ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research

Vol. 10, Issue, 03, pp. 34608-34612, March, 2020

https://doi.org/10.37118/ijdr.18241.03.2020

RESEARCH ARTICLE

OPEN ACCESS

CARDIOVASCULAR RESPONSES DURING POSTURAL REEDUCATION POSTURES IN YOUNG ADULTS

***Elizângela Sofia Ribeiro Rodrigues, Elane Cristinna De Carvalho Ramos, Sandra Maria Pinto Siriano Costa, Rafaela de Carvalho Alves, Rodrigo De Faveri Moreira, Janne Marques Silveira, Geovane Rossone Reis, Eros Silva Cláudio, Adriana Arruda Barbosa Rezende, Anny Pires de Freitas Rossone, Sávia Denise Silva Carlotto Herrera, Adelma Martins Pereira and Vinicius Garcia Costa**

University of Gurupi, UNIRG, Rio de Janeiro Avenue, Nº 1585 - sector central, Gurupi, 77403-090, Tocantins, Brazil

ARTICLE INFO

Article History:

Received 19th December, 2019

Received in revised form

25th January, 2020

Accepted 11th February, 2020

Published online 31st March, 2020

Key Words:

Cardiovascular System, Posture, Health Risk, Young Adult, Physiotherapy.

****Corresponding author:***

Elizângela Sofia Ribeiro Rodrigues

ABSTRACT

Postural changes drive away workers, generate public spending and require treatments. The most usual postural treatment is Postural Reeducation (PR), with static stretching and isometric contraction, which can increase heart rate (HR) and respiratory (R), blood pressure (BP) and bring risks. In order to investigate cardiovascular responses during postural reeducation postures in young adults, this study aimed to verify cardiovascular responses related to systolic blood pressure (SBP), blood pressure diastolic (DBP), heart rate (HR) and respiratory rate (RR) during PR postures. After approval by the Ethics and Research Committee in Human Beings (0091/2010) cardiovascular responses were verified during PR postures in 12 volunteers (5 control group and 7 treated group) sedentary. The mean age was 20 ± 2 years and 83% (10) were women. They presented low weight 8%, normal weight 67% and pre obesity 25%. They performed 5 PR postures randomized, repeating the posture 2 sessions/ weekly, totaling 10 sessions. The control group did passively (no isometric contraction, breath control, and self-growth). BP, HR, and RR were measured at the beginning of the session and end of postures (20' each). Student T-Test with $p<0.05$ was used. There were increases in vital data to maintain postures and postural changes ($p<0.05$). Only in systolic blood pressure in the middle of the session (treated group), and final diastolic blood pressure (control group) falls or maintenance ($p<0.05$) were observed. In view of the detected changes, it is recommended to monitor vital data during therapies with postural changes followed by postural maintenance.

Citation: Elizângela Sofia Ribeiro Rodrigues, Elane Cristinna De Carvalho Ramos *et al.* 2020. "Cardiovascular responses during postural reeducation postures in young adults*", International Journal of Development Research*, 10, (03), 34608-34612.

INTRODUCTION

Good posture can be defined as a harmonious arrangement of vertebrae, intervertebral discs, ligaments and static muscles [1, 2]. In view of the commitments or overloads of the segments, postural changes [3]. Work activity is an important factor predisposing of postural problems when working hours are excessive, prolonged and generating physical and emotional overload, which exposes workers as the group most affected by postural pathologies. [4] Currently, in Brazil and worldwide, postural changes are associated with health losses and increased public spending, estimated at billions of dollars per year [5], due to absence from work. This reality requires the implementation of specific treatments capable of minimizing losses. The Postural Reeducation (PR) method has been widely used as effective physical therapeutic conduct in the treatment of postural changes, by stimulating body awareness and eliminating postural compensation [6], through sustained isometric contraction and active stretching of muscle chains. [2]. However, PR is a technique that promotes sustained contraction of the worked muscles, which limits blood intake. In response, heart rate (HR), blood pressure (BP) and respiratory rate (RR) may increase, increasing cardiac output. Changes in vital data may predispose to potential health risks, such as heart infarction and stroke. [7] Postural changes are an important cause of morbidity, loss in quality of life, absences from work and increased health spending. Postural reeducation (PR) is a therapeutic option of great efficacy, however, it is known that the execution of the technique can generate an increase in vital data, which can expose the individual to risks. Knowing its therapeutic benefit and its potential risk to general health it is necessary to verify cardiovascular responses during PR techniques.

