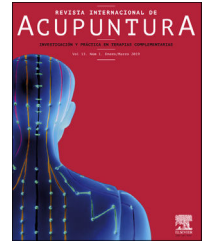




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Original article

The effect of acupuncture on exam anxiety in medical students: a randomized crossover study



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ABSTRACT

Objective: Acupuncture (AC) has been used for treatment of chronic and pre- operative anxiety. However, no study has evaluated the effect of AC on exam anxiety in undergraduate students. The aim of this study was to evaluate whether AC reduces pre-examination anxiety compared to placebo (PL) and non- intervention (NI).

Methods: Twenty students from the first terms of physiotherapy and dentistry courses were randomized to receive AC, PL and NI in a crossover manner and subsequently completed three anatomy exams with an interval of 1 month between exams/interventions. AC was performed on acupoints PC-6 (Neiguan), HT-7 (Shenmen), LV-3 (Taichong) and Yintang one day prior to each exam. The PL was performed outside the meridians and the needles were inserted superficially without obtaining De Qi. Levels of anxiety were measured using a visual analogue scale before and after each intervention as well as before each exam.

Results: Anxiety levels were reduced after AC and PL intervention compared to NI on the day before the exam, as well as on the day of the exam.

Conclusion: These results suggest that AC can be used as an anxiolytic method in students under conditions of situational stress.

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Efecto de la acupuntura en la ansiedad ante los exámenes en estudiantes de Medicina: estudio cruzado aleatorizado

RESUMEN

Objetivo: La acupuntura ha sido utilizada para el tratamiento de la ansiedad crónica y pre-operatoria. Sin embargo, ningún estudio ha evaluado el efecto de la acupuntura en la ansiedad ante los exámenes en estudiantes universitarios. El objetivo de este estudio fue evaluar si la acupuntura reduce la ansiedad previa al examen, en comparación con un placebo y la no intervención (NI).

Palabras clave:

Acupuntura

Aniedad

Estudiantes universitarios

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Métodos: Se aleatorizaron veinte estudiantes de los primeros trimestres de las carreras de fisioterapia y odontología para recibir acupuntura, placebo y no intervención de manera cruzada, y completaron posteriormente tres exámenes de anatomía con un intervalo de 1 mes entre exámenes/intervenciones. La acupuntura se realizó en los acupuntos PC-6 (Neiguan), HT-7 (Shenmen), LV-3 (Taichong) y Yintang un día antes de cada examen. El placebo se realizó fuera de los meridianos, insertándose las agujas superficialmente sin obtener De Qi. Los niveles de ansiedad fueron medidos utilizando una escala analógica antes y después de cada intervención, así como previamente al examen.

Resultados: Los niveles de ansiedad se redujeron tras la intervención de acupuntura y placebo, en comparación con la NI el día anterior al examen, y el día siguiente al mismo.

Conclusión: Estos resultados sugieren que la acupuntura puede utilizarse como método ansiolítico en estudiantes en condiciones de estrés situacional.

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Introduction

Exam anxiety is a type of situational anxiety common among university students.¹ Such condition, leads to undesirable mental symptoms and physiological states, that may negatively influence academic performance.² When untreated, anxiety can become a more complicated and serious health problem.³ Nowadays, the conventional treatments are pharmacotherapy and psychotherapy. However, these treatments have limited efficacy, generally presenting adverse effects and high rate of treatment with drawal.⁴ In this context, clinical research has shown that acupuncture (AC) has an anxiolytic effect, without significant adverse effects.⁵⁻⁷

AC is part of Traditional Chinese Medicine and is defined as the insertion of needles into skin and underlying tissues at specific sites, known as acupoints, for therapeutic or prevention purposes.⁸ Some studies have shown that AC is effective in anxiety treatment in preoperative⁷ and postoperative period,⁹ in pre-game period¹⁰ and in therapy for drug addiction.¹¹ However, the effect of AC in treatment of exam anxiety has not yet been elucidated. Therefore, the aim of study was to investigate whether AC can reduce exam anxiety in university students in comparison with placebo (PL) and no intervention (NI) conditions in a randomized crossover investigation.

Methods

Study design and randomization

This is a randomized, crossover, placebo-controlled and single-blind study conducted between March and July 2018 at the Federal University of Alfenas (UNIFAL-MG), Brazil. Students in first period of physiotherapy and dentistry courses were invited to participate in study at the beginning of semester and later recruited according to following eligibility criteria: with no previous experience with AC, without history of psychotropic or opioid medication use and without disease that limits the use of AC (eg haemophilia). The students signed a written informed consent form containing the objectives and procedures of study. The project was

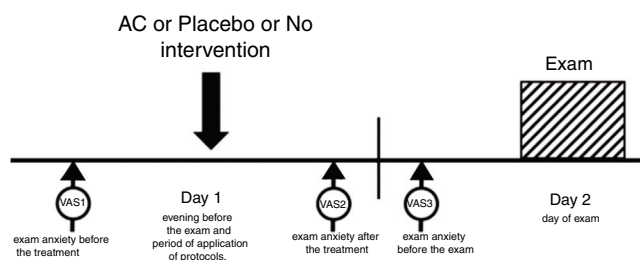


Figure 1 – Timeline of investigation with application times. Day 1: evening before the exam and period of application of protocols. Day 2: day of exam.

