

CHRONIC EFFECTS OF PULSED ELECTROMAGNETIC FIELD (PEMF) APPLICATION ON HEMODYNAMIC AND CARDIOVASCULAR PHYSIOLOGICAL VARIABLES

Lorenzo de Ávila Rodrigues Cortizo Vidal¹

Pedro Augusto Inacio²

Paulo Ricardo França³

Luara Alves Faria⁴

Douglas Farias da Fonseca⁵

Patrícia Sardinha Leonardo⁶

Rodrigo Alvaro Lopes-Martins⁷

Marcelo Magalhães Sales⁸

Alberto Souza Sá Filho⁹

Universidade Evangélica de Goiás – UniEVANGÉLICA^{1,2,3,4,5,6,7,9}
Universidade Estadual de Goiás – UEG (Quirinópolis)⁸

ABSTRACT

Objectives: To determine the effects of 8 treatment sessions inducing contractions by pulsed electromagnetic field (PEMF) on systolic blood pressure (SBP), diastolic blood pressure (DBP), HR, as well as on the visual analog scale (VAS). **Methods:** 23 participants older than 65 years and of both sexes participated in the study. Participants were invited to perform 8 sessions of PEMF intervention (2x/week), through electromagnetic pulse-induced contraction on both thighs and legs. 30 min were administered per session. Before and after the intervention, hemodynamic and cardiovascular analysis were performed, as well as the response to the VAS scale. **Results:** SBP and DBP did not demonstrate significant differences pre and post PEMF intervention sessions (SBP: $p = 0.982$; DBP: $p = 0.791$), as well as HR ($p = 0.970$). The Friedman test demonstrated significant differences between the PEMF intervention sessions for VAS ($p = 0.001$). **Conclusion:** PEMF treatment in the elderly was effective for modifying pain levels. However, the number of sessions was not sufficient to produce significant adaptations regarding hemodynamic variables.

Keywords: hemodynamics; aging; health.

INTRODUCTION

Pulsed electromagnetic field (PEMF) therapy emerges as a promising alternative for the treatment of special populations (LEONARDO, et al. 2023). PEMF uses magnetic fields to stimulate muscle tissue cells at different magnitudes of contractions and promote a variety of physiological effects, including improved blood circulation, reduced inflammation, and regulation of the autonomic nervous system. By providing a non-invasive and low-impact approach, PEMF can offer, to a great extent, an accessible and effective way to treat people with physical limitations, especially the elderly population, thus helping to suppress the main NCD (Non-Communicable Disease) and improve cardiovascular health (PEIXOTO, et al. 2023).

Despite this understanding, as it is a procedure still not widely known, there are gaps regarding the use of PEMF as an intervention method (TROFÈ et al., 2023). Research and clinical trials specifically addressing the use of PEMF field therapy still lack a support base (GRANJA-DOMÍNGUEZA et al., 2022). Therefore, this study becomes crucial to understand the magnitude and behavior of the chronic responses of PEMF intervention on systolic blood pressure (SBP), diastolic blood pressure (DBP), as well as potential adaptive responses of HR to eight sessions of electromagnetic pulse-induced muscle contraction. Additionally, as it involves the elderly, analysis of pain perception using the Visual Analog Scale (VAS) was also added to the investigation.

METHODS

The present study used as a reference the assumptions described by the ICMJE and respected the items proposed in the "CONSORT" guidelines. The study is a non-randomized and non-controlled chronic intervention.

23 participants older than 65 years and of both sexes were invited to participate in this study. As an inclusion criterion, the elderly should be classified as physically inactive, without recurrent practice of physical exercise, and non-smokers. As exclusion criteria, participants who used psychotropic substances were excluded. Furthermore, participants who had any type of recurrent previous injury were also eliminated from the sample.

Study Design

After signing the TCLE (Informed Consent Form), the baseline for measures of SBP, DBP, resting HR, SpO₂, and VAS scale was established. Subsequently, participants were invited to perform eight sessions of muscle contraction intervention with PEMF, twice a week, through the application of the pulse on both thighs (vastus lateralis) and legs (gastrocnemius); The maximum intervention time with PEMF was 30 min. At the end, a new hemodynamic and cardiovascular analysis were performed, as well as the response to the VAS scale.

The programming of the PEMF equipment Supramximus (Adoxy™) was performed following a progression of flux density (measured in tesla) every two sessions, where 20-25% flux density was used in the first two sessions, up to 50-55%

flux density in the last two sessions. The SUB frequency was maintained at 4Hz for 4 seconds and the SUPRA frequency was maintained at 40Hz also for 4 seconds.

