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Original Research Article

Acute Effect of Aromatherapy on Heart Rate Variability in First Year Medical Students

DeepaNair[1], Jaishree Tapadia[2]

[1]Associate Professor, Department of Physiology, Sri Aurobindo Medical College and Post Graduate Institute, Bhawrasla, Indore, Madhya Pradesh (India)

[2]Professor and Head of Department, Department of Physiology, Sri Aurobindo Medical College and Post Graduate Institute, Bhawrasla, Indore, Madhya Pradesh (India)

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Corresponding Author: Dr. Deepa R. Nair

Conflict of interest: Nil

Abstract:

Background: The first year undergraduate students have to adapt to the new environment and challenges. Many studies are available which show the effect of aromatherapy in stress reduction in different population but very few studies document the effect of aromatherapy on medical students. Hence the objective of this study is to assess the effect of aromatherapy on heart rate variability which is a non-invasive technique that allows for a reliable and accurate measure of sympathetic and parasympathetic functions and thus its effect on physical stress reduction.

Methods: The study was done on 50 first year medical students who were exposed to physical stress in the form of treadmill exercise following which their post-test heart rate variability was measured. Each student had to attend two sessions. In the first session, no aromatherapy was given which served as a control and in the second session, during the post test period, inhalational aromatherapy was administered. Statistical analysis involved paired t-test between the control session and aromatherapy session.

Results: This study showed that there is decrease in the mean heart rate, increase in RR interval, decrease in VLF power and increase in HF power though not significant, but the findings suggest that there may be factors which could have affected the result such as duration and number of sessions of aromatherapy.

Conclusion: The acute effect of aromatherapy in reducing physical stress was not very significant**.** In future more number of sessions and increased duration of aromatherapy might be useful. Given the absence of significant results and considering the variability in individual responses as indicated by the data, further research is warranted. Future studies might explore different types of aromatherapy, longer or more frequent exposure, or diverse population groups. This research contributes to the existing body of knowledge by highlighting the conditions under which aromatherapy may or may not influence physiological parameters like HRV.

Keywords: Heart Rate Variability (HRV), Treadmill exercise, Physical stress, Aromatherapy, Medical students.

Introduction

Aromatherapy has long been valued for its calming and restorative effects, making it an intriguing method for handling stress. By measuring Heart Rate Variability (HRV), a reliable indicator of how well the autonomic nervous system is functioning, we aim to investigate whether aromatherapy can positively influence HRV by boosting parasympathetic (relaxation) responses. Studies have shown that aroma inhalation of lavender, chamomile, and ylang-ylang induces a state of mind conducive to sleep. Short-term inhalation of lavender oil has been used as a sleep aid [1]. Our hypothesis suggests that the strategic use of essential oils might improve HRV scores, thereby helping to alleviate the physiological impacts of stress. This research is particularly important as it explores a natural, accessible approach to managing stress, which could significantly benefit the well-being of medical students.

Materials and Method

Study design and Procedure: This study was conducted in the research laboratory of Physiology department at Sri Aurobindo Medical College and Post graduate Institute, Indore, Madhya Pradesh on 50 first year undergraduate and comprised of two aspects: a control treatment (no essential oil) and an experimental treatment using essential oil (i.e., lavender). All research procedures were approved by the Institutional ethics committee. Inclusion of the participants were on a voluntary basis after being given full explanation regarding the purpose and the inclusion/exclusion criteria. Informed written consent was taken from all the participants

prior to the current study. Inclusion criteria were from First year medical students with normal baseline ECG willing to participate in the study. Exclusion criteria included subjects with a history of clinical diagnoses of respiratory disorders, any history of hypertension and heart disease, abnormal baseline ECG, history of asthma, participants with a clinical diagnosis of mental illness. All participants were first asked to rest on a clinical bed for 15 min, followed by baseline ECG and an assessment of their baseline Autonomic nervous system performance with an HRV analyser in a supine and relaxed position with the eyes open. The participants were asked to walk on the treadmill (zero-degree inclination) with a structured increase in walking speed until reaching and holding required as well as a heartbeat rate over 100/min for 10 seconds. The participants were allowed to rest for 15 min in the same position as they did during their baseline assessment. During this resting period, the participants in the control session did not receive any intervention, whereas those attending the essential oil treatment sessions received aromatherapy. Subsequently, the HRV analyser was used to obtain the post-test (lying supine, eye open, and no activity) measurements. All activities were conducted in the same quiet, ambient temperature and humidity room (temperature, 24˚C–26˚C; humidity, 50%–65%).