VAS1: exam anxiety before the treatment.

VAS2: exam anxiety after the treatment.

VAS3: exam anxiety before the exam.

VAS: visual analogue scale.

approved by the Research Ethics Committee of UNIFAL-MG (CAAE: 70436517.6.0000.5142).

Each participant was randomly assigned to following groups: acupuncture (AC), placebo (PL) and no intervention (NI). The first randomization occurred in day before the first anatomy test and was done through cards numbered 1 to 3, meaning: 1 = AC, 2 = PL and 3 = NI (Figure 1). Before the second exam, participants were randomly assigned to one of two remaining conditions by flipping a coin. Before the last exam, no further randomization was necessary.

Interventions

This study followed the CONSORT (Consolidated Standards of Reporting Trials) and STRICTA (Standards for Reporting Interventions in Clinical Trials of Acupuncture) guidelines.¹²

The AC session was held for 20 minutes in day before the anatomy test by two licensed acupuncturists. The participants remained seated in chairs during the procedure. The following acupoints were used: PC-6 (Neiguan), HT-7 (Shenmen), LV-3 (Taichong) and the Yintang. These acupoints were used according to anxiolytic effects.^{13,14} Sterile stainless steel needles measuring 0.30 x 30mm were bilaterally inserted at acupoints mentioned above (except Yintang). The needles were inserted and manually rotated in clockwise and counterclock-

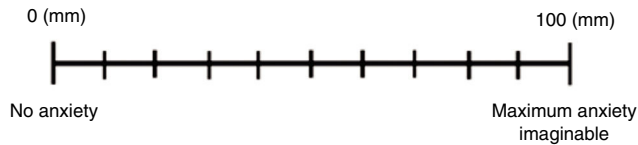


Figure 2 – Analogue visual scale.
No anxiety: 0 mm.
Maximum anxiety imaginable: 100 mm.

wise directions simultaneously with upward and downward movements. These movements were made until eliciting the *De Qi*.

Placebo acupuncture (PL) was done outside acupoints and main meridians. The location of these points was defined according to following anatomical references: In the upper limbs, one point was located midway between the ulna styloid process and the medial epicondyle of humerus, on the medial aspect of forearm. The other point was located midway between the styloid process of radius and the lateral epicondyle of humerus, on the lateral aspect of forearm. In the head, the only point was located between the *Yintang* point and the *Yuyao* point, in forehead region. In dorsum of foot, the point was located on first metatarsal bone in the same line as point LV-3. The needling was superficial, without obtaining *De Qi*. In day before the anatomical test, participants of NI group remained in treatment room at same time as the participants who underwent AC or PL. During this time, the researcher conducted a conversation with the participants on varied subjects, avoiding talking about the evaluation. To maintain the participants' blinding purpose, they were told that two different types of combinations of acupoints would be investigated compared to NI. In this way, participants were not aware of which group they were allocated to, except for the NI group.

Outcome Measure

Anxiety was measured before the intervention (VAS1), after the intervention (VAS2) and immediately before the exam (VAS3) (Figure 2). A 100 mm visual analogue scale (VAS) was

used where 0 means without anxiety and 100 means the maximum anxiety imaginable.

Statistical analyses

The primary analyzes and difference between the diverse study conditions at different periods were analyzed by paired T-test and Holm-Bonferroni test, adjusted for multiple comparisons. Data analysis was performed in IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY. All data were presented as mean, Holm-Bonferroni adjustment on both sides for values of $P < 0.05$ considered significant.

Results

Thirty-seven students accepted to participate in experiment. Two of them did not meet the inclusion criteria (Figure 3). Of these 35 participants, 15 did not attend treatment without justifiable reason. Twenty students (4 males, 16 females) aged 19 years or more

(3) were evaluated in this study.

