

Abstract

Title: The effect of physical training on body composition and health in men with metabolic syndrome

Background: Metabolic syndrome (MetS) is the co-occurrence of risk factors for cardiovascular disease and diabetes, such as abdominal obesity, insulin resistance, hypertension, and hyperlipidemia. The main predisposing factor for MetS is obesity, especially with central fat distribution. In obese individuals at risk for MetS, disrupted adipokine production can lead to insulin resistance and increased inflammation in the body. The treatment process for obesity and metabolic syndrome begins with lifestyle modifications, primarily through the introduction of regular physical activity. Both aerobic and resistance training, by affecting adipose tissue, skeletal muscles, and their internal production, are the main tools used to improve metabolic parameters in patients with obesity.

Aim: The aim of this study was to assess the impact of two types of twelve-week physical training (aerobic training vs. aerobic-resistance training) on body composition, insulin resistance markers, lipid profile, and selected adipokine concentrations in men with MetS, compared to men with MetS not undergoing training (control group). Subsequently, participants from all three groups were observed for four weeks without any planned intervention (follow-up).

Material and methods: The study involved 62 men (BMI = 34 ± 4 kg/m²), aged 30-45 years (37 ± 7 years), with increased waist circumference (WC ≥ 94 cm) and two out of four diagnosed MetS criteria. The participants were randomly assigned to three groups: group EG1 (n = 21) performing aerobic training, group EG2 (n = 21) performing aerobic-resistance training, and control group CG (n = 20) not engaging in any training.

Direct anthropometric measurements, body composition (dual-energy X-ray absorptiometry - DEXA), carbohydrate-lipid metabolism markers (glucose, insulin, lipid profile, HOMA-AD, HOMA-TG, QUICKI), and adipokine concentrations (irisin, interleukin-6, leptin, omentin, interleukin-8, adiponectin, adiponectin/leptin) were assessed four times: before the intervention, after 6 and 12 weeks of training, and 4 weeks after the end of the training sessions (observation).

The physical training interventions, aerobic (3 x 6 MET) and aerobic-resistance (3 x 5.5 MET), involved three sessions per week and were individually planned. The total energy expenditures in group EG1 were 823.37 ± 175.76 kcal/day after 6 weeks and 835.18 ± 234.05 kcal/day after 12 weeks of intervention. In group EG2, they were 735.17 ± 119.64 kcal/day after 6 weeks and 797.89 ± 383.25 kcal/day after 12 weeks of intervention.

Inter-group (between the examined groups) and intra-group (within each group) changes were subjected to statistical analysis.

Results: In group EG1, a significant reduction in body weight, adipose tissue, and visceral adipose tissue fraction was confirmed. In group EG2, an increase in fat free mass and a reduction in adipose tissue, gynoid adipose tissue, and waist circumference were observed. As for insulin resistance markers, group EG1 showed a decrease in HOMA-TG and an increase in QUICKI. In group EG2, a significant decrease in HOMA-TG, HOMA-AD, and an increase in QUICKI were observed. No significant changes in non-HDL cholesterol and HDL were confirmed in any of the groups. However, changes in adipokine levels were observed during the intervention. In group EG1, an increase in irisin and IL-8 concentrations (after 6 weeks of intervention) and a decrease in IL-6 and leptin concentrations after 12 weeks of intervention were confirmed. In group EG2, a decrease in IL-6 and leptin concentrations was observed at every stage of the intervention. No significant changes in adiponectin and omentin levels were found in any of the participating groups.

Conclusions: Combining aerobic and resistance training is associated with clear benefits in improving body composition and insulin sensitivity in men with metabolic syndrome.

The implementation of aerobic training leads to changes in the levels of selected adipokines in the blood of men with metabolic syndrome. In the group performing aerobic-resistance training for 12 weeks, a decrease in IL-6 and leptin concentrations at every stage of the intervention was confirmed, indicating anti-inflammatory effects.

During the observation period without organized training in both intervention groups, the effects of reducing adipose tissue and its visceral accumulation were maintained. Both intervention groups also confirmed further favorable changes in insulin resistance markers. In the aerobic-resistance group, a further decrease in IL-6 concentration was observed, indicating a reduction in inflammation. Male participants maintained favorable health outcomes by engaging in regular physical training during the observation period.