Aromatherapy Intervention: After being diluted 1:75 with distilled water, the mist of the essential oil was dispensed through an ultrasonic aromatherapy diffuser which was placed approximately 50 cm away from the participants. The essential oil treatment comprised of 2.5% lavender (Botanical name: *Lavendulaangustifolia*) inhalation during a 15 min break after the treadmill exercise. The participants who attended the control session received no intervention during the break after the physical exercise. The activity of ANS was assessed using the HRV analyser (Recorders & Medicare Systems (P) Ltd, India) before exercise (baseline measurement) and during the break (post-test measurement).

HRV Analysis: Five HRV parameters were collected as follows: (1) Mean heart rate: Average heart beat (beats per minute, BPM); [2] RR interval: It is the time between two successive R waves of the QRS complexes and is indicative of the ability of the cardiovascular system to adjust with the environmental changes [11,12]; [3] Low frequency band (LF): It signifies the result of a mixed modulation of sympathetic and parasympathetic activities. [4] High frequency band (HF): It reflects the parasympathetic nervous activity. [5] LF/ HF: The ratio of LF/HF denotes the sympathetic nervous activity relative to that of the parasympathetic nervous system. A ratio of "1" implies similar activities between the sympathetic and parasympathetic nerves, whereas the activation of the sympathetic system is higher than that of the parasympathetic system if the ratio exceeds 1.

Statistical Analysis: Descriptive statistics was used to analyse the demographic variables, including age, height and weight. Additionally, the paired t-test was used to analyse the variables to compare the means before and after of the treatment with 0.95 level of significance ($P<0.05$).

Results

For analysing the data, acquisition was done by computed software in RMS polyrite (Recorders & Medicare Systems (P) Ltd, India). Each data file was filtered to remove low-frequency composite oscillating waves. Since the QRS waves were high frequency waves, this filter made the QRS peaks in the electrocardiograph stand out more and facilitated selection in later parts of the program. The program then found the peaks of each graph, and other outliers caused by irregularities were eliminated using a threshold.

The mean age of the subjects was 18.60 ± 0.84 years and various subject characteristics are given in the Table-1 below.

Table 1 Subject Characteristics (n=50)

Parameters	Mean ± SD
Age (years)	18.60 ± 0.84
Height (cm)	167. 28 ± 1.25
Weight (kg)	61.82 ± 14.30

Table 2: Effect of Aromatherapy on HRV parameters

No.	Domain	Control	With aromatherapy	Paired t-test
1.	**Heart rate**	86.43 ± 11.73	83.60 ± 11.50	0.41
2.	**RR interval**	0.70 ± 0.09	0.73 ± 0.10	0.40
3.	**VLFPOWER %**	57.05 ± 16.09	47.50 ± 18.09	0.06
4.	**VLF POWER (ms^2)**	400.52 ± 182.10	337.52 ± 183.12	0.24
5.	**LF POWER (ms^2)**	183.26 ± 59.17	187 ± 63.66	0.83
6.	**HF POWER %**	20.96 ± 13.62	23.01 ± 11.99	0.58
7.	**HF POWER (ms^2)**	133.08 ± 61.12	146.69 ± 63.85	0.46
8.	**LF/HF POWER %**	1.75 ± 2.42	1.56 ± 0.89	0.72

From the table 2.it is found that there is reduction in mean heart rate though not significant. There is increase in RR interval which is again not significant. VLF power % and VLF power (ms^2) have reduced on aromatherapy whereas HF power % and HF power (ms^2) have increased. The LF/HF power % ratio has reduced though not significantly.