Objectives

To verify cardiovascular responses related to systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR) and respiratory rate (RR) during PR postures, in patients treated at the Escola Clinic Physiotherapy from Gurupi University – UNIRG, as well as to ascertain the need to implement the measurement of vital data during PR postures.

MATERIALS AND METHODS

An observational, prospective study was conducted at the School of Physiotherapy Clinic of Gurupi University - UNIRG, in the area of posture, in its own room, after authorization of the coordination of the Physiotherapy course, and approval of the Committee on Ethics and Research in Human Beings of Gurupi University - UNIRG (0091/2010). The collection was initiated after acceptance of the volunteers and signing the free and informed consent form. Before the beginning of the investigation period, all volunteers were evaluated by the short version IPAQ physical activity questionnaire [8], through interviews, with direct contact, in order to exclude assets and very active. The inclusion criteria were: being between 18 and 25 years old; be sedentary or insufficiently active according to the IPAQ classification; have not undergone any postural re-education technique in the last 12 months. Exclusion criteria were established: presenting risk factors and or any cardiovascular and respiratory pathology; have a frequency of less than 80% of the sessions; have resting BP equal to or greater than 140x90 mmHg; have musculoskeletal changes that prevent pr postures from performing; be using Beta- Blocker drug therapy.

The initial sample consisted of 20 volunteers, between 18 and 25 years of age, of both sexes, 16 female and 4 males, 10 individuals in the control group and 10 in the treated group. As there were eight dropouts, only 12 volunteers participated in the sample, five from the control group and seven from the treated group, healthy, sedentary or insufficiently active, who had not performed any postural reeducation technique in the last 12 months. The treated group underwent all phases of PR treatment actively, performing isometric contraction, respiratory work and receiving the self-growth verbal command. Two sessions were held per week, on alternate days, lasting 50 minutes each session, totaling 10 sessions. The session lasted 50 minutes, addressing two 20-minute postures each, and the initial 10 minutes were rest and the 40 minutes too divided into two stages of 20 minutes of volunteer posture. The measurement of vital data occurred in three moments: after 10 minutes of the arrival of the volunteer, after 20 of the first posture and after 20 minutes of the second posture. The first session addressed all activities that are part of postural reeducation, such as posture, scapular waist, and upper limb pompage, pelvic waist pompage and lower limbs, breathing, self-growth, and concentration. According to the evolution in the maintenance of postures, these were increased with a higher degree of tension. Postures were maintained for 20 minutes after posture, and the command voice was essential for the maintenance of isometric contraction, self-growth, and respiratory work. The volunteers performed all the postures. Each volunteer performed the same postures for two consecutive sessions. The order of postures was defined by drawing, which was: a frog in the ground, frog in the air, sitting posture, standing posture, and inclined posture. Postures were standardized for all volunteers during the same session. Previously, correct positioning was performed, with pompey of the scapular and pelvic waist and posture of upper and lower limbs according to Souchard (1998) [6]. The treated group actively went through all phases of treatment, with self-growth, isometric contraction, breathing control and abdominal contraction, in addition to receiving pompagens, axial traction, continuous verbal command and manual corrections for the maintenance of the necessary postural alignment. The control group went through the same postural corrections and verbal commands remaining in the same postures, but passively, without isometric contraction, without control of breathing and without self-growth. The data collected each day were recorded in an individual spreadsheet, plus general evaluation data (weight, height, body mass index, age). Blood pressure and heart rate were measured by auscultation and palpatory methods, respectively. RR (respiratory rate) was collected through visual inspection.

Statistical Analysis

For statistical analysis, the Microsoft Office Excel 2016 program was used. To verify that there was a statistical difference between the periods during the sessions, in the beginning, middle and end of the sessions, the Student T-Test was used. The parameters analyzed were SBP, DBP, HR, RR. In all analyses, the significance level of 0.05 was established. Individual and isolated analyses were performed for the treated group for the control group and for both groups simultaneously. Increases in vital data (HR, RR, SBP, and DBP) were observed with the maintenance of postures and also with changes in postures ($p<0.05$). Only for systolic blood pressure in the middle of the session (treated group), and final diastolic blood pressure (control group) a drop or maintenance of values ($p<0.05$) In the other comparisons, no statistically significant difference was observed ($p>0>0.05$). Descriptive statistical analysis was also performed, where prevalence sums were established regarding gender and age, as well as means and standard deviation for SBP, DBP, HR, RR.

