RESEARCH ARTICLE

Effectiveness of Acupuncture Therapy on Stress in a Large Urban College Population

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Abstract

This study is a randomized controlled clinical trial to study the effectiveness of acupuncture on the perception of stress in patients who study or work on a large, urban college campus. The hypothesis was that verum acupuncture would demonstrate a significant positive impact on perceived stress as compared to sham acupuncture.

This study included 111 participants with high self-reported stress levels who either studied or worked at a large, urban public university in the southwestern United States. However, only 62 participants completed the study.

The participants were randomized into a verum acupuncture or sham acupuncture group. Both the groups received treatment once a week for 12 weeks. The Cohen's global measure of perceived stress scale (PSS-14) was completed by each participant prior to treatment, at 6 weeks, at 12 weeks, and 6 weeks and 12 weeks post-treatment completion.

While participants of both the groups showed a substantial initial decrease in perceived stress scores, at 12 weeks post treatment, the verum acupuncture group showed a significantly greater treatment effect than the sham acupuncture group.

This study indicates that acupuncture may be successful in decreasing the perception of stress in students and staff at a large urban university, and this effect persists for at least 3 months after the completion of treatment.

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1. Introduction

Stress is a part of every person's life, and the link between stress and negative outcomes is well established [1,2]. A population of particular interest in stress and coping research are college students. College, for many students, includes a perfect storm of developmental and social challenges and task-specific stressors (e.g., increased academic rigor). Research by the American College Health Association's National College Health Assessment indicates that in 2015, 42.8% students reported more than average stress in the past 12 months, with 10.7% reported being under tremendous stress [3]. Furthermore, 30% of college students reported that stress had negatively impacted academic performance, and 76% of students reported feeling overwhelmed with all they had to do [3]. Thus, treatment providers of all types in collegiate health are much warranted.

One type of treatment that has heretofore been understudied is the effectiveness of acupuncture on college student stress and coping. While a few studies have examined acupuncture and stress [4—6], none have examined stress in a collegiate health care setting. The basis of stress in traditional Chinese medicine is commonly rooted in the liver energy imbalance; this pattern of imbalance is often referred to as liver qi stagnation. As stagnation builds over time, individuals can experience a wide variety of symptoms ranging from digestive disorders, such as irritable bowel syndrome and chest distension (a feeling of fullness in the chest), to menstrual disharmonies, such as dysmenorrhea, irregular menses, and premenstrual syndrome in the female population. Commonly, individuals with liver qi stagnation experience emotional challenges including depression, anger, general agitation, and mood swings [7].

This study is an attempt to evaluate the effectiveness of acupuncture in the perception of stress specifically in patients who study or work on a large urban college campus utilizing the underlying pathology of liver stasis. This 12-week pilot study focuses to answer the following questions: Will treatment of liver imbalance lead to a decreased stress perception in our targeted population? Furthermore, if this occurs, will we see a continuation of this perception when the treatment is completed? In anecdotal practice, patients in collegiate acupuncture clinics report stress reduction by approximately one-third of the previous stress level. For this study, using that qualitative report as an overestimate, we hypothesized a 20% decrease in stress perception.

2. Methods

2.1. Design

This was a two-group, randomized controlled trial. Participants were block-randomized to either verum acupuncture or sham acupuncture by the Research Nurse. The study was approved by the university's institutional review board. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation. Informed consent was obtained from all the participants before being included in the study.

2.2. Measures

Each participant completed the Cohen's global measure of perceived stress questionnaire [8] at five stages:
(Fig. 1)

1) Prior to treatment
2) at 6 weeks
3) at 12 weeks, at the completion of treatment
4) 6 weeks post completion and
5) 3 months post completion of treatment.

The treatment group received conventional and auricular acupuncture consisting of needle placement at a predetermined set of point:
GV 20, HT 7, PC 6, Yintang, Four Gates, CV 17, CV 6, ST 36 inserted unilaterally and auricular points: Shen Men, Liver, Point 0, and Heart.

