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Efficacy of acupressure for non-pharmacological stress reduction in college students

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Placebo-controlled;
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Summary
Objectives: Identifying a non-pharmacological intervention to reduce the stress response could be particularly beneficial to college students, a group prone to considerable stress. Acupressure has shown some efficacy in reducing stress in adults following stroke or traumatic brain injury (TBI), but multiple treatments were required. Results from single treatments in healthy populations have been mixed.
Design: The current study used a randomised, placebo-controlled, single-blind design to investigate the use of a single acupressure treatment for stress reduction in healthy college students ($n = 109$) during a stressor.
Interventions: Participants were randomly assigned to one of three single, 40-min interventions: active acupressure, placebo acupressure, or a relaxation CD control. A math task stressor administered before and after the intervention assessed intervention effects on stressor responsivity.
Main outcome measures: Stress responses were measured by physiological (heart rate (HR), heart rate variability (HRV), skin conductance response (SCR)) and subjective measures (State Anxiety Inventory, nine-item Psychological Stress Measure) of anxiety and stress.
Results: All interventions were associated with the following changes during the post-intervention stressor compared to the pre-intervention stressor: reduced HR ($p < 0.001$), increased HRV ($p < 0.024$), reduced SCR ($p < 0.001$), reduced subjective stress scores ($p < 0.001$), and increased correct answers ($p < 0.001$). Although all groups demonstrated stress reduction, there were no significant group differences after a single treatment.
Conclusions: All interventions significantly reduced the stress response, although not differently. The lack of active acupressure-associated treatment effects appears to be due to insufficient dosing.

While stress is adaptive in some situations, chronic stress can be detrimental to physical health[1] and mental well-being.[2] College students often experience considerable stress[3] and finding a treatment to reduce the stress response could be particularly beneficial to this population. Acupressure is a complementary and alternative medicine (CAM) treatment

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in which fingertip pressure is applied to acupoints, points on the skin designated as such by Traditional Chinese Medicine. Previous studies have suggested that acupressure may reduce stress and anxiety in medical settings.[4–6] Studies with healthy participants have also found acupressure to reduce subjective stress levels.[7–9] Although the mechanisms underlying these effects are unknown, it has been hypothesised that acupressure may affect the autonomic nervous system,[10–12] since active acupressure treatments have been found to reduce heart rate faster and to a greater extent than placebo acupressure.[12] As such, acupressure may be a promising treatment for stress as it is portable, non-pharmacological, and can be taught to the novice user.

Previous studies in our laboratory have found a series of 8 acupressure treatments elicits effects above those following placebo treatments: heart rate reduction was faster and greater *during* active acupressure treatments in stroke survivors,[12] and greater cognitive improvement was seen *following* active acupressure treatments in traumatic brain injury survivors.[13] However, it remains unknown as to how many treatments are necessary to elicit treatment effects. Two previous studies have explored the effects of a single acupressure treatment on stress-reduction in healthy populations, with Fassoulaki et al.[7] focusing on healthy volunteers in the absence of a stressor and Wang et al.,[9] investigating parents in preoperative waiting areas prior to their child's surgery. In both studies, a single session of pressure on an acupoint reduced subjective stress compared to pressure at a sham point. However, results were mixed concerning the effects of acupressure on physiological markers of stress, possibly due to methodological differences in type and duration of acupressure, as well as presence and type of stressor.[7,9]

The current study aims to rigorously explore whether a single acupressure treatment is sufficient to reduce subjective and physiological markers of stress in a healthy, yet stress prone, population (college students) using a randomised, placebo-controlled, single-blind design. A laboratory stressor was administered both before and after one of three interventions: active acupressure, placebo acupressure, or an audio relaxation CD. Physiological markers of stress (heart rate (HR), skin conductance response (SCR), and heart rate variability (HRV))[14,15] and subjective stress were measured. We tested the hypothesis that a single active acupressure session would be associated with greater physiological and subjective stress reduction, compared to the other two groups and what might be expected from practice effects or habituation.

Methods

Participants

Undergraduate students ($n = 109$) enrolled in an introductory psychology course at the University of Colorado at Boulder received course credit for study participation. Exclusion criteria included: drug use for medical or recreational purposes; personal history of cardiovascular disease, respiratory disease, or diabetes; current treatment for any medical or mental health conditions; and previous acupressure treatment. Participants gave informed consent and all aspects of the present study were in accordance with and approved by the University of Colorado Institutional Review Board.