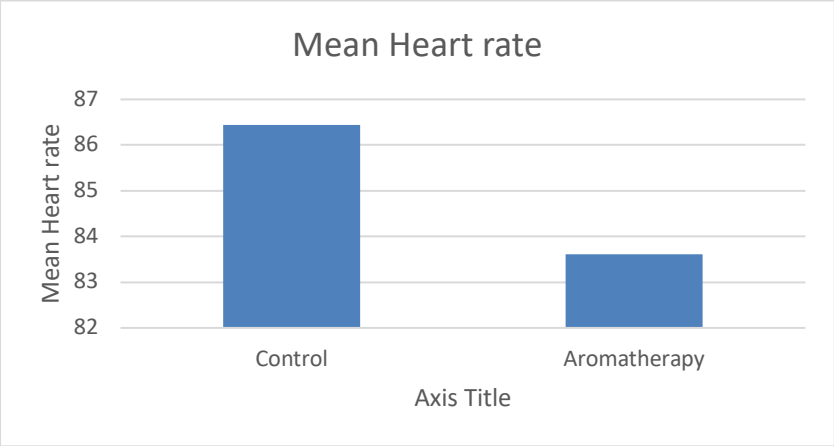

Figure 1: Effect of Aromatherapy on Mean Heart rate

From figure 1, we can see there is decrease in the mean heart rate.

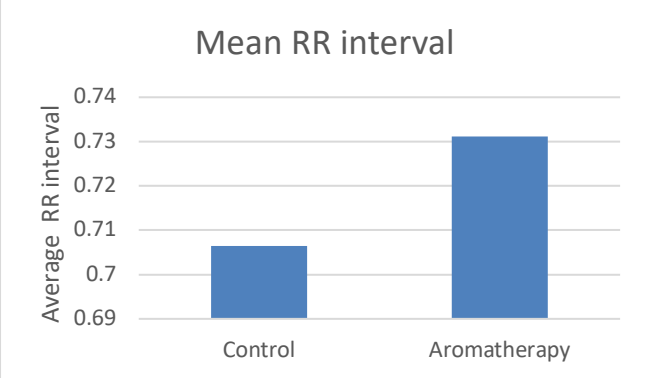

Figure 2: Effect of Aromatherapy on Mean RR interval

From fig.2, it is observed that the mean RR interval following aromatherapy has increased though not significantly.

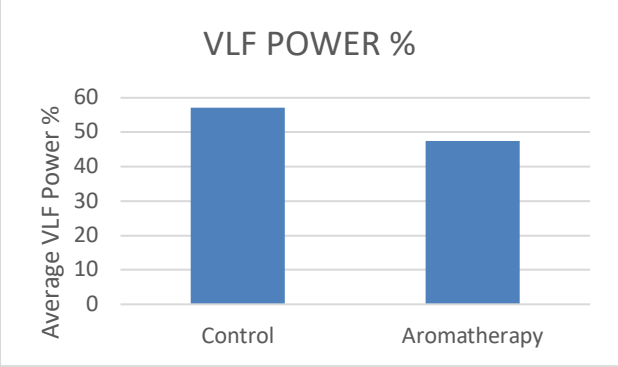

Figure 3: Effect of Aromatherapy on Mean VLF Power %

The above figure 3. shows that the mean VLF Power % has reduced on aromatherapy.