The second group (control group) received sham acupuncture into three points on the body that are located in between meridians and not known to have any effect on stress. Needles were inserted unilaterally and without stimulation or manipulation to avoid the needling sensation known as de qi.

Participants in both groups reported to the clinic once a week; needle retention was 30 minutes.

Both groups received the same supportive interaction with the practitioner, heated acupuncture tables, dimmed light, and soothing music in the rooms during the treatment phase.

Acupuncture needles used were as follows: (1) DBC Lhasa OMS Inc. Weymouth MA, Spring Ten Handle, sterile acupuncture needles with guide tube, size 0.22 × 30 mm; (2) Seirin Group B.V 230 Libbey Parkway Weymouth MA, D-Type acupuncture needle No. 3, size 0.20 × 15 mm; and (3) Helio Medical Supplies Inc. San Jose CA, Vinco MicroClean acupuncture needle, size 0.20 × 7 mm.

2.3. Participants

The study participants included college students, faculty, and staff at a large public university in the southwestern United States who self-identified as feeling stressed and were interested in acupuncture (Table 1). Recruitment methods included: (1) primary care clinicians who identified and informed the patients with stress about the trial and to contact the research nurse if interested; (2) flyers were distributed to departments throughout the university, which included residential Life, counseling center, the Department of Psychology's training clinic, and by displaying information about the study on video boards in the entrance hall of the health center; and (3) information regarding the study was included on the health services website and on the university intranet login.

Potential participants were screened by completing the Cohen's global measure of perceived stress questionnaire (Fig. 1). Participants who scored ≥ 16 on a scale of 0—56, were aged ≥ 18 years, and had never received acupuncture treatment for stress prior to this study were eligible to participate in the study.

Participants were excluded if they were aged < 18 years, had scores < 16, were pregnant, were unable to provide

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate *how often* you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate. For each question choose from the following alternatives:

    0.   Never, 1. Almost Never, 2. Sometimes, 3. Fairly Often, 4. Very Often,

	Never	Almost Never	Sometimes	Fairly often	Very Often
1. In the last month, how often have you been upset because of something that happened unexpectedly?					
2. In the last month, how often have you felt that you were unable to control the important things in your life?					
3. In the last month, how often have you felt nervous and "stressed"?					
4. In the last month, how often have you dealt successfully with irritating life hassles?					
5. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?					
6. In the last month, how often have you felt confident about your ability to handle your personal problems?					
7. In the last month, how often have you felt that things were going your way?					
8. In the last month, how often have you found that you could not cope with all the things that you had to do?					
9. In the last month, how often have you been able to control irritations in your life?					
10. In the last month, how often have you felt that you were on top of things?					
11. In the last month, how often have you been angered because of things that happened that were outside of your control?					
12. In the last month, how often have you found yourself thinking about things that you have to accomplish?					
13. In the last month, how often have you been able to control the way you spend your time?					
14. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?					

Figure 1   A global measure of perceived stress.

consent, or underwent prior treatment for stress by using acupuncture. A power analysis calculated a sample size of 64 to be able to detect a 20% decrease in stress level.

2.4. Procedure

This was a randomized controlled trial. The acupuncture practitioners knew the assignment (verum vs. sham acupuncture) but were unaware of the participants' score on the Cohen's global measure of perceived stress.

The duration of the treatment phase was 12 weeks during which the subjects underwent weekly 30-minute acupuncture sessions. The sessions were held in the Wellness wing of the University's Health Services building, which includes two acupuncture rooms. We enrolled participants on a rolling basis over a 9-month period.

Each participant completed the Cohen's global measure of perceived stress questionnaire prior to treatment, at 6 weeks, at the completion of the treatment phase, 6 weeks post completion, and 3 months post completion.

Table 1 Demographic characteristics of the study groups.

