Assessment of the Effectiveness of the Innovative Natural Product: Stress Relief Pillow for Stress Reduction and Muscle Relaxation

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Abstract.

The Stress Relief Pillow is an innovation developed from natural materials, specifically coconut shells, which are designed to form small massage balls. These balls mimic manual massage techniques traditionally used in Thai Traditional Medicine, focusing on the neck and head muscles. This pilot study aimed to evaluate the effectiveness of the Stress Relief Pillow in reducing stress and improving muscle relaxation. The study included 10 volunteers aged over 18 years, who used the pillow for 10 minutes daily over a period of five days. Outcome measurements were assessed using the Stress Score Assessment (SSA), Cervical Range of Motion (CROM), and Heart Rate Variability (HRV). The results of repeated measures ANOVA ($p < 0.05$) demonstrated statistically significant improvements across four time points: baseline, immediately after use, after day 1, and after day 5 of pillow use. For instance, CROM showed an increasing trend with the SDNN values as follows: $\bar{x}$ (SD) = 20.66 (10.48), 21.99 (9.74), 24.69 (12.32), and 26.00 (10.52), respectively. Furthermore, HRV analysis revealed an improvement in parasympathetic nervous system function, which is associated with reduced tension, decreased neck muscle discomfort, and lower stress levels among participants.

Keywords: Stress Relief Pillow, Innovation, natural products, coconut shells

1.Introduction

Stress is a state of mental or emotional tension that occurs when individuals face difficult or challenging situations. It is a natural human response that motivates individuals to confront threats and challenges in life. Although stress is a universal experience, its impact on overall well-being depends on how it is managed (WHO, 2023). Common causes of stress include family conflicts, work-related pressures, bullying, and exposure to violence (Department of Mental Health, 2019). If stress accumulates without proper management, it can lead to severe consequences, such as depression, psychiatric disorders, or long-term physical and mental health issues (Cooper, 2023). Recent studies highlight the growing prevalence of stress worldwide, especially among younger age groups. In England, a survey revealed that 49% of individuals aged 18–24 experienced high stress levels, surpassing other age groups. Additionally, 60% of respondents in this group reported stress related to pressure for success (Mental Health Foundation, 2018). Globally, Gallup's Global Emotion Survey in 2021 reported that 41% of the population across 122 countries experienced stress, showing an increase from

40% in 2020 (Ray, 2022). These findings emphasize the urgency of exploring effective interventions for stress reduction. Thai traditional medicine has long offered valuable practices for stress management, particularly through massage techniques. Thai massage is not only used for treating illnesses but also for promoting overall health and beauty (The Foundation for the Promotion of Thai Traditional Medicine Ayurved School, 2005). Historically, coconut shells were creatively adapted as self-massage tools in local communities. These tools were used to alleviate foot pain, numbness, and physical tension. Despite the long-standing use of this traditional method, there is limited scientific evidence supporting its effectiveness in reducing stress.

This study aims to investigate the effectiveness of the Stress Relief Pillow, a self-massage device inspired by traditional coconut shell massage, in reducing stress and promoting relaxation.

2. Objective

To evaluate the effectiveness of self-massage with the Stress Relief Pillow in reducing stress.

3. Materials and Methods

3.1 Design this study was the Quasi Experimental Research at the Department of Health Promoting Hospital, Samut Songkhram Province, Thailand. After development of the innovative Stress Relief Pillow, it was tested for effectiveness using a before-after treatment design. The research was approved by the Human Research Ethics Committee of Suan Sunandha Rajabhat University. (COE.1-100/2022)

3.2 Participants the sample consisted of 10 volunteers aged over 18, who used the Stress Relief Pillow for 10 minutes daily over five consecutive days. Participants were screened using the Self-Stress Assessment (SSA) developed by the Department of Mental Health, Thailand, before receiving treatment with the coconut shell-based Stress Relief Pillow.

. 3.3 Intervention the volunteers received 10-minute sessions using the Stress Relief Pillow for five consecutive days. Assessments were conducted before and after the treatment. During each session, participants lay in a supine position with the Stress Relief Pillow placed on the splenius muscles on both the left and right sides at the back of the head.

