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Effect of Foot Reflexology on the Happiness and Academic Stress of Nursing Students: A Randomized Controlled Trial

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Abstract

Background and Aim: Some nursing students might experience high level of stress and lower levels of happiness. The aim of this study is to determine the effect of foot reflexology on the happiness and academic stress of female Nursing student resident in dormitory.

Materials and Methods: This randomized controlled trial was conducted on 99 undergraduate nursing students studying at the Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, located in Tabriz, northwestern Iran. The students were subsequently divided into three groups of reflexology, sham, and control. The intervention group received foot reflexology for four weeks. The sham group received nonspecific foot massage without applying pressure on standard reflex points with the same condition and duration as the intervention group. No intervention was performed for the control group. Normality of data was checked using the Shapiro-Wilk test. Intergroup comparisons were performed using one-way ANOVA with Bonferroni post-hoc correction (p =.0167).

Results: The results indicated a significant difference between the three groups in terms of the level of stress and happiness after the intervention ($p < .05$). However, result of Bonferroni correction test showed that, only the difference between the reflexology and control groups remained significant for both variables ($p < .0167$). The reflexology group showed a mean increase in happiness by 8.73 points (95% CI: 4.12-13.34) and a mean reduction in stress by 10.25 points (95% CI: 5.67-14.83) compared to baseline. Effect sizes were moderate (Cohen's d = .62 for happiness; $\eta^2 = .09$ for stress).

Conclusions: Foot reflexology may be effective in reducing stress levels and increasing happiness among female nursing students in similar dormitory settings. However, further research is needed to confirm these findings in male students and to control for attention effects.

Keywords: Happiness, stress, nursing student, reflexology.

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Introduction

Happiness is a positive psychological state that is inversely associated with depression, and is positively associated with self-esteem, optimism, and interpersonal relationships among nursing students [1-2]. It is also associated with lower levels of stress and higher flexibility and self-confidence [3]. High stress level affects the efficiency of nursing students' entire system and the quality of care they provide [4]. Results of studies in this field have shown that stress management can increase happiness. On the other hand, since the existence of high stress and low level of happiness may have negative effects on the learning, efficiency and clinical success of students, making it difficult for them to achieve the main goals of nursing education, it is necessary to reduce stress and increase happiness in nursing students [2-4].

Several supplementary intervention and care have been developed to assist with the management of stress in students [5]. Complementary medicine is one of the recommended methods to reduce stress levels [6]. One of the branches of complementary medicine is reflexology, which is a non-invasive, simple, low-cost and complication-free method [7-8]. Therefore, this study was conducted with the aim of determining the effect of foot reflexology on the happiness and academic stress of female undergraduate nursing students living in the dormitory of Tabriz University of Medical Sciences, located in Tabriz, northwestern Iran.

Methods

The present randomized controlled trial (registered in Iranian registration of clinical trial with registration number: IRCT20110629006918N27) consists of two intervention groups and a control group with a pretest–posttest design. Each group consisted of 33 nursing students. The study was conducted from September 2018 to January 2019. Study setting was Kosar

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dormitory, Tabriz University of Medical Sciences. The participants consisted of female nursing student living in the dormitory of Tabriz University of Medical Sciences. Inclusion criteria included; being a nursing student, having healthy sole of the foot (no wounds and having a healthy foot), having no history of diagnosed psychiatric disorders, not using psychoactive or sedative medications during the past month, having no exposure to major stressful events during the past three months, not being pregnant at the time of enrollment. Exclusion criteria (occurring after enrollment) included being pregnant during the study, having any foot problems during the study process, being absent from more than two intervention sessions.

This study was conducted on three groups; reflexology ($n = 33$), sham ($n = 33$) and control ($n = 33$). Considering the importance of appropriate research environment for performing reflexology, it was necessary to choose a suitable place to continue the work. So, one of the dormitory's rooms with a good light and ventilation was chosen to perform the interventions. In this study, reflexology and nonspecific foot massage was performed by the researcher, who had learned the techniques from a reflexology specialist. The duration of training was 3 weeks. When students entered the intervention room, their academic stress and happiness were measured with respective tools by the assistant of the researcher.

The intervention group received foot reflexology once a week for four weeks (total of 4 sessions, 10 minutes per foot and a total of 20 minutes per session). Reflexology was performed first on the right foot, then on the left foot while the student was lying on her back. Also. For the comfort of the student, two pillows were placed under her feet. The specific reflex points included; the solar plexus point (for relaxation), the pituitary gland point (for hormonal balance), the

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adrenal gland point (for stress response), and the brain and spine points (for overall nervous system regulation). Pressure was applied using the thumb-walking technique with moderate pressure (sufficient to elicit a mild sensation of discomfort but not pain, rated by participants as 3-4 on a 10-point scale). After finishing the reflexology, participants were offered a glass of water for hydration. Data collection tools were completed again by the researcher's assistant after completing the reflexology sessions.