Age range (y)	Female	Male	Both
19—20	2	3	5
21—25	16	10	26
26—30	24	5	29
31—35	14	3	17
36—40	8	7	15
41—45	5	3	8
46—50	3	0	3
51—55	3	1	4
56—60	2	2	4
Total	77	34	111
Staff			17
Faculty			5
Student			89
Total			111

Table 3 Results of mixed model estimation. ($n = 369$; Wald $Chi^2 = 423.89$; $p > Chi^2 = 0.00$)

	Coefficient (SE)	z	$p > |z|$
Acupuncture	1.33 (1.34)	1.00	0.320
Time			
Week 6	−11.11*** (1.22)	−9.10	0.000
Week 12	−13.94*** (1.32)	−10.55	0.000
6 weeks post	−10.30*** (1.34)	−7.68	0.000
12 weeks post	−8.18*** (1.34)	−6.10	0.000
Interactions			
Acu*Week 6	−1.39 (1.65)	−0.85	0.398
Acu*Week 12	−2.12 (1.76)	−1.21	0.226
Acu*6 Week Post	−4.28** (1.77)	−2.42	0.015
Acu*12 Week Post	−5.68*** (1.76)	−3.22	0.001
Constant	34.47*** (0.95)	36.30	0.000

*** $p < 0.001$; ** $p < 0.05$.
LR test vs. linear model: $Chi^2(01) = 87.63$ Prob $>= Chi^2 = 0.0000$.

2.5. Statistical analysis

It was initially determined that 64 participants were necessary to have enough statistical power for analysis. Of the 111 initially participants recruited, 21 never started the clinical phase and 28 withdrew from the study, leaving 62 participants (Table 2). Subsequent statistical analyses indicated that 62 participants did allow for sufficient power for analysis.

We used a repeated-measures mixed model approach with both fixed and random effects. The estimation results of the repeated-measures mixed model are presented in Table 3. Based on the estimates in Table 3, contrast tests for main and interaction effects indicate no significant main effect of treatment ($Chi^2 = 1.41$; $p = 0.23$). Significant main effect of time ($Chi^2 = 392.7$; $p = 0.001$) and interaction between treatment and time ($Chi^2 = 12.75$; $p = 0.012$) were observed. As observed in Table 3, the interaction effects of acupuncture with 6 weeks and 12 weeks post measurements were significant at $p < 0.05$.

Table 2 Attrition rate and composition during study.

		Completed	Never started Rx	Withdrawn	Total
Acupuncture	Female	24	7	8	39
	Male	12	0	5	17
Sub total Rx		36	7	13	56
Sham	Female	18	9	11	38
	Male	8	5	4	17
Sub total Sham		26	14	15	55
Total		62	21	28	111
Total Recruited	111				

	Staff	Students
Completed	11	51
Not Completed	11	38
Total	22	89
Grand total		111

The fixed effects estimate the coefficients of the treatment effects and interactions over multiple measurements, i.e., the slope of the regression line. The random effects present an average deviation of the random intercepts from the population mean and within subject variance. In addition, we conducted Wilcoxon signed-rank test for pre- and post-treatment effects for the two treatment groups. The first score (before receiving treatment) and the final score (3 months post completion) were compared using the Wilcoxon signed-rank test. The pre- and post-treatment effects were significant for both the acupuncture conditions at $p < 0.001$ [z-score for sham acupuncture was 3.473 ($n = 25$); z-score for verum acupuncture was 5.252 ($n = 37$)].