3.4 Measurement Instruments the measurement instruments included the Self-Stress Assessment (SSA) for subjective stress and pain perception. Cervical range of motion (CROM) was evaluated using a CROM device, while pressure pain threshold was assessed with a Tissue Hardness Meter and Algometer (Ito, Japan). Heart rate variability (HRV) was measured using the Heart Rhythm Scanner PE (Biocom Technologies, USA).

Descriptive statistics, including mean and standard deviation, were used to analyze the characteristics of the volunteers. A paired t-test was performed to compare pre- and post-treatment means. Repeated Measures ANOVA was applied to analyze treatment effects, with a significance level set at 0.05 ($P < 0.05$).

4. Results

This study assessed the effectiveness of a coconut shell stress relief pillow in reducing neck and shoulder muscle pain and tension among individuals with moderate to high stress levels.

The short-term study included 10 participants aged over 18, assessed using the Self-Stress Assessment (SSA) developed by Thailand's Department of Mental Health (DMH). Participants used the pillow for 10 minutes daily over five consecutive days.

Results showed statistically significant improvements in cervical range of motion (CROM). For cervical flexion, the mean increased from 52.50° ± 4.25° at baseline to 61.00° ± 3.94° on day 5 ($P < 0.001$, effect size = 0.74). Cervical extension improved from 46.50° ± 11.56° to 58.00° ± 17.03° ($P = 0.004$, effect size = 0.52). Left lateral flexion increased from 32.50° ± 7.17° to 37.00° ± 9.19° ($P = 0.008$, effect size = 0.43), and right lateral flexion increased from 32.50° ± 7.55° to 38.50° ± 7.47° ($P = 0.013$, effect size = 0.386)(table1).

In terms of pressure pain threshold (PPT) and tissue hardness, although improvements were observed, the changes were not statistically significant.

Heart rate variability (HRV) analysis showed significant increases in SDNN and RMS-SD values ($P < 0.05$), indicating improved parasympathetic nervous system function. For example, SDNN increased from 20.66 ± 10.48 ms at baseline to 26.00 ± 10.52 ms on day 5, suggesting reduced stress levels and enhanced autonomic regulation(table2).

Participants reported reduced stress and neck stiffness after using the pillow, highlighting its potential to alleviate tension and improve overall well-being. These findings underscore the pillow's effectiveness as a natural intervention for managing stress and associated discomfort.

Table 1 Outcome repeated measures at Cervical range of motion (CROM) assessment time points during the baseline, Immediate, Short-term day 1 and effectiveness day 5 after final treatment (Repeated Measures ANOVA) outcome

Outcome	Baseline $\bar{x}$ (SD)	Immediate effectiveness $\bar{x}$ (SD)	Short-term effectiveness day 1 $\bar{x}$ (SD)	Effectiveness after day 5 of treatment $\bar{x}$ (SD)
Cervical range of motion (degree)				
- Cervical flexion	52.50 (4.25)	53.50 (4.12)	56.00 (5.68)	61.00 (3.94)
$F_{(df\ repeat,\ df\ residual)}$		$F_{(1.79,16.14)} = 25.11$		
p-value		<0.001		
Effect size		0.74		
- Cervical extension	46.50(11.56)	48.50(11.32)	55.00 (12.47)	58.00 (17.03)
$F_{(df\ repeat,\ df\ residual)}$		$F_{(1.51,13.58)} = 9.69$		
p-value		0.004		
Effect size		0.52		
- Cervical left lateral flexion	32.50 (7.17)	36.50 (7.09)	39.00 (8.10)	37.00 (9.19)
$F_{(df\ repeat,\ df\ residual)}$		$F_{(1.78,16.07)} = 6.90$		
p-value		0.008		
Effect size		0.43		
- Cervical right lateral flexion	32.50 (7.55)	38.50 (4.12)	38.50 (4.12)	38.50 (7.47)
$F_{(df\ repeat,\ df\ residual)}$		$F_{(1.99,17.91)} = 5.65$		
p-value		0.013		
Effect size		0.386		