RESULTS

The study was observational, prospective. Twenty individuals also distributed between the treated group (10) and the control group (10) of which completed the study, only 12 volunteers. The others, eight, were excluded because they had a frequency of less than 80% of the sessions. Five volunteers were evaluated in the control group and seven in the treated group totaling 10 sessions of postural reeducation. The prevalence, in relation to sex, was two (17%) for males and 10 (83%) for females. In the sample analyzed the mean age was 20 ± 2 years. When evaluating body mass index (BMI) 8% had low weight (BMI < 18.5), 67% normal weight (BMI between 18.5 and 24.9) and 25% pre obesity (BMI between 25 and 29.9). When comparing the initial, mean and final measurement values of the parameters (SBP, DBP, HR, RR) for the treated and control group during the sessions, for each group separately and for each individual, a statistically significant difference was detected with an increase in increasing the values of the means when comparing the measurement values at the beginning, middle and end of the sessions (most often being the last value compared to the highest). For the treated group, in the individual analyses, the following significances for systolic blood pressure (SBP) and diastolic blood pressure (DBP) were detected: an increase in the final DBP when comparing the values of the middle and end of the sessions and increasing the final DBP when comparing the values of the beginning and end of the sessions. In heart rate (HR): increased heart rate in the middle of the session when comparing the values of the onset and middle of the sessions and increased final heart rate when comparing the values of the middle and end of the sessions. In respiratory rate (RR): increased respiratory rate in the middle of the session when comparing the values of the beginning and middle of the sessions; increase in the final respiratory rate when comparing the values of the middle and end of the sessions and increased the final respiratory rate when comparing the values of the beginning and end of the sessions, all with $p<0.05$.

For the control group, in the individual analyses, the following significances for systolic blood pressure (SBP) and diastolic blood pressure (DBP) were detected: increased SBP in the middle of the session when comparing the values of the beginning and middle of the sessions; increase in final SBP when comparing the values of the beginning and end of the sessions. In heart rate (HR): increased final heart rate when comparing the values of the middle and end of the sessions. In respiratory rate (RR): increased respiratory rate in the middle of the session when comparing the values of the beginning and middle of the sessions; increase in the final respiratory rate when comparing the values of the middle and end of the sessions and increased the final respiratory rate when comparing the values of the beginning and end of the sessions, all with $p<0.05$. When comparing the treated group in its entirety, the following significances for systolic blood pressure (SBP) and diastolic blood pressure (DBP) were detected: increased final SBP when comparing the values of the middle and end of the sessions. In heart rate (HR): increased final heart rate when comparing the values of the beginning and end of the sessions. In respiratory rate (RR): increased respiratory rate in the middle of the session when comparing the values of the beginning and middle of the sessions, all with $p<0.05$. When comparing the control group in its entirety, the following significances for systolic blood pressure (SBP) and diastolic blood pressure (DBP) were detected: increased SBP in the middle of the session when comparing the values of the beginning and middle of the sessions. In respiratory rate (RR): increased respiratory rate in the middle of the session when comparing the values of the beginning and middle of the sessions, all with $p<0.05$.

However, in some analyses, a reduction or maintenance of the analyzed values was detected. For the treated group, in the individual analyses, there was a reduction in SBP in the middle of the session when comparing the values of the beginning and middle of the sessions; for the control group also in the individual analyses, there was a reduction in the final DBP when comparing the values of the beginning and end of the sessions. For the group treated in its entirety, there was a reduction in SBP in the middle of the session when comparing the values of the beginning and middle of the sessions; and for the control group in its entirety, the maintenance of the final DBP values was observed when comparing the values of the beginning and end of the sessions, all with $p<0.05$. When comparing the treated and control groups with each other, no statistically significant difference was detected for any of the variables.