3. Results

There was no statistical difference between the sham and verum acupuncture groups on PSS-14 scores pretreatment. The mean pretreatment PSS-14 score was 34.4 in the sham group and 35.8 in the verum acupuncture group (t score = −1.2; $p = 0.25$); the median was 34 and 35, respectively. At 6 weeks both groups' scores dropped to 23.5 or 31.7% for the sham group and 23.1 or 35.5% for the acupuncture group. By week 12, at the completion of the treatment phase, the sham group's score was 20.6, a 40.1% decrease from the pretreatment score, and the acupuncture group's score decreased to 19.4, a 45.8% decrease. The differences in the PSS-14 scores for the two groups were statistically significant at week 12 (t score = 2.2; $p < 0.05$). However, pre- and post-treatment effects for both groups were statistically significant. The Wilcoxon signed-rank test z-score was 3.5 ($p < 0.001$; $n = 25$) for the sham group and 5.3 ($p < 0.001$; $n = 37$) for the acupuncture group (Fig. 2).

The decrease in stress level persisted after the completion of treatment. At 6 weeks post completion of the treatment, the sham and acupuncture groups had a mean score of 24.1 (29.9%) and 20.8 (41.9%), respectively. At 12 weeks post completion of treatment, the mean score for the sham group was 26.2 (23.8%) and that for the
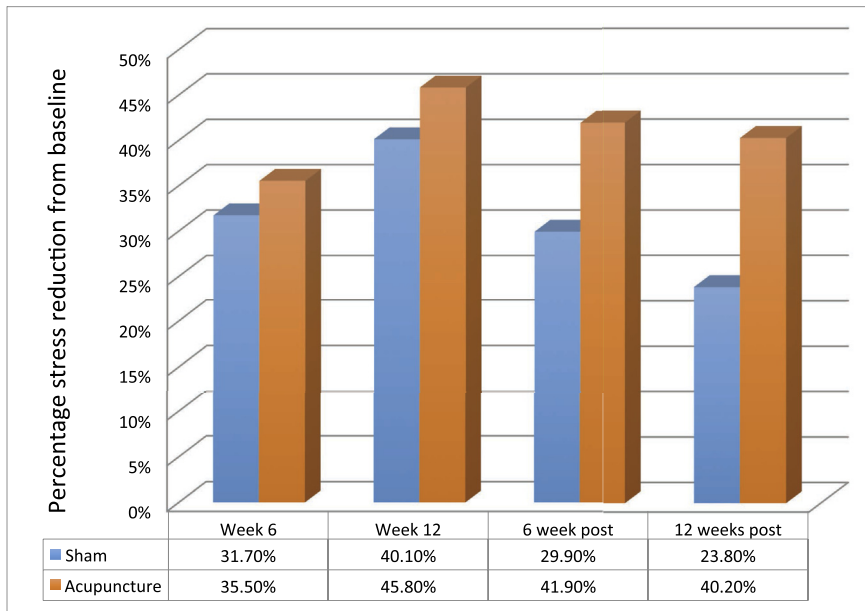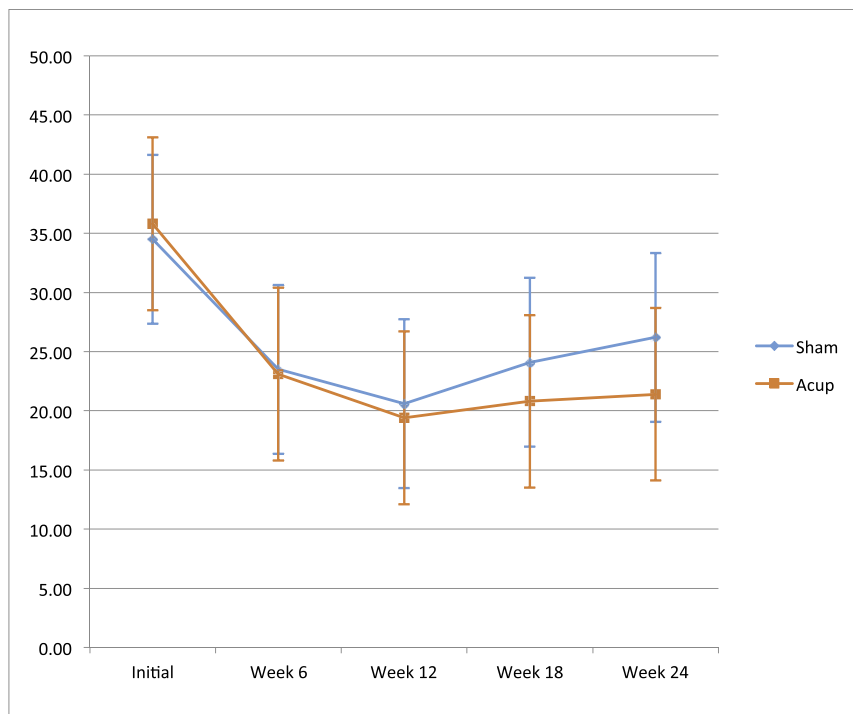
Figure 2   Maintained stress reduction after intervention.