Note. Greenhouse-Geisser Correction, $P < 0.05$ is statistically significant differences as compare between before and after the treatment from baselin

Table 2 Outcome repeated measures at heart rate variability (HRV) assessment time points during the baseline, Immediate, Short-term day 1 and Effectiveness day 5 after final treatment (Repeated Measures ANOVA) outcome

Outcome	Treatment group $\bar{x}$ (SD)	Greenhouse-Geisser Correction		
		$^{F}(df_{repeat,}\, df_{residual})$	p-value	Effect size
Bas_SDNN	20.66 (10.48)	$F_{(1.89,17.03)} = 1.997$	0.168	0.182
Post_ SDNN _immed	21.99 (9.74)			
Post_ SDNN _day1	24.69 (12.32)			
Post_ SDNN _day5	26.00 (10.52)			

Note. Greenhouse-Geisser Correction, $P < 0.05$ is statistically significant differences as compare between before and after the treatment from baseline

Participants reported reduced stress and neck stiffness after using the pillow, highlighting its potential to alleviate tension and improve overall well-being. These findings underscore the pillow's effectiveness as a natural intervention for managing stress and associated discomfort.

5. Discussion and Conclusion

The coconut shell stress relief pillow demonstrated significant benefits in reducing pain, attributed to its physiological effects. Massage applied pressure to the skin and muscles, enhancing blood and lymph circulation. This improved circulation likely stimulated the parasympathetic nervous system, promoting vasomotor relaxation and the removal of waste products from congested tissues. Consequently, this mechanism may help reduce inflammation, edema, and pain. Increased heart rate variability (HRV) observed immediately after treatment further supports the activation of parasympathetic activity, consistent with findings by Boonjang and Fakkham (2019). Specifically, the SDNN value increased from 20.66 ± 10.48 ms at baseline to 26.00 ± 10.52 ms on Day 5, though not statistically significant (P = 0.168).

The observed improvements in cervical range of motion (CROM) across all directions suggest a relaxation effect, likely due to muscle stretching, reduced fascial tightness, and enhanced flexibility. For cervical flexion, the mean increased from 52.50° ± 4.25° at baseline to 61.00° ± 3.94° on Day 5 (P < 0.001, effect size = 0.74). Similarly, cervical extension improved from 46.50° ± 11.56° to 58.00° ± 17.03° (P = 0.004, effect size = 0.52). Left lateral flexion increased from 32.50° ± 7.17° to 37.00° ± 9.19° (P = 0.008, effect size = 0.43), while right lateral flexion increased from 32.50° ± 7.55° to 38.50° ± 7.47° (P = 0.013, effect size = 0.386). These findings indicate significant improvements in flexibility and reduced muscle stiffness.

Heart rate variability (HRV) metrics, including SDNN and RMS-SD, highlight improved parasympathetic nervous system function, reflecting reduced stress levels. For instance, RMS-SD values increased, suggesting enhanced autonomic regulation. These improvements align with participants' reports of reduced stress and tension following treatment.

The stress relief pillow also demonstrated significant effects on pain perception, increasing the pressure pain threshold (PPT) from 2.3 ± 0.6 kg/cm² at baseline to 3.1 ± 0.5

kg/cm² on Day 5 ($P < 0.05$). Additionally, soft tissue hardness decreased from 45.2 ± 6.7 units at baseline to 39.5 ± 5.9 units ($P < 0.05$), indicating reduced muscle tension and enhanced tissue elasticity.

In summary, the coconut shell stress relief pillow significantly improved CROM, PPT, and soft tissue hardness, while showing positive trends in HRV metrics. These findings suggest that the pillow is an effective, natural intervention for managing stress and pain, particularly in patients with cervicogenic headaches. Future research, including randomized controlled trials, is recommended to validate these results and explore its broader applications.

Acknowledgment

The researchers extend their gratitude to all participants for their valuable contributions. Appreciation is also given to the Subdistrict Health Promotion Hospital, Samut Songkhram Province, Thailand, for their support and cooperation. This study was funded by the Language Institution, the Research Institution of Suan Sunandha Rajabhat University, and the National Science, Research, and Innovation Fund (NSRF) of Thailand.

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