DISCUSSION

The present study aimed to verify, in healthy individuals, cardiovascular blood pressure, systolic (SBP) and diastolic (DBP), heart rate (HR) and respiratory rate (RR) during pr postures, in patients treated at the University of Gurupi Physical Therapy Clinic - UNIRG, as well as to ascertain the need to implement the measurement of vital data during PR postures. In this investigation, when observing gender, age and when evaluating body mass index (BMI) we chose to avoid the association of these parameters with the significant findings detected since most of the investigated were female (83%), the sample was behaved by young adults (with a mean age of 20 ± 2 years) and 67% of those evaluated had normal weight. The volunteers of this research were submitted to PR postures (frog on the ground, frog in the air, sitting posture, standing, and leaning posture). PR encompasses the sensory, motor and musculoskeletal system as a whole, stimulating body awareness and eliminating postural compensation, reeducating the body to an adequate alignment. [6] Among the modalities of exercise, postural reeducation stands out as an important technique of postural treatment, generating static stretching and isometric contraction, besides promoting benefits in respiratory mechanics. Isometric contractions can generate a considerable increase in muscle strength gain and mass, which is beneficial to the body, a fact that contributes to highlighting the positive use of this modality of exercise during postural treatment of PR. [9, 10]

Due to the RP method included isometry maintained for a long period, there is concern that this method may cause bp, HR and RR elevations. [7] In the investigated group (treated and control) there was an increase in vital data (BP, Hr, and f) in response to postural changes and also during the maintenance of postures over the time of the session ($p<0.05$). Rpg is a technique that is based on obtaining isometry that can be obtained through a sustained contraction. This contraction, isometric can promote the collapse of blood vessels of the worked muscles, and consequently increase SBP and HR to try to overcome the resistance imposed by the colabamento of the vessels. RR may increase due to an oxygen deficit caused by decreased blood intake. [11] During isometric contraction the blood vessel is compressed by the muscle, this compression increases the resistance to the passage of blood flow through the vessel, the consequence is the increase in BP. The heart is forced to increase its work, so it increases HR, to try to supply the blood deficit in the musculature. respiratory rate is also increased to supply the lack of muscle oxygen. All these changes happen due to a massive sympathetic discharge. [11] These cascading physiological reactions occur during any isometric contraction and may also occur during the execution of PR postures. The isometric contraction used in PR can lead to a progressive increase in blood pressure (BP) and heart rate (HR) during postures, in addition to compromising blood intake and reducing oxygen supply to muscle tissue demand, in a higher or lesser degree, varying according to the muscle tension generated in each posture. In agreement, in the study conducted by Williams (1991) after evaluating the effect of isometric contraction on blood pressure and heart rate, it can be found that both rates increase in response to isometric contraction regardless of the size of the muscle mass involved (quadriceps or forearm). Postural change itself can also promote changes in vital data. In this sense, in the study conducted by Oliveira et al. (2016) [12], in which they evaluated 98 university students where there were evaluations of SBP, DBP, mean blood pressure, HR and partial hemoglobin saturation in positions (sat dorsal decubitus, sitting, orthostatic position, in elevated feet of the upper limbs) and after rapid running, increases were detected mainly in SBP and HR according to changes in body position.

Another study, conducted by Silva (2014) [13], evaluated HR, DBP, and SBP during the sitting posture of the RPG method in a sedentary and hypertensive individual and detected at the time of posture execution that there was an increase in HR and SBP values. On the other hand, in this study, a reduction in SBP values in the treated group can also be observed ($p<0.05$). Mechanical obstruction of muscle blood flow can cause the accumulation of metabolites produced during contraction, these metabolites can promote vasodilation in the active musculature, which can generate a reduction in peripheral vascular resistance (PVR), this could explain the reduction in SBP, throughout the session detected in this study. After exercise vasodilation may continue due to reduced sympathetic nervous activity. [14] After performing physical exercise, some changes may occur, including the "post-exercise hypotension" characterized by the reduction of BP during the recovery period, which causes the BP value after exercise to be less than the value measured before the motor activity. [14] Also, in this research, a reduction in DBP was observed in the control group ($p<0.05$), which only went through the postures and verbal commands, remaining in postures without postural corrections, passively (without isometric contraction, breath control, and self-growth). In agreement, according to the review study conducted by Silva & Smethurst (2010) [15], the practice of counter-resistance exercises can promote post-exercise hypotension.