Procedure

A randomised, placebo-controlled, single-blind design was used. Participants were randomly assigned to receive one session of the following interventions: active acupressure, placebo acupressure, or an audio relaxation CD. Participants were blinded to which intervention they received if active or placebo acupressure; the relaxation group became aware of their assignment when the intervention (i.e., audio CD) began. Similarly, research assistants were blind to treatment condition during data collection if active or placebo acupressure, with only the acupressure practitioner aware of treatment type. To monitor data collection and maintain blinding, research assistants remained in the room, behind a curtain, during acupressure treatments. Due to the nature of the audio CD, research assistants were aware of this condition. All data entry and analyses were conducted by completely blinded individuals. To control for diurnal biological variations in the stress response,[16] all participants completed the experiment between 2 and 5 pm.

After obtaining informed consent, electrodes (Vermed, Bellows Falls, VT) were affixed to participants' wrists and left ankle for ECG (electrocardiogram) data collection, with electrodes (ADInstruments, Colorado Springs, CO) affixed to the distal phalanges of the index and middle fingers of the non-dominant hand for SCR data collection, using a PowerLab 4/30 data acquisition system and stored with LabChart 7 software (ADInstruments). Data were continuously recorded at a sampling rate of 1000 Hz for the duration of the experiment.

Pre-intervention assessment

Following initiation of ECG and SCR data collection, participants answered demographic questions and completed the nine-item Psychological Stress Measure (PSM-9)[17] to assess baseline subjective stress levels. Levels of expectancy about the intervention were assessed, as has been done previously.[12] Baseline group differences in attitudes towards conventional and complementary medicine were assessed with the Complementary, Alternative, and Conventional Medicine Attitudes Scale (CACMAS)[18] and participants completed an assessment of past, present, and likely future use of 17 CAM modalities.[18] To assess general health and life attitudes, participants completed the Multidimensional Health Locus of Control (MHLC) scale,[19] the Satisfaction with Life Scale (SWLS),[20] and a modified version of the revised Life Orientation Test (LOT-R).[21] Participants also completed the State Anxiety Inventory (State portion of the State-Trait Anxiety Inventory)[22] to assess anxiety levels prior to the first stressor. The PSM-9 was administered multiple times throughout the experiment to capture change in subjective stress levels (see Fig. 1).

Math Task 1

Following baseline measures, participants rested in a chair for 5 min, after which the PSM-9 was administered. Participants were then asked to perform a math task that reliably

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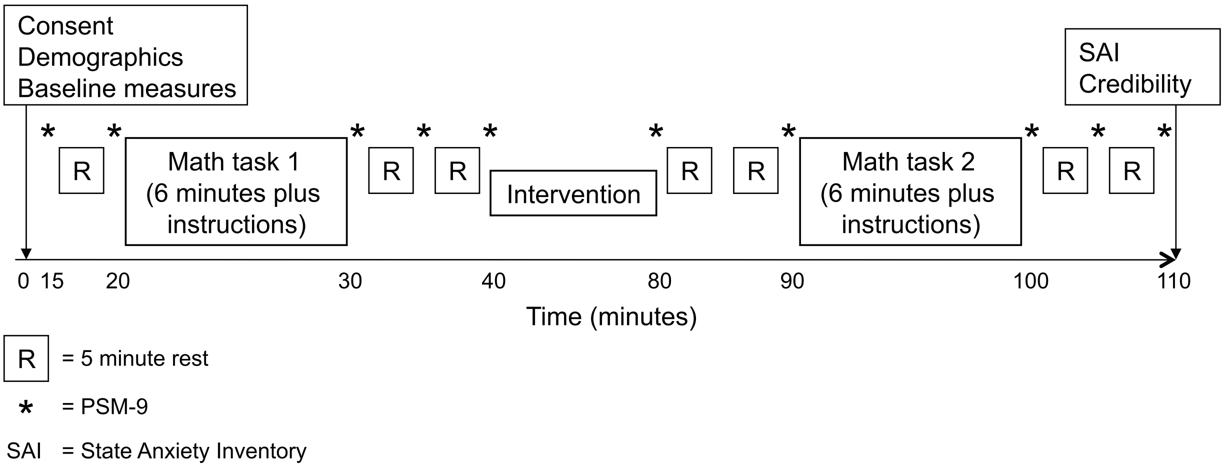

Figure 1 Experimental design.

induces a stress response,[23,24] during which they continually subtracted backwards from a given number by another given number (e.g., subtract 3 from 298) for 6 min. If a mistake was made, the participant was corrected and continued subtracting from the correct answer. After each minute, new numbers were given. Task difficulty was adapted depending on performance; difficulty increased with better performance (i.e., the numbers to subtract by became more difficult) and vice versa. Participants then completed the PSM-9, rested for 5 min, and completed one of three interventions.