The sham group received nonspecific foot massage without applying pressure on standard reflex points with the same condition and duration as the intervention group. No intervention was carried out for the control group. In the case of the control group, the time to measure the variables was equivalent to that of intervention and sham groups.

In this study, happiness was assessed by OHI (Oxford Happiness Inventory) designed by Argyle and Luo (1990). This tool contains 29 items, each being scored one a four-point Likert scale [9-10]. The total score ranges from 0 to 87, with higher scores indicating greater happiness. The validity and reliability of OHI was confirmed by 727 university student in Iran in 2008 [11]. To evaluate the psychometric properties of the OHI, internal consistency was assessed. The analysis revealed that all 29 items were highly correlated with the total score, with a Cronbach’s alpha coefficient of 0.92.

To measure academic stress, Academic Stress Scale constructed and standardized by Rao in 2012 was used. This scale consists of 40 items and each item has five alternative responses[12]. The total score ranges from 40 to 200, with higher scores indicating greater academic stress. The psychometric evaluation of this scale involved translation, back-translation, and assessment of face and

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content validity by a panel of experts, along with evaluating reliability through internal consistency and test-retest stability. Cronbach's alpha was calculated as 0.89 for Academic Stress Scale.

Based on a previous study [13] reporting a Cohen's d of 0.6 for stress reduction and 0.5 for happiness improvement, we calculated that with α=0.05 and power=0.90, we needed 27 participants per group for one-way analysis of variance to compare the mean stress and happiness in three groups. Taking into account 20% attrition, the final sample size for each group was 33 people, and a total of 99 people. First, students were selected based on a table of random numbers. Then they were divided into three groups using random blocks with a block size of four.

Only the outcome assessor (who collected the data) and the data analyst were blind to group allocation. Participants and the intervention provider could not be blinded due to the nature of the intervention.

This study was approved by the Ethics Committee of the Tabriz University of Medical Sciences, with the ethical approval code: IR.TBZMED.REC.1397.278. Written informed consent forms were signed by all participants. Also, the purpose of the study as well as the potential risks and benefits of participation were explained to the students. They were also assured that they could withdraw from the study at any time. In addition, confidentiality was considered in this study and all personal information was kept in a locked file cabinet with limited access. In addition, all participants were allocated a code number in the final paper. To minimize the risk of treatment contamination among students residing in the same dormitory, several measures were implemented. First, the intervention sessions were conducted at strictly different times for each group to prevent direct interaction. Second, all participants were briefed on the importance of study confidentiality and

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were explicitly instructed not to discuss the intervention details or specific activities with peers in other groups. Furthermore, the nature of the intervention was designed to be individual-focused/private, which reduced the likelihood of information sharing.

Data were entered into SPSS software version 24 to be analyzed using descriptive statistics (number, percentage, mean, and standard deviation).

First, the normality of the data was checked using the Shapiro-Wilk test. Since the data were normally distributed (p >.05 for all variables), parametric tests were used. Baseline values of the three groups (reflexology, sham, and control) were compared using one-way analysis of variance (ANOVA). Intra-group comparisons (before vs. after) were performed using paired t-tests.

For intergroup comparisons after the intervention, one-way ANOVA was used. Since the three groups were compared, a Bonferroni post-hoc correction was applied to control for Type I error. The critical p-value was set at .053 = .0167. Only p-values below .0167 were considered statistically significant. Effect sizes were calculated: Cohen's d for paired comparisons and eta-squared (η^2) for ANOVA. Mean differences with 95% confidence intervals were also reported. Figure 1. Shows the flow diagram of the study.