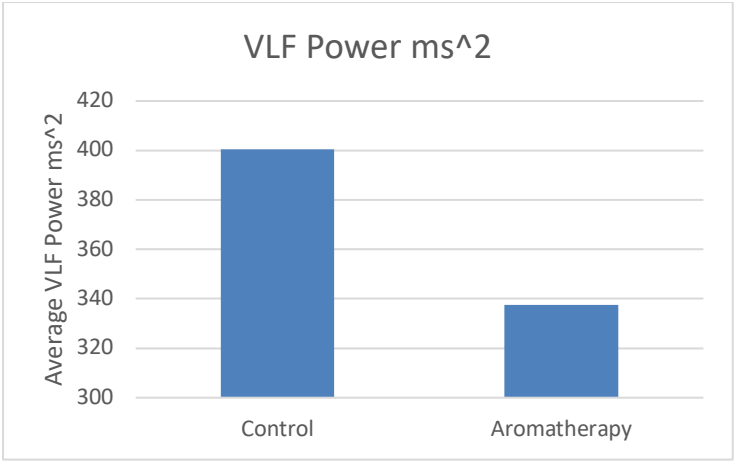

Figure 4: Effect of Aromatherapy on Mean VLF Power ms^2

The above figure 4. shows that the mean VLF Power(ms^2) has reduced on aromatherapy.

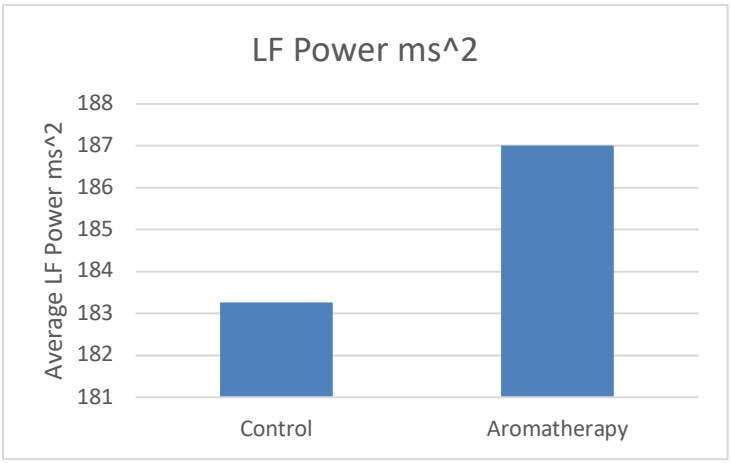

Figure 5: Effect of Aromatherapy on Mean LF Power (ms^2)

From the above fig. 5 its observed that there is increase in LF Power (ms^2).

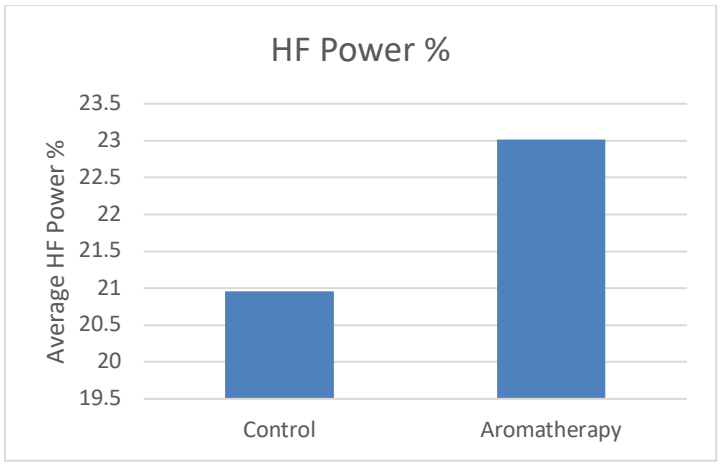

Figure 6: Effect of Aromatherapy on Mean HF Power %

From the above fig. 6 its observed that there is increase in HF Power%.

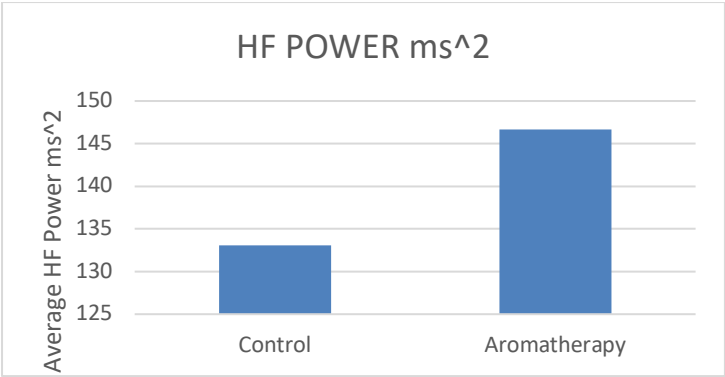

Figure 7: Effect of Aromatherapy on Mean HF Power (ms^2)

The above fig7.indicates increase in HF Power (ms^2) following aromatherapy.

