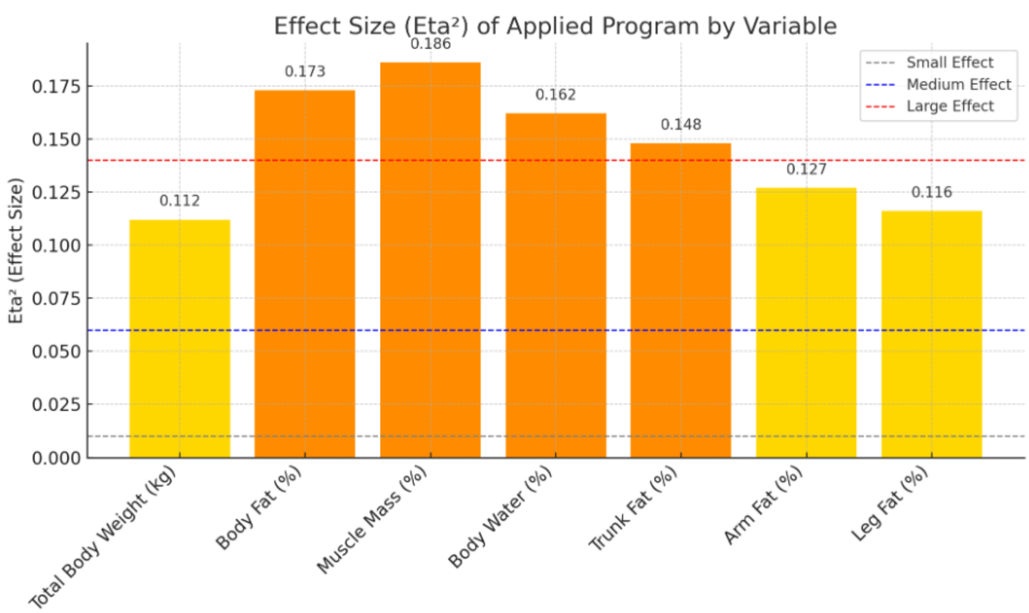
Table 3. ANOVA, differences between initial and final measurements, experimental and control groups

Variable	F	Sig.	Eta²
Total body weight (kg)	4.95	.031*	0.112
Body fat percentage (%)	8.27	.006*	0173
Muscle mass percentage (%)	9.14	.004*	0.186
Body water percentage (%)	7.62	.008*	0.162
Carcass fat percentage (%)	6.84	.012*	0.148
Arm fat percentage (%)	5.72	.021*	0.127
Leg fat percentage (%)	5.10	.028*	0.116

Legend:F: F-test value; Sig.: statistical significance (Sig<.05 – significant difference); Eta2: effect size coefficient (0.01=small effect, 0.06=medium effect; 0.14+=large effect).

In the control group, on the other hand, there were no significant differences between the initial and final measurements, which further confirms that the observed changes in the experimental group were indeed a consequence of the experimental treatment.

Chart 1.The size of the effects of the conducted experimental program, initial and final measurement between experimental and control.



The graph clearly shows the effects of the applied program on the body composition of the subjects, especially in reducing fat deposits and increasing muscle mass. Visual analysis clearly indicates the success of the program, with the effects of the program being predominantly large or medium. Such results confirm the effectiveness of the planned and targeted approach in improving physical fitness. This further confirms that the experimental program was effective in improving the body composition of the subjects.

Previous studies support our findings, confirming that high-intensity interval training (HIIT) can have a significant impact on changes in body composition. Nunes et al. (2019) conducted a study in obese postmenopausal women and showed that an eight-week HIIT program led to significant reductions in body fat percentage and visceral fat, along with positive changes in inflammatory markers. These findings suggest that HIIT may be an effective strategy for fat loss even in specific and vulnerable populations.

Similar results were reported by Maillard et al. (2018), who analyzed the effects of a HIIT program on a group of obese and normal-weight young men. After eight weeks of training, there was a significant reduction in body fat in obese subjects, along with improvements in aerobic and anaerobic fitness. This suggests that HIIT not only affects body composition, but also overall physical fitness.

Also, Boudou et al. (2003) showed that high-intensity aerobic interval training reduces the amount of abdominal fat in postmenopausal women with type 2 diabetes. After 12 weeks of intervention, participants showed significant progress in reducing central obesity, which further confirms that the metabolic and aesthetic effects of HIIT are multiple and applicable to different target groups.

CONCLUSION

Based on the results obtained, it can be concluded that high-intensity interval training (HIIT), carried out over a period of 10 weeks, three times a week, for 45 minutes per training session and with an intensity of 75–90% of maximum load, leads to significant changes in body composition. Participants in the experimental group recorded a decrease in body fat percentage and an increase in muscle mass, with positive changes in other relevant parameters such as water percentage and regional fat distribution.

These findings confirm the effectiveness of HIIT programs as a practical and effective form of physical activity for improving body composition. However, given the breadth of potential effects that this type of training can have, it is recommended that future research include additional parameters, such as motor skills or other morphological characteristics, body circumference, and the like, in order to gain an even more comprehensive picture of the long-term impact of HIIT on health and functionality of the body.

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