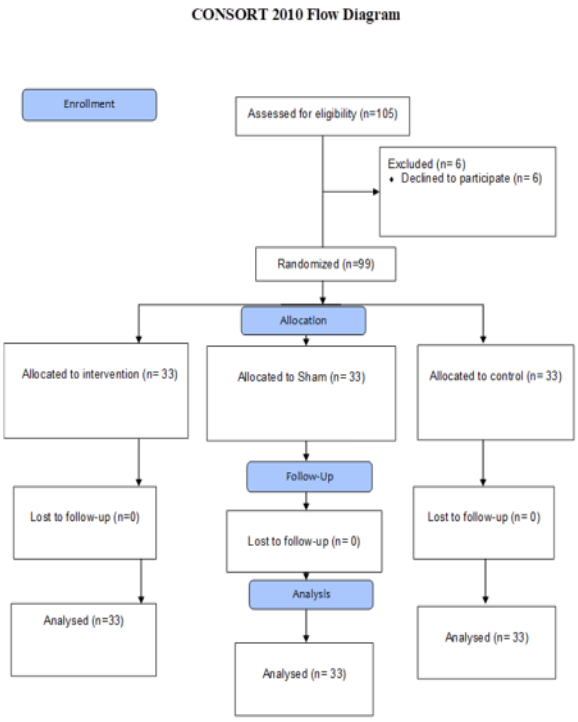

Figure 1. Flow Diagram of the Study

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Results

A total of 99 participants were enrolled and randomized, with 33 participants in each group. All participants completed the study (no attrition). The demographic variables of the participants indicated that their mean age in the intervention group was 20.87 ± 1.16, in the sham group was 21.48 ± 1.15, and in the control group was 21.30 ± 1.26.

Also, the majority of students in all 3 groups were single (93.9% in the intervention group, 93.1% in the sham group and 96.7% in the control group). The grade point average of students in the intervention group was 16.50 ±.87, in the sham group was 16.85 ±.71, and in the control group was 16.91 ±.87. The Shapiro-Wilk test indicated that the data were normally distributed (p >.05 for all variables); therefore, parametric tests were used.

There were no significant differences in baseline demographic characteristics or baseline outcome measures between the three groups (p>.05 for all comparisons). Comparing the mean scores of happiness and academic stress within each group before and after the intervention is shown in Table 1.

Table 1. Comparing the mean scores of happiness and academic stress between each group before and after the intervention

Variable	Intervention (N=33)		Sham (N=33)		Control (N=33)		Within-group *p-value**	Between-group *p*-value**
	Before	After	Before	After	Before	After		
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		
Happiness	38.57 (11.28)	47.30 (10.65)	41.34 (15.71)	42.51 (15.75)	37.06 (13.44)	35.13 (13.05)	0.001 (I); 0.61 (S); 0.32 (C)	.045
Academic Stress	68.18 (33.73)	57.93 (29.00)	63.93 (28.31)	62.51 (31.09)	52.40 (34.89)	53.76 (31.17)	0.008 (I); 0.78 (S); 0.63 (C)	.021

**Paired t-test, **One-way ANOVA*

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Prior to the intervention, there were no significant baseline differences among the three groups in terms of happiness and academic stress scores (p>.05) for both variables. Post-hoc pairwise comparisons using the Bonferroni adjustment (critical p=.0167) revealed that the reflexology group had significantly higher happiness scores than the control group (mean difference [MD] = 12.17, 95% CI [4.89, 19.45], p=.001). However, no statistically significant differences were observed between the reflexology and sham groups (MD = 4.79, 95% CI [−2.53, 12.11], p = .198) or between the sham and control groups (MD = 7.38, 95% CI [−.10, 14.86], p= .053). Regarding academic stress, the reflexology group after intervention, demonstrated significantly lower scores than the control group (MD = −11.34, 95% CI [−19.87, −2.81], p=.009), whereas the differences between the reflexology and sham groups (MD = −4.58, 95% CI [−13.11, 3.95], p = .292) and between the sham and control groups (MD = −6.76, 95% CI [−15.29, 1.77], p =.120) were not statistically significant. The effect-size analysis indicated moderate effects of reflexology on both happiness (Cohen's d = .62; η^2 = .07) and academic stress (Cohen's d = .53; η^2 = .09).

Discussion

The present study is a randomized clinical trial study that was conducted with the aim of determining the effect of reflexology on the happiness and academic stress of female nursing students living in the dormitory. In line with the first aim of the study, which was to compare the mean score of happiness in the three studied groups (reflexology, sham, control) before and after the intervention, the results showed that the mean score of happiness in the reflexology group increased significantly after the intervention compared to the sham and control groups. Using change score analysis to control for baseline

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differences, and after applying Bonferroni correction, only the difference between the reflexology and control groups remained significant (mean difference = 12.17, 95% CI: 4.89-19.45, *p* =.001). The effect size was moderate (Cohen's d =.62). The lack of significant difference between reflexology and sham groups suggests that the non-specific effects of massage (e.g., relaxation, attention) may have contributed to the observed improvements, and the specific effects of reflexology may be less pronounced than initially suggested. In a study by Bostani et al. (2020) exploring the effect of progressive muscle relaxation (PMR) exercise and support group therapy on the happiness of nursing students it was shown that a significant difference there is between the PMR exercise and the control group regarding happiness. In addition, the mean score of happiness was significantly higher in the PMR exercise group compared to the support group therapy after the intervention[14]. Our findings are consistent with this study in demonstrating that non-pharmacological interventions can improve happiness in nursing students.