For Brum et al. (2004) [14], light intensity and long-lasting exercises can promote a pressure reduction during exercise, a fact that can cause a slight reduction or maintenance of DBP. The study conducted by Silva (2014) [13], in which HR, DBP, and SBP were evaluated during the sitting posture of the RPG method in hypertensive sedentary individual, showed that there was a reduction in the values of SBP, DBP, and HR in the post-posture phase when compared to the resting phase pre-posture, where DBP remained stable, inferring about the hypotensive effect after exercise. We also found, in this investigation, that there was no significant change when comparing the group treated with control, which can be attributed to the intensity of physical exertion considered low, which can also be perceived in Moreira's research (2009) [16] and also the efficacy of autonomic adjustments in healthy individuals in the face of postural changes, as well as in the investigations of Zuttin et al. (2008) [17] and Silva et al. (2019). [18] It is noted, in this study, that the change of posture and prolonged maintenance in the same position, during the session, alters vital data as much as the same practice accompanied by isometric contraction (PR approach), which emphasizes the need to maintain control vital data during treatments involving postural changes. The present study made it possible to verify the importance of implementing vital data control during PR sessions, to minimize possible risks to the patient's health, since performing physical exercises without previous monitoring can bring several health risks. With the same concern, the study conducted by Oliveira et al. (2016) [12] in which they detected increases in the vital data (SBP and HR) of university students by adopting different body positions, praised the importance of considering body posture when evaluating the cardiovascular behavior during therapeutic care. The practice of exercises depending on their degree of intensity and physical requirement can trigger a number of unwanted metabolic phenomena. Faced with some silent or early-stage disease, due to the lack of clinical diagnoses or in precarious conditions of measurement of vital data, physical exercise can lead to stroke, angina, acute myocardial infarction, and even sudden death. [19] Knowing that PR is a therapeutic modality that employs isometric exercise as the main target of treatment, it would be indicated to monitor vital data during the execution of PR postures, both in healthy individuals and for patients with diseases, gender, and age. [7]

Conclusion

Significant changes in vital data were observed during the study, thus the implementation of vital data monitoring during postural reeducation therapeutic practices become recommended.

REFERENCES

BARROS FILHO TEP, BASILE JUNIOR R. (1995). Spine, diagnosis and treatment of the main pathologies. Sarvier.

BRACCIALLI LMP, VILARTA R. (2000). ASPECTS TO BE CONSIDERED IN THE DEVELOPMENT OF PREVENTION PROGRAMS AND ORIENTATION OF POSTURAL PROBLEMS. Rev Paul Educ Fís. p.16–28.

BRUM PC, de Moraes FORJAZ CL, TINUCCI T, NEGRÃO CE. (2004). Acute and chromium adaptations of physical exercise in the cardiovascular system. Rev paul Educ Fís. 18:21–31.

Da Silva AJMR, Smethurst WS. (2010). COUNTER-RESISTANCE EXERCISE AND HYPERTENSION: A REVIEW OF POST-EXERCISE HYPOTENSION. Revista de Enfer- magem. 4:357–363.

da Silva ALG, Peiter APD, da Luz Goulart C, Schneiders PB, Martin EAS, et al. (2019). VARIATIONS OF HEART RATE IN DIFFERENT BODY POSITIONS AND DURING MASR IN UNILATERAL LOWER LIMB AMPUTATE. Saúde e Pesquisa. 12:77–84.

da Silva Oliveira W, Brandão JA, Borges GF. (2016). BODY POSITION AND HEMODYNAMIC CHANGES: A PHYSIOLOGICAL APPROACH. Revista Brasileira de Prescrição eFisi- ologia do Exercício. 12:609–617.

Deliberato P; (2002). Preventive Physiotherapy: fundamentals and applications. do Nascimento Moreira D. Effect of the level of physical activity and aerobic aptitude on cardiac au- toomal modulation: study of the variability of heart rate in supine and orthostatic posture in healthy young people;(2009).

Hall J, Edward, Guyton, Arthur C; (2017). Guyton & Hall medical physiology treatise. vol. 13. Rio de Janeiro: Elsevier.

Iunes DH, Castro FA, Salgado HS, Moura IC, Oliveira AS, et al. (2005). INTRA RELIABILITY AND INTEREXAMINER AND REPEATABILITY OF POSTURAL EVALUATION BY PHOTOGRAMMETRY.Revista Brasileira de Fisioterapia.9:327–334.