Initial anxiety levels (VAS1) did not differ among the three tested conditions. In VAS2, both CA (-2.2, 95% CI -3.332, -1.068, $t_{20} = -4.067$, $p = 0.001$) and PL (-2.35, 95% CI -3.489, -1.211, $t_{20} = -4.318$, $p < 0.001$) reduced anxiety levels, relative to NI group. In VAS3, also the AC (-1.65, 95% CI -2.959, -0.341, $t_{20} = -2.639$, $p = 0.016$) and PL (-2.35, 95% CI -3.577, -1.123, $t_{20} = 4.009$, $p = 0.001$) reduced anxiety levels in relation to NI. However, there was no significant difference between AC and PL in both VAS2 (0.15, 95% CI -0.628, 0.928, $t_{20} = 0.403$, $p = 0.691$) and VAS3 (0.7, 95% CI -1.731, $t_{20} = 1.421$, $p = 0.171$), compared to NI group (Figure 4, Figure 4). Figure 5

The values obtained through the semi-structured interview demonstrated that biopsychosocial factors contribute to development of anxiety (Figure 6). The averages obtained for biological variables ($1.6 + 0.52$), emotional ($1.7 + 0.59$) and social ($1.2 + 0.45$), obtained the classification of "quite" in used scale.

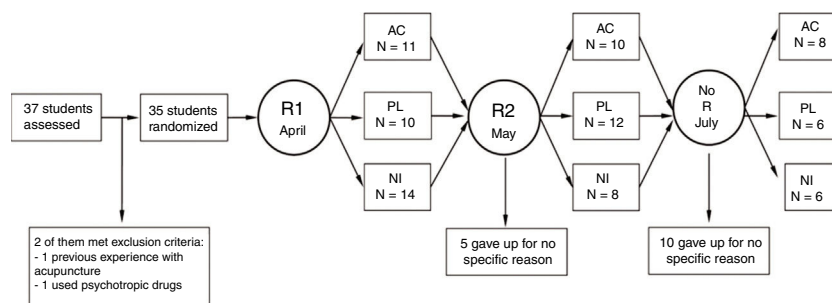


Figure 3 – Diagram of study.

The first randomization (R1) was performed through the removal of papers numbered from 1 to 3 before the first intervention, prior to first anatomy examination; the second randomization (R2) was performed before the second intervention, which preceded the second anatomy examination, flipping a coin; no randomization was required on third intervention in July, before third anatomy examination.

R: randomization; AC: systemic acupuncture; PL: placebo acupuncture; NI: no intervention.

Parameter	Time of measurement	Intervention		
		AC	PL	NI
Exam anxiety - (VAS 100mm)	I (baseline)	73,5	71,5	69,5
	II (after intervention)	41,5*	40**	63,5
	III (before exam)	58,5*	51,5**	75

Figure 4 – Mean of VAS obtained in three treatment groups. VAS results in three evaluated periods.

AC: systemic acupuncture; PL: placebo acupuncture; NI: no intervention.

TIME-I: baseline.

TIME-II: night of day prior to the examination.

TIME-III: immediately before anatomy examination.

***: Paired t-test adjusted p <0.05 for AC in relation to NI in TIME-II and III;**

**** : Paired t-test adjusted p <0.05 for PL in relation to NI in TIME-II and III.**

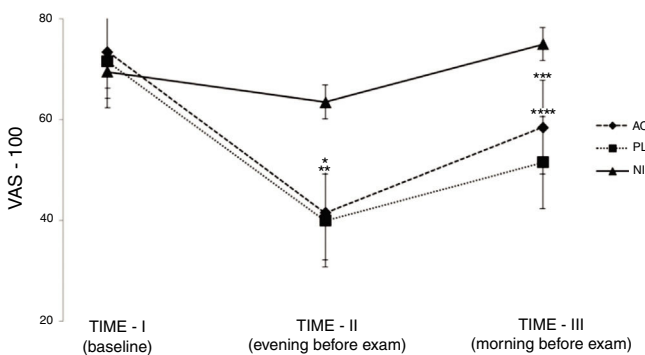


Figure 5 – Anxiety measured by Visual Analogue Scale. 100 mm - VAS results in three evaluated periods.

AC: systemic acupuncture; PL: placebo acupuncture; NI: no intervention.

TIME-I: baseline.

TIME-II: night of day prior to the examination. TIME-III: immediately before anatomy examination.

***: Paired t-test adjusted p <0.05 for AC in relation to NI;**

**** : Paired t-test adjusted p <0.05 for PL in relation to NI in TIME-II;**

*****: Paired t-test adjusted p <0.05 for AC in relation to NI;**

******: Paired t-test adjusted p <0.05 for PL in relation to NI in TIME-III.**

Discussion

This is first study demonstrating the effectiveness of an acupuncture protocol for anxiety situational reduction in undergraduate students prior to performing anatomy examinations. The study was a randomized and cross-over intervention which demonstrated that both real acupuncture and placebo acupuncture reduced anxiety compared to non-intervention group. The effects of treatments on non-intervention occurred both after the application of same

on the night prior to test (VAS2), and shortly before application of this examination on following day (VAS3).

