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Working

Infrared thermography and platform vibratory - protocol [↗](#)

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ABSTRACT

Cross-sectional study approved by local ethics committee (*Certificado de Apresentação para Apreciação Ética - CAAE - 19826413.8.0000.5259*) and Trial registration (*Registro Brasileiro de Ensaios Clínicos – REBEC - RBR-738wng*). Using Infrared thermography (IRT), Tsk and thermal symmetry of the posterior lower extremities (thigh, knee, calf and heel) were examined in 19 healthy participants. IRT was assessed during 60-second WBVE exposures of 0, 30 and 50 Hz. From the adjusted linear mixed effects model, vibration frequency, time and regions of the lower extremity were significant ($p < 0.001$). However, the variable laterality was not significant ($p = 0.067$) and was excluded from the adjusted statistical model. The adjusted model was significant ($p < 0.01$) and all variables in the model were significant ($p < 0.01$) indicating that Tsk decreases with time, independently of the vibration frequency. The value of the Pseudo-R-Squared for the model was 0.8376. The presented mathematical model of the current study may be useful to justify the patterns observed for all vibration frequencies between 0 and 50 Hz.

EXTERNAL LINK

<https://doi.org/10.1371/journal.pone.0212512>

PROTOCOL STATUS

Working

SAFETY WARNINGS

This protocol is not recommended for participantes who have: joint pain and/or implants, musculoskeletal diseases, vertigo and other clinical diseases that could involve some risk or discomfort during whole body vibration exercise (WBVE), other declared disease.

CEP

- 1 The local ethics committee approved the study (*Certificado de Apresentação para Apreciação Ética - CAAE - 19826413.8.0000.5259*)

[PB_PARECER_CONSUBSTANCIADO_CEP_2612008_E3.pdf](#)

REBEC

The trial registration (*Registro Brasileiro de Ensaios Clínicos – REBEC - RBR-738wng*)

Inclusion criteria

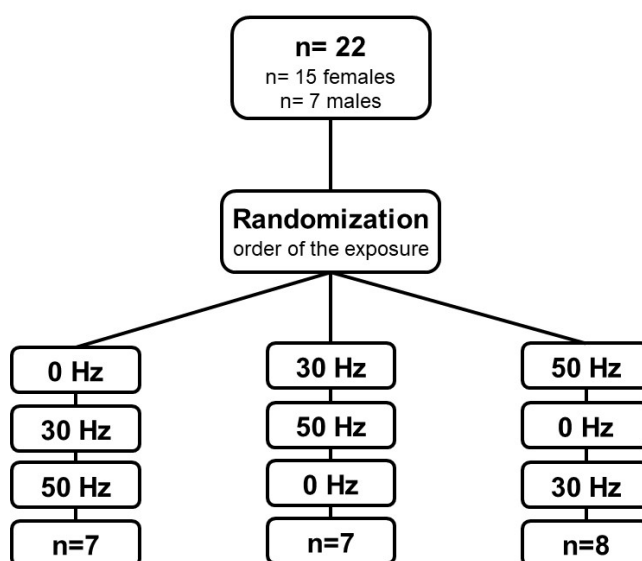
- 3 The participants had to meet the following inclusion criteria of aged 20 to 45 years old and healthy.

Exclusion criteria

- 4 The exclusion criteria were; joint pain and/or implants, musculoskeletal diseases, vertigo and other clinical diseases that could involve some risk or discomfort during whole body vibration exercise (WBVE), other declared disease.

randomization

- 5 The individuals were randomized using colored cards, and those assessing the outcomes and the participants do not know order of the



frequencies.

Acclimation

- 6 Before the intervention, all participants were provided with a 15-minute acclimation period to ensure Tsk was stabilized.

Descriptive data of the individuals

- 7 A health-activity interview about the caffeine intake, smoking (nicotine) and sports training, at least, in the previous four hours before the intervention was conducted. The measurement of body mass and height and the determination of the body mass index were carried out prior to the intervention.

Equipament - platform vibratory

- 8 The intervention was performed on a commercial machine (Power Plate pro5 TM, Power Plate International Ltd, The Netherlands).