Intervention: Acupressure treatments

As has been done in prior work,[12,13] participants lay face up on a massage table during treatment sessions, fully clothed with shoes removed, as is common practice for acupressure treatments.[25,26] Prior to treatment initiation, participants lay quietly for 5 min, after which the PSM-9 was administered. An acupressure practitioner with over 20 years of clinical and educational experience and appropriate certification administered treatments (active or placebo). During treatment, the practitioner applied pressure with her fingertips to acupoints, in sequence (for detail, see Ref. 12). The entire treatment, itself, lasted 40 min. The placebo control procedure was designed to be indistinguishable from the active treatment session, to last the same duration, and contain the same amount of physical contact, with pressure applied to sham points rather than acupoints. To guarantee matching practitioner/participant interactions for both treatment types, only scripted dialogue was used and was minimal at that. A research assistant seated behind a curtain was present to monitor this interaction and data collection. After the treatment, participants completed the PSM-9 and rested for 5 min.

Intervention: Relaxation CD

As with the acupressure treatments, those in the relaxation CD condition experienced the intervention laying face up on a massage table, fully clothed with shoes removed. Participants lay quietly for 5 min, after which the PSM-9 was administered. The relaxation CD was then played, which was an adaptation of a commercially available relaxation CD (''Total Relaxation'', Empowered Within, Salem, OR) adjusted to match the acupressure treatments in length. The CD had soothing background sounds (i.e., beach sounds, crickets) and instructed participants to relax both mind and body. As with acupressure treatments, a research assistant remained in the room (behind a curtain) to monitor data collection and match researcher presence in the acupressure interventions. After the intervention, participants completed the PSM-9 and rested for 5 min.

Math Task 2

After an additional 5-min rest, the PSM-9 was administered again, followed by the second math task. This was identical to the first, but with different numbers to reduce practice effects. Following the task, participants completed the PSM-9 and rested for 5 min.

Post-intervention assessment

Participants rested for an additional 5 min and completed post-treatment assessment measures: the PSM-9, State Anxiety Inventory and credibility questionnaire.[12,27]

Data analyses

HR peaks were automatically detected and ectopic beats removed using LabChart 7. Mean HR was calculated for the intervention and for each minute during the math tasks. Mean HRV measures were calculated using LabChart 7 for the intervention and each math task. Standard HRV measures were chosen.[28] In the time domain, the standard deviation of the NN intervals was calculated (SDNN). In the frequency domain, low frequency power (0.04—0.15 Hz), high frequency power (0.15—0.4 Hz), and the LF/HF ratio were calculated. LF power is thought to be influenced mainly by the sympathetic nervous system, with some input from the parasympathetic nervous system, while HF power is mediated by parasympathetic activity and the LF/HF ratio is a measure of balance between the two.[14,28] HRV data were not normally distributed, so were log-transformed (ln) prior to analyses and will consequently be referred to as lnSDNN, lnLF power, lnHF power, and lnLF/lnHF ratio.

Average SCR was calculated with LabChart 7 for the intervention and each minute during the math tasks. Data were normalised using log transformation (ln), with an added constant to render all values above zero for transformation (ln(SCR + 20)), so data will be henceforth referred to as lnSCR.

Data were analysed using SPSS version 17.0 (SPSS, Inc., Chicago, IL). Repeated measures ANOVA was used in analyses of all physiological data, with math task (task 1 vs. task 2) as a repeated factor and group (active vs. placebo vs. relaxation) as a between-subjects variable. Additional analyses assessed HR and SCR change across each math task with task minute (1 through 6) as a repeated factor and group as a between-subjects variable. Repeated measures ANOVA was also used to assess pre- to post-intervention changes in STAI score, number of correct subtractions during the math task, and change in PSM-9 score following task 2 compared to task 1. All repeated measures ANOVA analyses used Greenhouse—Geisser corrections.