The results presented in this study are corroborated by other studies that use acupuncture in situational anxiety.^{7,13,15,16} However, these studies used different protocols compared to that used in this research, as shown below: in a study conducted by Wiles et al (2017), the level of anxiety was measured in patients waiting for neurosurgery. These patients were either treated with acupuncture or allocated to a control group without intervention. In this study, Yintang point was used and anxiety measured through the State-Trait Anxiety Inventory (STAI). The results showed that acupuncture reduced the level of preoperative anxiety in these patients compared to control group. Another study during the preoperative period using Yintang point, also concluded that stimulation of this point may decrease anxiety, which was measured by STAI and bispectral index (BIS), in relation to placebo group.¹⁵ A review of literature also concluded that the Yintang point has an anxiolytic effect in patients during preoperative period.¹⁶ The acupuncture anxiolytic effect in preoperative period was also verified in a meta-analysis.⁷ In this study, the effects of auricular acupuncture, acupressure (pressure on acupuncture point) and acupuncture on anxiety were jointly analyzed. The evaluation of anxiety level was done with STAI and EVA. The fourteen

studies included in this review demonstrated a decrease in anxiety level in acupuncture groups compared to placebo acupuncture group.

In present study, placebo acupuncture reduced the level of anxiety in same way as real acupuncture. Placebo acupuncture was performed out of the way in main energy channels and out of acupuncture points. The needles were inserted only into the skin without being deepened, and no manipulations were made, ie, Te Qi was not evoked in this procedure.¹⁷ It is known in literature that the evocation of Te Qi is essential for manifestation these effects in Acupuncture.¹⁸ Although this placebo acupuncture procedure is routinely used in several studies^{17,19}, it has been shown in more recent studies that superficial needle insertion also has important physiological activity. When this type of control is used, there is a relative decrease in effect of real acupuncture.²⁰ This same study demonstrates that when control is done by procedures that do not cause needle penetration, the effect of real acupuncture is greater. Thus, ideally, the control group should take into account techniques that could simulate the real application of acupuncture, but without penetration of needle.²¹

Regarding the protocols, real acupuncture was performed by one acupuncture treatment and placebo acupuncture was performed by another. The results demonstrate that there was no difference between effect of real acupuncture and placebo acupuncture. It may be that this similarity of effects between

Semi-structured interview	Factors		
	Biological	Emotional	Social
	1,6(0,52)	1,7(0,59)	1,2(0,45)

Figure 6 – Averages of factors in semi-structured interview. Values applied on scale of 0 to 3, followed by standard deviation.

the two procedures was due to reasons discussed in previous paragraph, and not because the procedures were performed by different acupuncturists. This is because each protocol was applied exactly the way it was planned. That is, anyone who performed any of protocols, according to their specific descriptions, would not introduce an additional variable. Furthermore, this similarity of effect between real acupuncture and placebo may have occurred because of insufficient sample numbers.

Prior to initiation of specific anxiety assessments (VAS) and treatments, the students were interviewed to explore the occurrence of perceptions about anxiogenic factors in biopsychosocial sphere. It was evidenced that the perception of these factors by students was characterized as quite propitious for anxiety development.

From an actions mechanisms point view, there are few studies, both in humans and animals, that investigate the physiological bases underlying the acupuncture anxiolytic effect. For example, one point used in this study was the C-7 (*Shenmen*). This point has been shown to reduce anxiety-related behavior and modulate the hypothalamic-pituitary-adrenal axis in a maternal separation model in rats.²² Another study, also using C-7, has shown that this point can normalize dopamine release in mesolimbic system (brain reward system) after alcoholic abstinence in rats, causing an anxiolytic effect.^{23,24}

In addition to animal studies, it has been demonstrated in humans that anxiolytic effect of acupuncture may be related to modulation of amygdaloid body (amygdala), an important component of limbic system, which plays a leading role in anxiety genesis.²⁵ A study using functional magnetic resonance has shown that acupuncture has the potential to modulate not only amygdala, but also other components of limbic system, such as anterior cingulate cortex and the parahippocampal gyrus. Other human studies also show potential anxiolytic effects through measurement of cortisol level. In these studies the evaluation of salivary cortisol level as an indicator of stress was done. For example, in athletes undergoing acupuncture, there was a significant increase in immunoglobulin A and a decrease in salivary cortisol, before competition.²⁶ Specifically in relation to situational anxiety, there is currently no study investigating the mechanisms of systemic acupuncture in reducing anxiety.

Future studies could use stress biomarkers, such as salivary cortisol or catecholamines in urine, to better clarify the acupuncture biological mechanisms.

Conclusion

The results demonstrate that both real acupuncture and placebo decreased anxiety levels in pre-assessment period undergraduate students. This reduction occurred even with students living in a biopsychosocial environment characterized as quite propitious to anxiety development. These results suggest that acupuncture can be used as an anxiolytic method in students with situational anxiety who are submitted to situations of biopsychosocial stress.

Conflicts of interest

None declared.

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