

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.

Quality of life was similar between groups in all studies. Unsupervised interventions were similar for all outcomes evaluated.

**Conclusion:** Supervised gamified exercise programs seem to increase the level of physical activity compared to usual exercises in patients with chronic diseases. However, studies with better methodological qualities and subgroup analyzes are needed.

**Implications:** Gamified physical exercise programs can be a good strategy to increase physical activity levels if they are supervised compared to habitual exercise programs. However, other strategies need to be implemented so that this improvement in the level of physical activity has a positive impact on the quality of life of patients with chronic non-communicable diseases.

**Keywords:** Gamification, Sedentary behavior, Physical activity

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**Ethics committee approval:** Not applicable.

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### ACUTE INFLUENCE OF MODIFIED LASER IRRADIATION OF BLOOD (ILIB) ON ANAEROBIC POWER AND SYMPATOVAGAL BALANCE IN ACTIVE ADULTS

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**Background:** Intravascular Laser Irradiation of Blood (ILIB) is a low-level laser technique, that has systemic effects, including activation of the antioxidant system, inhibition of the systemic inflammatory process, increased blood fluidity and hemorrheological property on the red cells. However, the use of ILIB as an ergogenic resource in sports is little studied.

**Objectives:** To investigate the acute influence of ILIB on muscle power and heart rate variability (HRV), in physically active individuals submitted to a submaximal effort test.

**Methods:** The study is a randomized controlled crossover clinical trial. Nine male participants, university students, with a mean age of  $24 \pm 4.52$  years and practitioners of regular physical activity were evaluated. The volunteers participated in the two intervention groups (ILIB and placebo) at different times. First, an evaluation session was carried out, being identified HRV indicators and blood lactate level at rest and in response to the stress test. After seven days, the participants received a session of the experimental protocol, which was drawn. After finishing these sessions, a reassessment was performed, getting data on HRV indicators and blood lactate level at rest and in response to the exercise test. After seven days, the entire data collect was repeated, however, the participants performed the remaining experimental protocol. The results were analyzed using Two-Way ANOVA with repeated measures, complemented with the Bonferroni test. All conclusions were obtained at the 5% significance level.

**Results:** For the physical performance variables, the Fatigue Index showed a significant difference ( $p < 0.05$ ) from the Post-Placebo moment ( $54.5 \pm 13.9$ ) in relation to the Post-ILIB ( $45.1 \pm 9.9$ ). Blood lactate showed a significant difference between moments (initial, post-test and after 15 min) within all groups. For HRV, in the time

domain, the indices showed a significant difference ( $p < 0.05$ ) when comparing the moments within the interventions in relation to the initial moment. Furthermore, the RMSSD values were different between Pre-ILIB ( $3.54 \pm 0.44$ ) against Post-ILIB ( $4.22 \pm 0.27$ ); after the Wingate test, the Pre-Placebo ( $1.00 \pm 0.31$ ) differed from the Post-Placebo ( $1.77 \pm 0.74$ ). In the frequency domain, HF and LF/HF showed a significant difference ( $p < 0.05$ ) from Post-ILIB to Pre-ILIB after 15 min.

**Conclusion:** The study showed a possible relationship between the acute influence of the use of ILIB on parasympathetic activity. It did not show improvement in performance in an anaerobic test, but suggested a possible improvement in the ability to withstand high-intensity stimuli. The lack of ILIB studies in sports science, as well as the study's findings, suggest that more research should be done, using different protocols with different stimuli.

**Implications:** The ILIB can be useful for coaches and health professionals working with athletes, helping to optimize physical recovery, making it a resource for post-training recovery.

**Keywords:** Photobiomodulation, Physical performance, Heart rate variability

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### PROFILE OF WORKERS WHO USE COMPUTER TERMINALS

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**Background:** Nowadays, the computer allied to the use of the internet is already fundamental in the work routine. Understanding the individual, in a broad and integral way, is an ongoing need to establish strategies for the prevention and cure of occupational diseases.

**Objectives:** To trace the sociodemographic profile of workers who use computer terminals in the cosmetics industry.

**Methods:** The present research was approved by the Ethics Committee of the Faculty of Medicine of the University of Coimbra through the letter 094 CE - 2018. This is a cross-sectional study, carried out with 55 workers of both genders, older than eighteen years of age, who made use of computers in their work activities in a Cosmetics Industry located in the mid-western region of Brazil, had a workload greater than four hours a day, and agreed to participate in the research by signing the informed consent form (ICF). We excluded workers who terminated their work contract and were on vacation during the research and those who, despite having signed the ICF, decided to discontinue participation. The Sociodemographic Questionnaire was applied, which consisted of a standardized instrument created for this study.

**Results:** It was observed that, on average, the workers' age was 29 years old, with a body mass index (BMI) of 24. Most were male (52.7%), married (58.2%), without children (61.8%), had completed college (52.7%), worked 9 hours a day (65.5%), in good ergonomic conditions (67.3%), sat for 2 to 6 hours (54.5%), took breaks (72.7%), and had no systemic arterial hypertension (SAH) (94.5%), was not a