For measures during the intervention itself, group differences in mean HR, HRV, and SCR were assessed with one-way ANOVA. Group differences at baseline in the CAC-MAS, CAM usage, MHLC, the SWLS, the modified LOT-R, PSM-9, expectancy and age were also assessed with one-way ANOVA, as was post-intervention credibility. Bonferroni corrections were used for post hoc testing. To assess group differences in categorical demographic variables (gender and ethnicity), logistic regression was used (binomial and multinomial, respectively).

Results

Demographic and baseline measures

The experiment was completed by 109 students, with no significant group (relaxation vs. active vs. placebo) differences in baseline or demographic measures, with the exception of a significant group difference in age, $F(2, 108) = 3.73$, $p = 0.027$, partial $\eta^2 = 0.07$ (see Table 1). Post hoc tests found the placebo group to be significantly older than the active group ($p = 0.043$), but as the difference was less than 1 year, it is unlikely that this age difference is relevant. Due to compatibility issues related to hardware/software interfacing and upgrades, data were available for fewer participants for SCR and HRV than other measures. However, demographic group comparisons remained the same regardless of group size. Sample size for each measure is 109 unless otherwise noted.

Heart rate

Analysis of HR data during the tasks ($n = 90$) revealed a significant effect of task, $F(1, 87) = 36.97$, $p < 0.001$, partial $\eta^2 = 0.30$, such that HR was lower during the second stressor (post-treatment) than the first (pre-treatment). However, there was no significant effect of group and no significant interaction between task and group, indicating that all groups showed similarly decreased stress reactivity (see Table 2). Additionally, there was no significant effect of time during the tasks, suggesting that HR did not habituate during each stressor. Furthermore, there were no significant group differences during the intervention itself ($n = 103$).

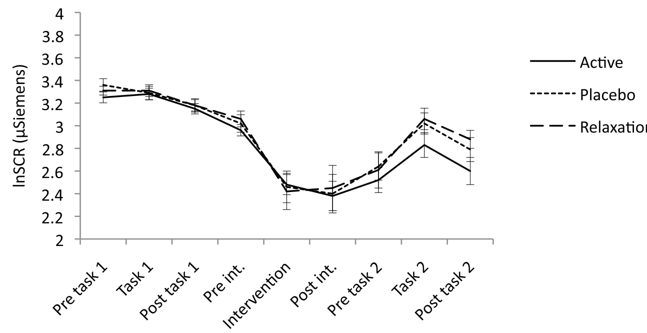

Figure 2 Physiological stress response throughout the experiment, as measured by lnSCR (µSiemens).

Heart rate variability

There was a significant effect of task on both lnSDNN and lnLF power ($n = 51$), such that lnSDNN ($F(1, 48) = 9.17$, $p = 0.004$, partial $\eta^2 = 0.16$) and lnLF power ($F(1, 48) = 5.47$, $p = 0.024$, partial $\eta^2 = 0.10$) were increased during the second task (post-treatment) compared to the first task (pre-treatment) (see Table 2). As with HR, however, there was no significant effect of group and no significant interaction between task and group, suggesting similarly decreased stress reactivity in all groups. No significant effects of task or group, or significant interactions, were found for lnHF power or the lnLF/lnHF ratio.

During the intervention, a significant group difference in lnSDNN was found ($F(2, 50) = 3.38$, $p = 0.042$, partial $\eta^2 = 0.12$), with a marginally significant group difference in lnLF power ($F(2, 50) = 3.10$, $p = 0.054$, partial $\eta^2 = 0.11$), such that both acupressure groups (active and placebo) showed an increased lnSDNN and lnLF power compared to the relaxation group (see Table 2). Post hoc tests showed a marginal effect of both active ($p = 0.091$) and placebo ($p = 0.090$) groups having a higher lnSDNN than the relaxation group, but the two acupressure groups were not different from each other ($p = 1.00$). Post hoc tests on lnLF power revealed a marginal difference between the relaxation group and placebo group ($p = 0.070$), but no significant differences between the active group and either the relaxation group ($p = 0.207$) or the placebo group ($p = 1.00$).

