

Effect of Foot Reflexology on Capillary Blood Glucose, Tissue Temperature, and Plantar Pressure of Individuals With Diabetes Mellitus (Type 2): A Pilot Study

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ABSTRACT

Objective: The purpose of this study was to assess the effect of foot reflexology on capillary blood glucose, feet tissue temperature, and plantar pressure of the feet of individuals with diabetes mellitus (type 2).

Methods: Forty-five individuals with type 2 diabetes mellitus were stratified into 2 groups: treated (n = 21), which received orientation about foot self-care and received 12 foot reflexology sessions; and control (n = 24), which received only orientations about foot self-care. A portable glucose meter, an infrared thermography camera, and a baropodometer evaluated the variables.

Results: The data indicate that, after 12 therapy sessions, there were no significant differences between the groups for producing effects on capillary blood glucose, feet tissue temperature, and plantar pressure.

Conclusion: No significant effect was observed after 12 foot reflexology sessions in the variables that were evaluated. (*J Chiropr Med* 2018;xx:1-8)

Key Indexing Terms: *Massage; Diabetes Mellitus, Type 2; Lower Extremity*

INTRODUCTION

Individuals with diabetes mellitus are more susceptible to developing several complications, both acute and chronic.¹ Among the alterations caused by this pathology, the authors highlight the high risk of lower-limb complications.²

Complications caused to the nerves and peripheral blood vessels may lead to decreased foot temperature because thermal

regulation is hindered.³ When sensory nerve fibers are damaged, cold and heat perception are altered, and when blood flow is reduced, heat regulation through vasodilation and vasoconstriction is not effective, thus compromising tissue temperature.⁴

At the same time, high blood glucose levels contribute to reduced tissue elasticity and increased stiffness of the joints responsible for movement.¹ This leads to biomechanical gait dysfunction, which directly affects body weight distribution on the plantar surface, leading to increased pressure on some regions of the foot.⁵

Alteration of feet tissue temperature and plantar pressure make the individual vulnerable to trauma.⁶ In light of this, it is necessary to implement actions to prevent and control plantar complications, with the aim of improving the health conditions of individuals with diabetes mellitus.⁷

In this sense, the use of integrative and complementary practices constitutes an option for health promotion and disease prevention and recovery, with possible effects on the development of illness.⁸ Among integrative and therapeutic methods available, the authors highlight foot reflexology, which is characterized as being easy to apply and not greatly dependent on technology.⁹

Also known as pressure therapy, foot reflexology aims to promote relaxation and stimulate equilibrium.⁸ It is based

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Paper submitted November 9, 2017; in revised form March 1, 2018; accepted March 21, 2018.

1556-3707

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<https://doi.org/10.1016/j.jcm.2018.03.003>

on the belief that all regions of the body are connected to specific points on the foot, so applying pressure to these points on the plantar surface stimulates the corresponding reflex area.⁹

Some researchers who are interested in investigating reflex therapy have proven its effects for controlling arterial blood pressure and heart rate and reducing anxiety.^{10,11} Thus, with its goal of attaining mind and body homeostasis, foot reflexology can contribute to improving the population's health conditions.⁹ However, it is necessary to conduct studies that ascertain the method's effects and ensure its use in the health care field. Thus, the goal of the present study is to evaluate the effects of foot reflexology on capillary blood glucose, plantar pressure, and feet tissue temperature of people with type 2 diabetes mellitus.

METHODS

The present research was a small-scale randomized clinical trial carried out in 2 primary health care services in a municipality in the south of the state of Minas Gerais, Brazil. The project was approved by the Federal University of Alfenas Ethics Committee, protocol CAAE: 07183512.1.00005142 and was entered into the Brazilian Clinical Trials Registry (RBR-8zk8sz). All participants in the study signed a free and informed consent form.

The study's representative population was composed of individuals aged 18 years or older who were diagnosed with type 2 diabetes for at least 5 years. Criteria for exclusion were as follows: the presence of foot ulcers, lower limb amputation, uncontrolled hypertension, thrombosis, cognitive deficits, and previous reflexology treatment.

The sample size was determined from a pilot test completed before the study began, which was conducted with 12 volunteers who met the eligibility criteria. The statistical software GPower 3.0.10 (Franz Faut, Universität Kiel, Kiel, Germany) was used, with a power effect of 0.80 and effect size of 0.68 ($\alpha = 0.05$). Thus, it was found that it would be necessary to have the allocation of 26 participants in each group.

A total of 214 individuals who were enrolled in the "System of Registration and Monitoring of Hypertensive/Diabetics," and had a diagnosis of type 2 diabetes mellitus fulfilled the eligibility criteria. Of these, 161 were excluded based on at least 1 exclusion criterion. After being contacted in their homes, only 53 agreed to participate in the study. Using simple stratification, participants were randomized into 2 groups according to age, sex, and length of time since diagnosis. The treated group comprised 26 participants who received orientation about foot care and 12 foot reflexology sessions, whereas the control group comprised 27 participants who received only orientation about foot self-care, which was considered a representative sample of the population.

During the follow-up, 5 participants in the treated group and 3 in the control group did not participate in all of the steps of the study and were, therefore, excluded. Thus, at the end of the study, the authors analyzed the data for 45 participants, as described in Figure 1.

The randomization process and the application of the reflexology intervention were carried out by the main researcher and were not disclosed to the assistant researcher, who was responsible for the evaluations. Participants were also instructed not to disclose which group they belonged to.

Evaluation

Participants from both groups were evaluated at the beginning of the study and after the 6th and 12th reflexology sessions. The assistant researcher was trained to analyze capillary blood glucose, feet tissue temperature, and plantar pressure. These procedures were carried out in a specific location, allowing for control of the environment and standardization of procedures. Capillary blood glucose was evaluated by measuring blood glucose at random using a Biocheck Gold portable glucose meter (Bioeasy, South Korea).

To measure feet tissue temperature, the authors used infrared thermography, a relatively new method in the health care field, which captures body temperature through an infrared thermal image, detecting subtle changes in dermal blood flow.^{4,12} Foot temperature was measured according to norms established in the literature: the environment was thermally controlled, the temperature was constantly at 23°C; the number of individuals in the laboratory was restricted to 3, including the evaluator; participants were positioned in supine position and were barefoot, remaining in this position for 15 minutes (the time necessary for the body to attain thermal equilibrium with the environment).¹² The thermographic camera (FLIR E60, Porto Alegre, Rio Grande do Sul, Brazil) was positioned 95 cm above the ground at a standardized 98 cm away from the participant's feet. To prevent body heat from other regions from interfering with the plantar surface image, a cardboard support was used for thermal isolation.

After capturing the thermographic image of the foot, computer thermal analysis was conducted on 18 points pre-established by the researchers. An electronic baropodometer (Footwork, Brazil) was used to analyze plantar pressure. This instrument allowed us to evaluate plantar pressure distribution during static and body sway analysis, in orthostatic position, and during dynamic analysis, while in movement.⁵

For the static and body sway analysis, participants were asked to remain barefoot on the baropodometer platform, with their arms alongside their body, for 20 seconds. During this period, the machine captured pressure points on the left and right feet and the body's dislocation around its supporting axis. Afterward, in the dynamic analysis, participants were asked to walk 5 meters along an ethylene

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