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The Immediate Effectiveness Assessment of Natural Innovation Product "Khao Yai Pomelo Spray" on Heart Rate Variability to Relaxation and Reduces Stress

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Abstract

Khao Yai Pomelo Spray is an innovative product developed from the Khao Yai variety pomelo, a Geographical Indication (GI) crop of Samut Songkhram Province, Thailand. Discarded pomelo peels are repurposed through steam distillation to extract essential oils. The resulting air spray is ideal for bedrooms, musty areas, and wardrobes, with a unique scent that promotes relaxation and reduces stress. This study was the Experimental Research at the Department of Health Promoting Hospital, Samut Songkhram Province, Thailand. After development of natural innovation product "Khao Yai Pomelo Spray" it was tested for effectiveness using a before-after treatment design. Research Objective to determine the Immediate Effectiveness assessment of natural innovation product "Khao Yai Pomelo Spray" on Heart Rate Variability to relaxation and reduces stress. The sample group consisted of 20 patients volunteers who target group were age more than aged 18-60, divided into two groups (n=10 per group): Experimental group and Control group. The results show a statistically significant increase in the SDNN Heart Rate Variability (HRV) were significantly ($p<0.05$) different in the comparison study before and after the result of heart rate variability Experimental group: SDNN significantly increased from 49.2 (SD=18.4) to 60.7 (SD=20.0); $t = -4.135$, $p = 0.003$ Control group: SDNN significantly decreased from 78.6 (SD=37.8) to 41.3 (SD=7.2); $t = 3.573$, $p = 0.006$ Between-group comparison showed a significant difference in stress-related HRV outcomes; $t = 2.875$, $p = 0.010$. Summary, Khao Yai Pomelo Spray act as health innovation product to stress reduction and therapy.

Keywords: Immediate, Effectiveness, Khao Yai Pomelo Spray, Heart Rate Variability, Relaxation

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1. Introduction

Stress is a physiological and psychological response to stimuli or situations perceived by an individual as threatening or exceeding their ability to cope, leading to imbalances in physiological, psychological, and emotional domains. If stress is not managed appropriately, it may result in health problems, both physical and mental. Stress often arises from family relationship issues, work responsibilities, bullying, and exposure to violence (Department of Mental Health, 2019). If accumulated without proper intervention, stress can lead to depression, psychiatric disorders, or long-term adverse effects on both body and mind (Cooper, 2023).

Additionally, the Gallup global emotion survey reported that populations in 122 countries experienced an increase in stress from 40% in 2020 to 41% in 2021 (Ray, 2022). Therefore, stress reduction is considered a key approach to managing its causal factors.

In Thailand, the world happiness report indicated a decline in Thai happiness rankings from 46th in 2017 to 49th in 2025 (World Happiness, 2018; World Happiness, 2025). Moreover, the self-assessed mental health survey conducted by the Department of Mental Health between January 1, 2020, and September 20, 2025, found that 7.7% of respondents reported high levels of stress (Mental Health Check-in, 2025).

Methods for alleviating stress in traditional Thai medicine and complementary medicine are diverse, with aromatherapy being particularly popular. Natural essential oil scents can stimulate the brain to release endorphins, which reduce pain, relieve stress, and decrease anxiety. Serotonin release promotes calmness, serenity, and relaxation under stressful conditions. These effects are observed in essential oils derived from lavender, rosemary, jasmine, citrus peel, garlic, and anise, among others (Suwanna Rattanasathien, 2021; Sedthapong Laojun, 2020).

Samut Songkhram White Pomelo is an economically important fruit in Samut Songkhram Province, Thailand, registered as a Geographical Indication (GI), reflecting the quality and uniqueness of the region (Department of Intellectual Property, 2020). Generally, the peel is discarded as agricultural waste, which, if unmanaged, may create environmental problems. Utilizing pomelo peel can therefore add value while reducing agricultural waste sustainably.

This study investigates the efficacy of the natural innovation product, "Samut Songkhram White Pomelo Spray", on heart rate variability (HRV) as an indicator of relaxation and stress reduction. The innovation integrates local wisdom with modern technology through steam distillation to extract essential oils from pomelo peel, combined with jasmine flower scent to enhance its fragrance. Furthermore, the development of this product adds value to agricultural by-products, generates income for the community, and supports sustainable local circular economy development (Department of Agricultural Extension, 2023; Department of Intellectual Property, 2020).

2. Research Objective

To determine the immediate effectiveness assessment of natural innovation product "Khao Yai Pomelo Spray" on heart rate variability to relaxation and reduces stress.

3. Materials and Methods

3.1 Design

This study was the experimental research at the department of health promoting hospital, Samut Songkhram Province, Thailand. After development of natural innovation product "Khao Yai Pomelo Spray" 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 (COA.1-111/2022).