Skin conductance

There was a significant effect of task on lnSCR ($n = 49$), $F(1, 46) = 63.70$, $p < 0.001$, partial $\eta^2 = 0.58$, with a decrease from the first stressor (pre-intervention) to the second stressor (post-intervention) (see Table 2). A significant effect of minute during the math task was also found, $F(5, 240) = 15.08$, $p < 0.001$, partial $\eta^2 = 0.24$, such that lnSCR decreased across the minutes of the task, likely indicating habituation to the task. Although all groups showed a reduction in lnSCR, there were no effects of group or interactions between group, task, and minute, $p > 0.05$. During the intervention itself, there were also no significant group differences in lnSCR, $p > 0.05$ (see Fig. 2).

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Table 1 Participant characteristics and baseline measures.

	Active	Placebo	Relaxation
Sample size	39	40	30
Age (mean ± SEM)*	18.97 ± 0.18	19.72 ± 0.27	19.03 ± 0.17
Gender (% male)	38.5	57.5	43.3
Ethnicity			
% Asian	5.1	12.5	3.3
% Black	2.6	0	3.3
% Latino	0	0	6.7
% White	87.2	82.5	86.7
% Other	5.1	5.0	0
Expectancy	5.87 ± 0.49	5.44 ± 0.47	5.03 ± 0.15
Baseline PSM-9 score	2.54 ± 0.26	2.40 ± 0.20	2.67 ± 0.18
CACMAS			
Philosophical congruence with CAM	4.22 ± 0.12	4.40 ± 0.15	4.42 ± 0.13
Dissatisfaction with conventional medicine	2.10 ± 0.14	2.42 ± 0.16	2.33 ± 0.14
Holistic balance	3.75 ± 0.14	4.11 ± 0.16	4.11 ± 0.18
CAM usage (# of types)			
Past use	3.15 ± 0.30	3.30 ± 0.38	3.03 ± 0.37
Current use	0.77 ± 0.19	0.95 ± 0.24	0.70 ± 0.19
Possible future use	9.51 ± 0.61	8.60 ± 0.90	8.23 ± 0.89
MHLC			
Internal	29.74 ± 0.59	30.89 ± 0.82	30.73 ± 0.86
Chance	19.23 ± 0.70	20.15 ± 0.81	20.40 ± 0.98
Powerful others	18.23 ± 0.91	17.55 ± 0.90	18.47 ± 0.88
SWLS	5.48 ± 0.16	5.48 ± 0.17	5.63 ± 0.12
LOT-R	31.74 ± 0.83	30.92 ± 0.98	31.97 ± 0.66
Credibility*	5.50 ± 0.28	4.87 ± 0.30	6.43 ± 0.26

Symbols reflect significant group difference (active vs. placebo vs. relaxation CD). All measures: mean ± SEM (unless otherwise indicated). *Expectancy*: mean score on a scale of 1—9, with 1 = least expectant to 9 = most expectant; *PSM-9: nine-item Psychological Stress Measure*: mean score on a scale of 1—8, with 1 = not at all stressed to 8 = extremely stressed; *CACMAS: Complementary, Alternative and Conventional Medicine Attitudes Scale*, mean score on a scale of 1—7, with 1 = strongly disagree to 7 = strongly agree; *CAM usage*: Complementary and alternative medicine usage, out of 17 listed types; *MHLC: Multiple Health Locus of Control scale*: sum, with a possible score of 6—42 for ''internal'' and ''powerful others'' locus of control and 7—49 for ''chance''; *SWLS: Satisfaction with Life Scale*: mean score on a scale of 1—7, with 1 = strongly disagree to 7 = strongly agree; *LOT-R: modification of the revised Life Orientation Test*: sum, with a minimum possible score of 0 (least optimistic) to 42 (most optimistic); *Credibility rating*: mean score on a scale of 1—9, with 1 = least credible to 9 = most credible.

* $p < 0.05$.

Math task: Behavioural

There was a significant effect of task on the number of subtractions completed correctly during the math task, such that participants answered significantly more correctly during the second math task (post-intervention) ($M = 21.29$, $SEM \pm 0.40$) compared to the first (pre-intervention) ($M = 19.13$, $SEM \pm 0.42$), $F(1, 106) = 96.01$, $p < 0.001$, partial $\eta^2 = 0.47$. However, there was no significant effect of group, with all groups improving similarly.

Subjective stress appraisal

There was a significant effect of time on State Anxiety Inventory score, $F(1, 106) = 14.81$, $p < 0.001$, partial $\eta^2 = 0.12$, showing that across group, participants reported reduced anxiety post-intervention ($M = 1.57$, $SEM \pm 0.05$) compared to baseline ($M = 1.69$, $SEM \pm 0.04$). However, there was no significant effect of group, with all reporting similarly reduced anxiety. There were no significant baseline differences in State Anxiety Inventory score among the groups.