The second aim of the study was to compare the mean score of academic stress in the three studied groups (reflexology, sham, control) before and after the intervention, and the results showed that the mean score of academic stress in the reflexology group reduced significantly after the intervention compared to the sham and control groups. Using change score analysis with Bonferroni correction, only the difference between the reflexology and control groups remained statistically significant (mean difference = -11.34, 95% CI: -19.87 to -2.81, *p* =.009). The effect size was moderate (Cohen's d = -.53). The non-significant difference between reflexology and sham groups highlights the potential contribution of non-specific effects. A study entitled: “Fascia therapy and Reflexology compared to Hypnosis and Music

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Therapy in Daily Stress Management", carried out by Payrau et al. (2017) suggested that fascia therapy, hypnosis, and reflexology could be used as non-pharmacological and safe interventions in stress management. The results of this study are consistent with the present study [15].

In a study by Lee (2011) exploring the effects of self-foot reflexology on stress, fatigue, skin temperature and immune response in female undergraduate students, the results showed that self-foot reflexology was effective in reducing perceived stress and fatigue, and raised skin temperature in female undergraduate students. however, no statistically significant different was observed in cortisol levels and immune response [16]. The results of this study are consistent with the present study.

The moderate effect sizes observed in the present study (Cohen's d = .62 for happiness, .53 for stress reduction) indicate that reflexology has clinically meaningful effects, although these effects may be partially attributable to non-specific factors. When compared to other stress-reduction interventions in nursing students, such as progressive muscle relaxation (d = .72 reported in Bostani et al., 2020) and mindfulness-based interventions (d = .55-.65), the effect sizes in our study are comparable. This suggests that reflexology could be considered as one of several viable options for stress management in this population.

The mechanisms underlying the effects of reflexology may include; (1) activation of the parasympathetic nervous system leading to relaxation, (2) reduction in cortisol levels, (3) release of endorphins, and (4) decreased activity of sympathetic nervous system. However, the specific mechanisms remain incompletely understood and require further investigation. The lack of significant difference between reflexology and sham

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groups in our study suggests that the tactile stimulation and relaxation response (non-specific effects) may play a substantial role in the observed outcomes.

Considering that reflexology can be done by the person himself and its teaching and learning is done easily, and on the other hand, it is a low-cost, effective method and does not require special tools and places, so it can be used as an effective method for reduce stress and increase happiness among students(5, 15, 16, 17). Also, considering the nature of nursing profession, the students themselves can use this method for their clients.

On the other hand, considering the growing use of non-pharmacological methods in health care [18], the findings of this research can be used by planners, managers, nurses and other members of the healthcare team include such interventions in the treatment and care programs of clients.

This study has certain limitations that should be acknowledged. First, the sample was limited to female nursing students residing in a single dormitory at Tabriz University of Medical Sciences, which may restrict the generalizability of the findings to male students or different environmental settings. Second, although the one-month intervention period could potentially influence students' mood fluctuations, the inclusion of both control and sham groups was implemented to mitigate this effect and enhance the study's rigor. Also, the sham group received a foot massage, which may have its own relaxing effects, so we cannot claim reflexology works better than a true placebo. The control group did not receive any attention, making it impossible to separate the effect of reflexology from the effect of receiving attention. The sample size calculation was based on an assumed effect size from previous literature, and this assumption should be validated in future studies. The reflexology protocol (specific points, pressure intensity, and frequency) was based

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on expert opinion and may vary across practitioners, limiting its reproducibility. We also did not measure physiological markers (e.g., cortisol, heart rate variability) to objectively verify the stress-reduction effects.

Despite these limitations, this study had several strengths. The use of a randomized controlled design with a sham group strengthens the internal validity. The use of change score analysis to control for baseline differences is a statistical strength. The inclusion of a sham group, despite its limitations, represents an attempt to control for non-specific effects. The use of validated instruments and the reporting of effect sizes and confidence intervals enhance the clinical interpretability of the findings.

Conclusions

Foot reflexology may be effective in reducing stress levels and increasing happiness among female nursing students in similar dormitory settings, with moderate effect sizes. Considering that this type of massage can be performed by people themselves and it is possible to teach and learn it easily, and on the other hand, since it is a low-cost and effective method that does not take much time or require special tools and places, it may be considered as an effective method for reducing stress and increasing happiness in students. However, given the methodological limitations of this study (including lack of a true placebo, absence of attention control, and limited generalizability), definitive conclusions about the superiority of reflexology over non-specific effects cannot be drawn. Educational authorities and instructors are advised to consider this intervention with caution, and further research with more rigorous designs, including active control groups, longer follow-up periods, and objective outcome measures, is needed to confirm these findings in diverse populations including male students.

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Conflict of Interests

None of the authors has any conflict of interest to declare.

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