Equipament - infrared camera

- 9 An infrared camera (FLIR Systems, E40, Wilsonville, OR, USA), with a sensor array size of 160 x 120 pixels and noise equivalent temperature difference (NETD) of 70mK at 30°C and had $\pm 2\%$ repeatability of the overall reading. The camera's emissivity was set to 0.98 and images were captured and processed using the software FLIR ResearchIR Max (version 4.40.4.17, Sweden).



Preparation for intervention

- 10 The intervention was performed in the *Laboratório de Vibrações Mecânicas e Práticas Integrativas (LAVIMPI)*, *Universidade do Estado do Rio de Janeiro (UERJ)* with controlled ambient temperature ($25.5 \pm 0.35^\circ\text{C}$) and relative humidity ($50.5 \pm 2.16\%$). To avoid any effect of circadian rhythm participants performed the intervention session between 1-5 pm. During the intervention, participants wore shorts, t-shirt and were barefooted.

Intervention

The intervention consisted of a single session with three bouts of 60-seconds with 90-seconds rest separating each bout. Participants

- 11 assumed a squat position on the base of the OVP with 130° knee flexion (measured by a manual goniometer), the distance of the feet followed the line of the shoulders and the arms to the side. Participants were exposed to three experimental protocols of squat position + without vibration (0 Hz); squat position + WBVE 30 Hz (frequency), 1.20 mm (amplitude) and squat position + WBVE 50 Hz (frequency), 0.77 mm (amplitude).
- A three-axial accelerometer (Vibration Datalogger DT-178A, Ruby Electronics, Saratoga, USA) was fixed on the base of the OVP to verify the peak acceleration and gravitational force of the OVP. The vibration frequency of 30 and 50 Hz with 1.20 and 0.77 mm of amplitude produced a gravitational force of 2.22 *g* and 4.40 *g* at a peak acceleration of 21.73 m/s² and 43.11 m/s², respectively.
- For the lower limb temperature assessment, the camera was placed at an angle of approximately 90° to the surface and 2 m from the WBVE machine to provide a full view of the lower limbs. The height of the camera varied according to the height of each participant corresponding to 10 cm below the popliteal line of the right leg of each individual.

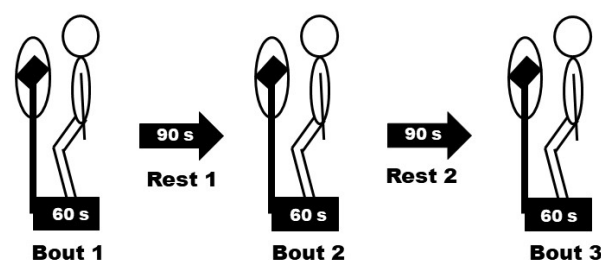
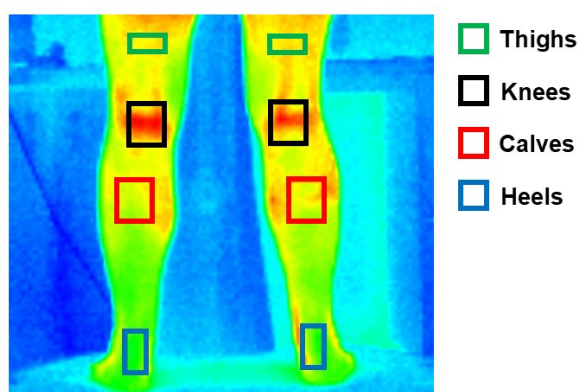


Image acquisition

- 12 A sequence of images of the posterior aspect of the lower limbs was automatically recorded for 1 minute in each bout at 30 frames per second. These 1800 images were divided in five equal ranges with 360 frames each. The average of each range, consisted of 12 seconds of duration, were obtained to represent the mean time of range (6, 18, 30, 42, and 54 seconds, respectively). In all time frames a focal line was used to assess the same regions of interest (ROI). The figure shows the ROI used in the analysis (left and right thighs, left and right knees, left and right calves, left and right heels).





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