Jirkowski J, Comerlato T. (2015). EFFECTS OF THE RPG METHOD ON THORACIC MOBILITY AND RESPIRATORY MUSCLE STRENGTH IN A COPD CARRIER. PERSPECTIVE, Erechim. 39:155–163.

Matsudo S, Araujo T, Matsudo V, Andrade D, Andrade E, et al. (2001). INTERNATIONAL QUESTION OF ATIVIDADE FISICA (I PAQ): STUDY OF VALIDADE AND REPRODUCIBILITY IN BRAZIL. 6:5–18.

MONTEIRO LZ, SPINATO IL, da SILVA CAB, PINHEIRO MHNP, de Souza Araújo SANTOS ZM, et al. (2009). Knowledge of the physical education professional in the face of work with patients with diabetes mellitus in the gyms of Fortaleza, CE. Rev bras Educ Fís Esporte. 23:135– 142.

Neto A, Costa CMC, Siqueira, Colaboradores JTME; (2009). Pain - Príncipios and practices. 1ªed.São Paulo: Artmed.

RS Z, MA M, MC C, LEB M, AM C, et al. (2008). Evaluation of autonomic modulation of cardiac fre- qünce in the supine and sitting postures of sedentary young men. Revista Brasileira de Fisioterapia. 12:7–12.

SILVA GN. CARDIOVASCULAR RESPONSES DURING THE SITTING POSTURE OF GLOBAL POSTURAL REEDUCATION IN AN INDIVIDUAL WITH SYSTEMIC ARTERIAL HYPERTENSION; (2014).

Souchard PE; (1998). Global postural reeducation: closed field method. São Paulo, Ícone.

Teodori RM, Negri JR, Cruz MC, Marques AP. (2011). Global postural reeducation: a review of the literature. Brazilian Journal of Physiotherapy. 15:185–189.

YL M, SL B, HG S, CSG C, PR B. (2008). Cardiovascular responses during the sitting posture of Global Postural Reeducation (RPG). Rev Bras Fisioter. 12:161–168.

AUTHOR BIOGRAPHY

Elizângela Sofia Ribeiro Rodrigues Master's degree in Physiotherapy. Triangle University Center, UNI- TRI, Brazil. Specialization in Cardio-Respiratory Physiotherapy.

Rafaela de Carvalho Alves Physiotherapist. Master in Health Sciences from the Federal University of Tocantins (UFT - Palmas / TO).

Professor of the Physiotherapy Course at the University of Gurupi (UnirG - Gurupi / TO).

Janne Marques Silveira Physiotherapist. Master in Cardiovascular and Respiratory Physiotherapy at the University Center of Triângulo (UniTri - Uberlândia / MG

Professor of the Physiotherapy Course at the University of Gurupi (UnirG - Gurupi / TO).

Geovane Rossone Reis Ph.D. student in Regional Development - UFT, Master in Public Policy Management- UFT, Mechanical Ventilation Specialist - PUC-GO, Physiotherapist - UBM-RJ.

Eros Silva Cláudio Physiotherapist graduated from the State University of Goiás - ESEFFEGO (Higher School of Physical Education and Physiotherapy of the State of Goiás) since 2012. Post-graduate degree in Human Anatomy, Higher Education Teaching and Traumato Orthopedic Physics with an emphasis on Manual Therapies.

Adriana Arruda Barbosa Rezende Master's degree in Human Motricity from Castelo Branco-RJ University (2009), a specialist in Hospital Physiotherapy from PUC-GO (2006), graduated in Physiotherapy from PUC-GO (2005), currently, she is Technical Advisor to Health Programs and Projects at the Health Foundation Support to Tocantins Research- FAPT.

Anny Pires de Freitas Rossone Physiotherapist - UnirG, Specialist in Public Health and Orthopedic Trauma.

Sávia Denise Silva Carlotto Herrera Physiotherapist. Master in Health Sciences from the Federal University of Tocantins (UFT - Palmas / TO). Professor of the Physiotherapy Course at the University of Gurupi (UnirG - Gurupi / TO).

Adelma Martins Pereira physiotherapy applied to neurology and physiotherapy applied to acupuncture.

Vinicius Garcia Costa Academic researcher in the physiotherapy course at Gurupi University.

****