	Week 6	Week 12	6 week post	12 weeks post
Sham	31.70%	40.10%	29.90%	23.80%
Acupuncture	35.50%	45.80%	41.90%	40.20%

	Pre-intervention	Post-intervention	3-month Post-intervention
	Initial	12 weeks	24 weeks
Verum acupuncture	35.8 (6.4)	19.4 (6.2)	21.4 (8.5)
Sham acupuncture	34.5 (5.5)	20.6 (6.9)	26.2 (9.1)

Data are presented as mean (SD).

PSS = perceived stress scale.

Figure 3   PSS-14 scores over the study period.

acupuncture group was 21.4, which is a 40.2% decrease in the perception of stress (Fig. 3).

The difference between verum acupuncture and sham acupuncture was 18.3%.

4. Discussion

There was a 45.8% improvement in the perception of stress in the verum acupuncture group at the conclusion of the treatment phase, similar to the sham acupuncture group, which showed a 40.3% difference. While both verum and sham acupuncture patients showed a substantial initial decrease in perceived stress scores, at 12 weeks post-treatment, verum acupuncture showed a significantly greater treatment effect than sham acupuncture. After 3 months post completion, the mean PSS-14 score only slightly increased and maintained a 40.2% decrease as compared to the pre-treatment score. The sham group's PSS-14 score went to a 24.1 % decrease from the pre-intervention score.

One limitation of this study is that applying the conventional scientific method to acupuncture can be misleading. In order to determine a statistical difference between sham and verum acupuncture, the numbers would need to be much higher (approximately 10 times the usual number to reach statistical power) to avoid a type II error or false negative result [9,10]. We treated every participant with the same point combination, no matter what their underlying energetics may have suggested, if we had done a full tongue and pulse analysis according to traditional Chinese medicine concepts. Acupuncturists will vary their point selection depending on history, symptomatology, and tongue and pulse diagnosis.

Another limitation was participant attrition. In total, 111 participants were randomized into study groups. However, 21 participants never started the clinical phase, and 28 participants withdrew from the study, mainly for the inability to maintain the schedule required to be in the study. We enrolled participants on an ongoing basis and therefore bridged semester breaks, which made it difficult for students to keep up their weekly visits for acupuncture. Furthermore, 38 students and 11 staff/faculty either never started or dropped out. The number of participants who completed the verum acupuncture arm was more than those who completed the sham acupuncture arm (36 vs. 26; Table 2).

A further limitation was the frequency of treatment. Typical practice is to treat an acupuncture patient twice a week rather than once a week. This schedule would have been impossible to maintain for 12 weeks in this population. We already had a high dropout rate because of the weekly time commitment for our participants.

Stress is ubiquitous yet difficult to treat. This study is an early step in examining the effectiveness of acupuncture in a collegiate health environment and showed that acupuncture may have a lasting beneficial effect on the perception of stress, even beyond the conclusion of treatment. A randomized control trial of at least 640 students would be the definitive study in showing the beneficial effects of acupuncture on the perception of stress in a college environment.

Disclosure statement

The authors declare that they have no conflicts of interest and no financial interests related to the material of this manuscript.

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