There were no significant group differences in PSM-9 score at any of the 10 measurement points, including baseline (see Table 1). However, as with other measures, participants rated their subjective stress levels as being significantly lower following the second stressor (post-treatment) than they did the first (pre-treatment), $F(1, 48) = 49.27$, $p < 0.001$, partial $\eta^2 = 0.51$, with all groups demonstrating reduced subjective stress (see Fig. 3).

Expectancy and credibility

There were no significant group differences in mean pre-intervention expectancy rating, but there was a significant group difference in mean post-intervention credibility rating, $F(2, 108) = 7.20$, $p = 0.001$, partial $\eta^2 = 0.12$. Post hoc tests revealed this difference to be between the relaxation ($M = 6.43$, $SEM \pm 0.26$) and placebo groups ($M = 4.87$, $SEM \pm 0.30$), $p = 0.001$, and marginally between the

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Table 2 Mean heart rate (HR), heart rate variability (HRV), and skin conductance response (SCR) measures during both math task stressors and the intervention (active acupressure, placebo acupressure, or relaxation CD).

	Stressor 1	Intervention	Stressor 2
HR (BPM)			
Active	83.00 ± 2.22	65.73 ± 1.99	78.54 ± 1.90
Placebo	81.60 ± 2.08	61.84 ± 1.33	76.13 ± 1.78
Relaxation	84.45 ± 2.38	65.05 ± 1.67	78.79 ± 2.04
HRV: lnSDNN (ms^2)			
Active	4.28 ± 0.09	4.63 ± 0.09*[a]	4.36 ± 0.09
Placebo	4.19 ± 0.09	4.63 ± 0.09*[a]	4.29 ± 0.09
Relaxation	4.11 ± 0.09	4.36 ± 0.09*[a]	4.28 ± 0.09
HRV: lnLF (ms^2)			
Active	7.56 ± 0.19	7.73 ± 0.17*[b]	7.75 ± 0.18
Placebo	7.44 ± 0.19	7.83 ± 0.17*[b]	7.56 ± 0.17
Relaxation	7.32 ± 0.18	7.29 ± 0.16*[b]	7.63 ± 0.17
HRV: lnHF (ms^2)			
Active	6.91 ± 0.21	8.05 ± 0.26	6.85 ± 0.24
Placebo	6.51 ± 0.20	7.57 ± 0.25	6.50 ± 0.23
Relaxation	6.40 ± 0.20	7.47 ± 0.24	6.67 ± 0.23
HRV: lnLF/lnHF (ms^2)			
Active	0.65 ± 0.13	−0.32 ± 0.19	0.90 ± 0.18
Placebo	0.93 ± 0.12	0.26 ± 0.18	1.05 ± 0.18
Relaxation	0.92 ± 0.12	−0.18 ± 0.18	0.96 ± 0.17
lnSCR (μsiemens)			
Active	3.28 ± 0.05	2.48 ± 0.09	2.83 ± 0.11
Placebo	3.29 ± 0.06	2.46 ± 0.14	3.02 ± 0.09
Relaxation	3.31 ± 0.05	2.42 ± 0.16	3.06 ± 0.09

All measures: mean ± SEM.
[a]Significant group difference within lnSDNN, $p = 0.042$.
[b]Marginally significant group difference within lnLF, $p = 0.054$.

relaxation and active groups ($M = 5.50$, $SEM \pm 0.28$), $p = 0.078$. Importantly, the two acupressure interventions were not rated differently on credibility (see Table 1).

Discussion

A single treatment session of active acupressure, placebo acupressure, or relaxation CD resulted in reduced physiological and subjective stress responses to a laboratory stressor, although there were no significant differences among the groups. Interestingly, a significant group difference was found during the intervention itself. HRV (SDNN and LF power) was greater for both acupressure groups (active and placebo) than for the relaxation group. As increased HRV can indicate better autonomic adaptation,[14,29] this could suggest an added benefit of touch treatment in comparison to the relaxation intervention, especially since HRV was not significantly different among the groups prior to the intervention. However, as there were no group differences in HRV during the post-treatment stressor, its exact meaning and potential long-term benefits remain unknown.

