

with breath-by-breath aliquots to obtain SD1 and SD2 values, normalized by the number of points in VE. All procedures were approved by the Local Ethics Committee (51596221.4.0000.5076).

**Results:** Demographic and anthropometric data including age, height, weight and BMI were not significantly different between groups ( $P > 0.05$ ). SD1 and SD1/SD2 for VE were significantly different for heart failure and heart failure-COPD compared to COPD and controls ( $P > 0.05$ ). SD2 did not differ between groups ( $P > 0.05$ ). Surprisingly, COPD and controls shared very similar mean values for SD1, SD2, and SD1/SD2, and HF-COPD showed similar vVE to heart failure alone ( $P > 0.05$ ).

**Conclusion:** Our results demonstrated increased vVE in chronic heart failure applying the Poincaré approach.

**Implications:** Despite the small number of patients, our preliminary results support the measurement of vVE by the Poincaré method as a promising tool in clinical physiology.

**Keywords:** Ventilation variability, COPD, Cardiac insufficiency, Heart failure

**Conflict of interest:** The authors declare no conflict of interest.

**Acknowledgment:** Not applicable.

**Ethics committee approval:** Evangelical University of the State of Goiás - 51596221.4.0000.5076.

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## ACUTE HEMODYNAMIC RESPONSES DURING RESISTANCE TRAINING WITH BLOOD FLOW RESTRICTION: A SYSTEMATIC REVIEW AND META-ANALYSIS OF CROSS-STUDIES

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**Background:** Studies using resistance training with partial restriction of blood flow (BRF) have shown significant gains in muscle performance, such as gains in strength and hypertrophy, however, few studies have evaluated the hemodynamic effects after using the technique.

**Objectives:** It consists of analyzing whether the BFR significantly alters the hemodynamic variables (HR, SBP, DBP) in comparison with the passive control (PC) and active control (conventional resistance training - CRT) groups.

**Methods:** The present study is a systematic review with meta-analysis registered in PROSPERO (No. CRD42021234757) and follows the Cochrane standard recommendations and the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines.

**Results:** A total of 15 randomized crossover studies with 466 participants were eligible for analyses. Our data demonstrated that BFR significantly increased HR compared to the PC condition (mean difference [MD] = 7.25, 95% CI: 2.15–12.35 bpm,  $I^2 = 12\%$ ), considering all data pooled (6 studies, 7 comparisons,  $n = 192$  subjects); however, BFR showed no significant differences from the CRT condition (MD = -4.75, 95% CI: -12.70 at 3.20 bpm,  $I^2 = 83\%$ ) (10 studies,  $n = 276$  subjects). Considering all data pooled (5 studies, 7 comparisons,  $n = 186$  subjects), BFR significantly increased SBP (MD = 11.67, 95% CI: 6.17–17.17 mmHg,  $I^2 = 0\%$ ) compared to the condition of PC. In contrast, there was no difference when compared to the CRT condition (MD = 2.17, 95% CI: -5.62 to 9.96 mmHg,  $I^2 = 77\%$ ) (10 studies,  $n = 264$  subjects). Similar to SBP, BFR significantly increased DBP (MD = 6.93, 95% CI: 1.24–12.61 mmHg,  $I^2 = 41\%$ ) (5 studies, 7 comparisons,  $n = 186$  subjects) compared to PC condition while there

was no difference when compared to the CRT condition (MD = 1.41, 95% CI: -6.49 to 9.31 mmHg,  $I^2 = 89\%$ ) (11 studies,  $n = 306$  subjects).

**Conclusion:** Our data demonstrated that, despite causing remarkable hemodynamic responses compared to no exercise, BFR modulates all hemodynamic parameters HR, SBP and DBP, similarly to CRT.

**Implications:** The present research provides evidence supporting the use of BFR associated with RT in healthy subjects.

**Keywords:** Hemodynamics, Resistance training, Blood flow restriction

**Conflict of interest:** The authors declare no conflict of interest.

**Acknowledgment:** Not applicable.

**Ethics committee approval:** Not applicable.

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## EFFECTIVENESS OF GAMIFIED EXERCISE PROGRAMS ON THE LEVEL OF PHYSICAL ACTIVITY IN ADULTS WITH CHRONIC DISEASES: A SCOPING REVIEW

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**Background:** Non-communicable chronic diseases are characterized by their slow progression and long duration. They usually require ongoing management. The practice of regular physical exercises is recommended due to the already proven benefits; however, it still has low adherence by patients. In view of this, we currently observe the increasing use of technologies with the aim of reducing sedentary behavior to improve disease management, as well as prevent them in this population.

**Objectives:** To map and understand the state of the art in the use of gamified exercise programs in the level of physical activity, sedentary behavior, and quality of life in patients with chronic non-communicable diseases. In addition, to investigate whether there is a difference in the benefits of programs with or without professional exercise supervision.

**Methods:** In this scope review, searches were performed in the following databases: PubMed, EMBASE, PEDro, LILACS and Cochrane Library. Randomized clinical trials with adults or elderly people with chronic diseases undergoing gamified exercise programs that investigated the effect of gamified exercise programs compared to usual exercise on physical activity level, sedentary behavior and quality of life were included. The methodological quality (via PEDro, 0 to 10pts), the description of the intervention (via TIDier, 0 to 20pts) and the quality of health applications (via MARS, 0 to 20pts) of the included studies were evaluated.

**Results:** Nine studies were included ( $n=901$ ;  $61 \pm 5$  years) including three studies in individuals with cancer, one with stroke, one with multiple sclerosis, one with COPD, two with Diabetes Mellitus, and one with knee and hip osteoarthritis. In three studies, gamification was performed via a smartphone application. The intervention was supervised in six of the nine studies. The scores of the studies in PEDro and TIDier were  $5.5 \pm 1.3$  (ranging from 0 to 8 pts) and  $16.11 \pm 3.14$  (ranging from 10 to 20 pts), respectively. MARS (ranging from 10,9 to 16,9 pts) was applied in three studies and the score was  $13.4 \pm 9.75$ . Supervised gamified interventions increased the level of physical activity (movement time, daily steps and distance walked in 6 minutes) compared to usual supervised exercises.