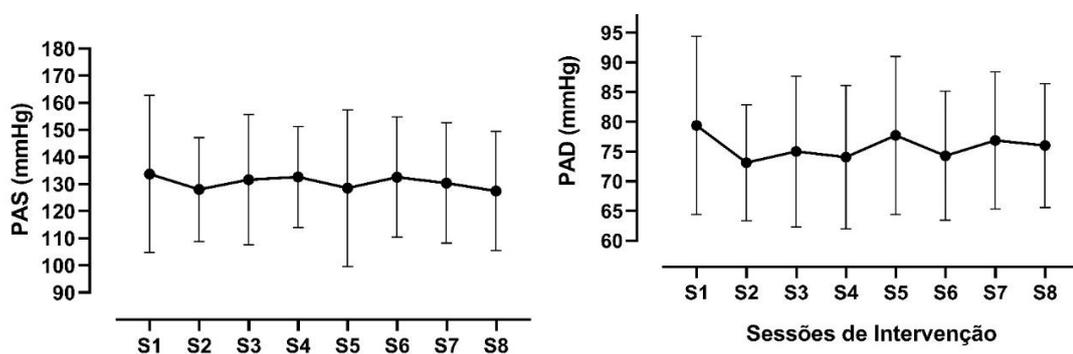
Statistical Analysis

An ANOVA was used to compare the behavior throughout the eight PEMF intervention sessions. The Wilcoxon test compared the VAS scale scores pre and post intervention. The Friedman test compared the behavior of the measures throughout the eight sessions. The effect size was determined to express the effects of the intervention sessions for HR and VAS scale. A p-value < 0.05 was established as a parameter.

RESULTS

When analyzing the behavior of SBP and DBP throughout the eight sessions, the ANOVA did not demonstrate significant differences between the different PEMF intervention sessions (SBP: $p = 0.982$; DBP: $p = 0.791$). Figure 1 presents the behavior of the SBP and DBP variables throughout the eight interventions.

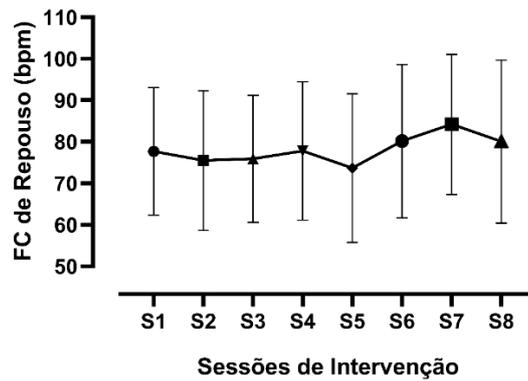
Figure 1. Behavior of SBP and DBP throughout the PEMF interventions.



Source: Author

The behavior of resting HR throughout the eight sessions did not demonstrate differences between the pre and post PEMF intervention condition ($p = 0.970$). Figure 2 presents the behavior of resting HR throughout the sessions.

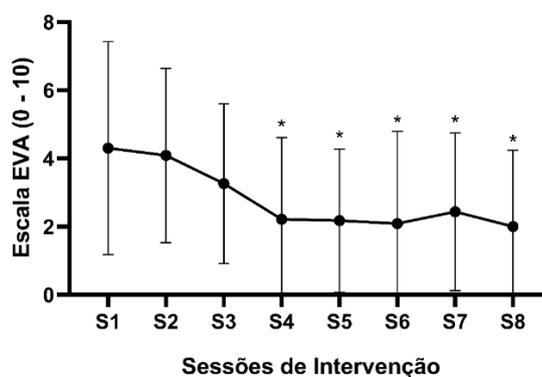
Figure 2. Behavior of HR in response to the eight PEMF intervention sessions.



Source: Author

When analyzing the effects of the treatment on the pain scale throughout the eight sessions, the Friedman test demonstrated significant differences between the PEMF intervention sessions ($p = 0.001$). Regarding baseline scores, there were significant differences between S1 vs. S4 ($p = 0.0012$), S1 vs. S5 ($p = 0.0029$), S1 vs. S6 ($p = 0.0033$), S1 vs. S7 ($p = 0.0162$), S1 vs. S8 ($p = 0.0059$). From the fourth intervention session onwards, there were no significant differences between S4 and S8. The behavior of the VAS scale scores is presented in Figure 3.

Figure 3. Behavior of the VAS scale scores across the eight sessions



Source: Author

CONCLUSION

It is concluded that PEMF treatment in the elderly was effective for modifying pain levels. However, the number of sessions was not sufficient to produce significant adaptations regarding hemodynamic variables.

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