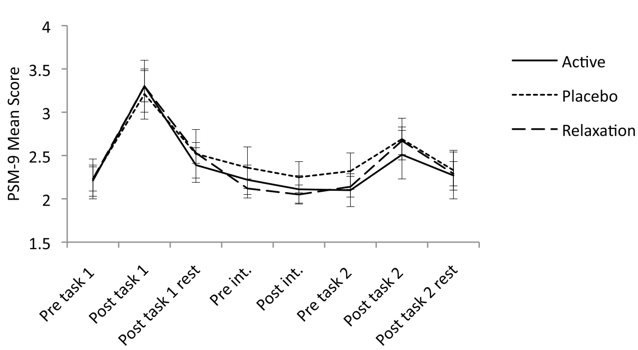

Figure 3 Subjective stress response throughout the experiment, as measured with the PSM-9.

The results of this study provide insight about optimal dosing of acupressure, which is important as acupressure dosing necessary to elicit an effect in a healthy population has not been delineated. However, in populations with neurological dysfunction, our laboratory recently reported 8 acupressure treatments were sufficient to observe treatment effects: active treatments were associated with greater and faster heart rate reduction in stroke survivors during treatments themselves[12] and greater cognitive improvement in traumatic brain injury (TBI) survivors following the treatment series,[13] compared to placebo treatments. In both studies, a significant (stroke) and marginally significant (TBI) reduction in the stress response were found after the 8-treatment series. Because previous studies in healthy populations found single acupressure treatments to reduce stress and/or anxiety,[7,9] it was surprising that a single treatment was not sufficient in the current study with a healthy population, especially given the acute timing of stress response assessment (immediately preceding and following the intervention). It was expected that laying down and relaxing, which occurred in all interventions in the current study, would confer some stress-reduction benefit (which it did), but that the active acupressure would result in additional, measurable effects beyond those seen with placebo acupressure and relaxation. As this effect was not seen and appears to be associated with insufficient dosing, future studies will examine the utility of acupressure for stress reduction when a series of treatments is administered rather than a single treatment in healthy populations. In this way, the results will be able to differentiate the effects of physical contact at active acupressure points from pure relaxation.

Importantly, the three groups did not differ in treatment expectations prior to the intervention, as expectancy can influence treatment effects.[30,31] Interestingly, participants rated the relaxation CD intervention as more credible than either the active or placebo acupressure treatments. A possible reason for this could be that participants knew they may have received a placebo treatment if they experienced acupressure, due to the informed consent process. Moreover, participants would become aware of group assignment once the relaxation CD began playing, but it was not designated as a control condition in the consent form. As such, participants in the relaxation group likely assumed they were receiving a ''real'' treatment. It is important to note, however, that participants did not rate the placebo acupressure treatment as less credible than the active acupressure treatment, indicating that participants were unable to distinguish between placebo and active treatments, replicating prior work with the same placebo.[12,13] That the placebo be credible as a treatment is crucial for its use as an acupressure control.

A potential confound of the current experiment is possible habituation to the stressor, as it was presented twice during the experiment within a relatively short amount of time (~1 h apart). Task adaptability and the use of different numbers between tasks were employed to minimise habituation and practice effects. However, SCR is known to habituate with multiple task administrations.[32,33] Indeed, it appears that SCR habituated with each additional minute within each math task, but this habituation was not seen for HR. Habituation of cardiovascular responses is less well-characterised,[34] with some studies finding HR habituation[35,36] and others finding little to no HR[34,37,38] or HRV habituation.[34] Similarly, habituation to the stressor and practice effects could account for improvements in the math task, but not all studies have shown this effect on performance in multiple administrations of an arithmetic stressor.[35] Had the originally hypothesised group differences been observed (i.e., greater effects seen in the active group compared to placebo and relaxation groups), this would have allowed practice effects and habituation to be teased apart from group effects. Unfortunately, the present results make it difficult to determine the contribution of habituation and practice.

In conclusion, all three groups showed a reduction in physiological and subjective markers of stress during a math task stressor. Interestingly, HRV measures during the intervention itself were increased for the active and placebo acupressure groups compared to the relaxation control group, suggesting a benefit of the treatments involving touch. Future studies will explore multiple acupressure treatments to determine optimal dosing for stress reduction in healthy populations. Combined with the possibility for self-administration (and thus, portability and affordability), acupressure warrants further study as a stress reduction technique.

Conflict of interest statement

None of the authors have a conflict of interest.

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