3.2 Participants

The sample group consisted of 20 patients volunteers who target group

were age more than aged 18–60, divided into two groups (n=10 per group): Experimental group and control group. All of them were screened by using the self-stress assessment (SSA) which had been developed by department of mental health (DMH), Thailand. Then they were treated by getting Khao Yai Pomelo Spray on heart rate variability to relaxation and reduces stress.

3.3 Intervention

The effectiveness of Khao Yai Pomelo Spray in stress relief was evaluated among 20 participants aged 18–60, divided into two groups (n=10 per group):

- Experimental group: Received the pomelo air spray.
- Control group: Received standard stress management guidance.

The experimental group inhaled the air spray in a 25°C room for 10 minutes, twice a week for 4 weeks.

3.4 Measurement Instruments

The measurement instruments included self-stress assessment (SSA), and subjective stress, measured using heart rhythm scanner PE (Biocom Technologies, USA) for measurement the heart rate variability (HRV).

3.5 Statistical Analysis

Descriptive statistic was used to analyze the characteristic of the volunteers focusing on mean and standard deviation. Additionally, the paired t-test was used to analyze the variables to compared the means before and after. An analysis of Independent t-test of the Experimental group and Control group with 0.95 level of significance ($p<0.05$).

4. Results

The effectiveness of Khao Yai Pomelo Air Spray in stress relief was evaluated among 2 0 participants aged 18–60, divided into two groups (n=10 per group):

- Experimental group: Received the pomelo air spray.

- Control group: Received standard stress management guidance.

The experimental group inhaled the air spray in a 25°C room for 10 minutes, twice a week for 4 weeks. Stress was assessed using: heart rate variability (HRV), specifically SDNN (Standard Deviation of Normal-to-Normal Intervals).

Details of characteristic data shows that the experimental group and the comparison group had some personal data variables that were significantly different. These include an average age of 67.8 years and 52.1 years (p=0.047), with a majority being female (p=0.001), having a bachelor's degree or equivalent (p=0.037), being students (p=0.037), and being single (p=0.047). However, some variables showed no significant differences between the groups prior to the experiment, such as the average age of 24.2 years and 19.6 years (p=0.055), and the average height of 161.9 cm and 160.6 cm (p=0.346). Both groups of volunteers were single and had no chronic illnesses.

The results show a statistically significant increase in the SDNN Heart Rate Variability (HRV) were presented in Table 1. There were significantly ($p<0.05$) different in the comparison study before and after the result of heart rate variability:

- Experimental group: SDNN significantly increased from 49.2 (SD=18.4) to 60.7 (SD=20.0); $t = -4.135$, $p = 0.003$
- Control group: SDNN significantly decreased from 78.6 (SD=37.8) to 41.3 (SD=7.2); $t = 3.573$, $p = 0.006$
- Between-group comparison showed a significant difference in stress-related HRV outcomes; $t = 2.875$, $p = 0.010$

Additionally, the SDNN were significantly ($p<0.05$) different in the comparison study before and after the result of heart rate variability. It appears that the participants experienced less stress after using the innovative Khao Yai pomelo spray.

These results suggest that the Khao Yai Pomelo Spray may help improve heart rate variability and reduce stress more effectively than standard care. The innovative Khao Yai Pomelo Spray, it may be assumed, can help to relaxation and reduces stress. Besides that, it improves the function of the parasympathetic nervous system, reducing tension and stress in those who are stressed. This was consistent with the study of Posri, T. (Posri, T., 2020).

Table 1. showed the comparison of the within-group and between-groups means for the at heart rate variability (HRV) assessment of the experimental group and control group through time-domain analysis of SDNN increased significantly ($p < 0.05$)

Outcome	Experimental group (n=10)		$\bar{d}$	Control group (n=10)		$\bar{d}$	Results comparison of the between-groups [2]
	Baseline $\bar{x}$ (SD)	Immediate effectiveness $\bar{x}$ (SD)		Baseline $\bar{x}$ (SD)	Immediate effectiveness $\bar{x}$ (SD)		
heart rate variability-HRV SDNN $\bar{x}$(SD)	49.2(18.4)	60.7(20.0)	-11.5	78.6(37.8)	41.3(7.2)	37.3	t=2.875, p=0.010
Results comparison of the within-group [1]	t= -4.135, p=0.003			t=3.573, p=0.006			

Note.: [1]Paired Simple t- test; [2]Independent t-test; $\bar{d}$ is statistically significant differences as compare between before and after the treatment from baseline

5. Conclusion

The study evaluated the immediate effectiveness assessment of natural innovation product "Khao Yai Pomelo Spray" on Heart Rate Variability to relaxation and reduces stress. The research was a Experimental Research conducted on patients with stress. It was found that after Khao Yai Pomelo Spray therapy was administered the SDNN values went up significantly ($p<0.05$). Moreover, the results revealed significantly better improvements in the SDNN values for the treatment group ($p<0.05$).

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