https://doi.org/10.6063/motricidade.31647

Abstract

Combined Exercise Training, Body Composition, Glucose and Insulin Metabolism in Sedentary Workers

Fernanda M. Silva[1,2]*, Pedro Duarte-Mendes[3,4], Ana M. Teixeira[1,2], Carlos Farinha[1], Carlos M. Soares[1,2,5], José P. Ferreira[1,2]

[1] University of Coimbra, Faculty of Sport Sciences and Physical Education, Coimbra, Portugal.
[2] Research Unit for Sport and Physical Activity (CIDAF, uid/dtp/04213/2020), University of Coimbra, Coimbra, Portugal.
[3] Department of Sports and Well-being, Polytechnic Institute of Castelo Branco, Castelo Branco, Portugal.
[4] Sport, Health & Exercise Research Unit (SHERU), Polytechnic Institute of Castelo Branco, Castelo Branco, Portugal.
[5] Molecular Physical-Chemistry R & D Unit, Department of Chemistry, University of Coimbra, Coimbra, Portugal.

*E-mail: geral.fernandasilva@gmail.com

Conflict of interest: nothing to declare. **Funding:** Fernanda M. Silva is a grant holder from the Portuguese Foundation for Science and Technology (2020.08759.BD).

Sedentary behaviour (SB) and physical inactivity are two major risk factors for obesity, insulin resistance, type 2 diabetes, and cardiovascular disease development (Davies et al., 2018). Effective stress-reducing interventions, such as regular exercise, are essential to prevent the harmful impact of SB on metabolic outcomes (Pedersen, 2017). We aimed to analyse the effects of a combined training program on body composition, blood pressure (BP), and glucose and insulin metabolism markers in non-diabetic sedentary workers and to assess the associations between the changes promoted by the exercise intervention and the different variables studied. This is a single-blinded two-arm randomised controlled trial. Thirty-six participants (53.7±6.9 years old; BMI: 27.2±3.9 kg/m^2) underwent 16

weeks of combined exercise training [CET (n=18), resistance (6-15 reps at 45-90% 1RM) and aerobic exercise (60-95% HRmax)], 3 times/week, 75 min/session, or a control group (n=18). Body composition, blood pressure (BP), and fasting blood samples were taken pre- and post-intervention. Body composition was determined by bioimpedance (Inbody 270, USA). Blood pressure was measured using an automated oscillometric cuff (NBP-24 NG, USA). Fasting glucose and insulin were analysed using standard enzymatic assays (Atellica CH Analyzer, USA) and ELISA (Crystal Chem, USA), respectively. Plasma HbA1c level was determined by the Ion-exchange HPLC method (Tosoh Bioscience, California). The homeostatic model assessment of insulin resistance (HOMA-IR) was calculated as (glucose x insulin/22.5). The CET group significantly decreased BMI, waist circumference, fat mass, visceral adipose tissue, and increased muscle mass after the exercise intervention (p<0.01), while no significant changes were observed in the control group. A significant reduction of BP was observed in the CET group (time p=0.001). Fasting glucose increased in both groups without intergroup differences (time p<0.001); however, no significant changes were observed in HbA1c% levels. Fasting insulin was significantly higher in the control group after 16 weeks of follow-up (group p=0.01). The control group also increased the HOMA-IR index (time p=0.01) after 16 weeks of follow-up, with intergroup differences at follow-up (group p=0.03). No significant changes were observed in the CET group for insulin and HOMA-IR index (p>0.05). Bivariate correlations showed a significant positive correlation between the change (Δ) in systolic BP and Δ HOMA-IR index (r=0.475, p=0.046). Our results suggest that a combined training program could be an effective strategy to improve body composition and maintain normal glucose and insulin metabolism, preventing the development of metabolic disorders as well as the vascular dysfunction associated with the insulin resistance phenotype.

Acknowledgements

We thank the Clínica Affidea Castelo Branco for carrying out the blood collections and Bombeiros Voluntários Castelo Branco for providing their facilities.

References

Davies, K. A. B., Sprung, V. S., Norman, J. A., Thompson, A., Mitchell, K., Halford, J. C. G., Harrold, J. A., Wilding, J., Kemp, G. J., Cuthbertson, D. J. (2018). Short-term decreased physical activity with increased sedentary behaviour causes metabolic derangements and

altered body composition: effects in individuals with and without a first-degree relative with type 2 diabetes. *Diabetologia, 61*(6), 1282–94.

Pedersen, B. K. (2017). Anti-inflammatory effects of exercise: role in diabetes and cardiovascular disease. *European Journal of Clinical Investigation*, 47, 600–11.