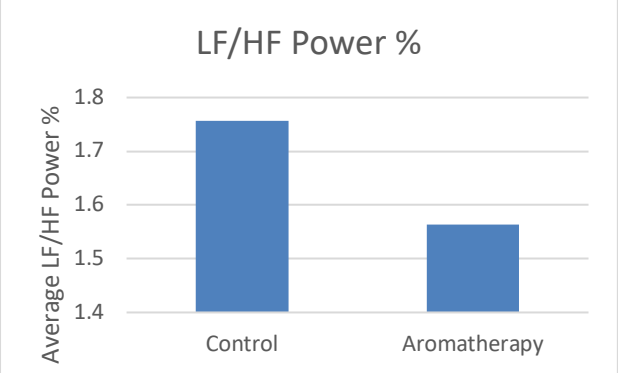

Figure 8: Effect of Aromatherapy on Mean LF/HF Power %.

From the above fig.8 its observed that there is decrease in Mean LF/HF Power %.

Heart rate, RR interval, VLF POWER %, VLF POWER (ms^2), LF POWER (ms^2), HF POWER %, HF POWER (ms^2), and LF/HF POWER % all showed no statistically significant difference (all p-values > 0.05). This suggests that the inhalational aromatherapy did not produce statistically significant changes in HRV parameters under the conditions tested.

Discussion

The absence of statistically significant effects of aromatherapy on HRV parameters could be interpreted in several ways:

Sensitivity of HRV to Aromatherapy: It's possible that HRV, particularly in a relatively young and healthy population, is not significantly influenced by short-term inhalational aromatherapy. HRV is a complex measure influenced by various autonomic and non-autonomic factors, which might not be substantially modulated by the types of aromas used or the duration/method of exposure in your study.

Sample Size and Power: Although 50 participants is a decent sample for a pilot study, this size might still be underpowered to detect small to moderate effects of aromatherapy on HRV. A power analysis could provide insights into whether a larger sample might be able to detect significant differences, should they exist.

Variability in Responses: The wide standard deviations observed in many of the HRV measures suggest considerable variability in responses among individuals. This variability could mask potential effects of aromatherapy. Exploring individual differences or subgroup analyses might reveal more about the responsiveness to aromatherapy.

Damapong*et al*. assumed that using lavender essential oil could reduce stress, then using aromatherapy by inhaling lavender essential oil should be a choice to reduce stress in the elderly people [5]. In another study, Yu-Hao Lee *et al.* demonstrated that aromatherapy could reduce sympathetic activities, i.e., decrease in blood pressure, heart rate, and low frequency component of HRV. Research also showed that aromatherapy can excite parasympathetic activities, i.e., increases in high frequency component of HRV [3]. Lee *et al.* showed that the floral-water eye-mask aromatherapy provides an opportunity for use in integrative care by regulating the autonomic nervous system and reducing stress [6]. In his another study, Lee showed that postoperative

aromatherapy received by cholecystectomy patients was effective in reducing stress and pain and improving sleep quality [7]. Geethanjalia*et al.* showed that inhalation of clary oil aromatherapy act as a potential therapeutic modality to improve the autonomic function towards vagal tone domination [8-14].

Conclusion

In conclusion, the study aimed to investigate the acute effects of aromatherapy on heart rate variability (HRV) among first-year medical students following physical stress induced by treadmill exercise. Despite the well-controlled design using a paired t-test to analyse pre- and post-intervention differences within subjects, the results did not demonstrate a statistically significant effect of aromatherapy on the HRV parameters.

The findings suggest that under the conditions tested, inhalational aromatherapy does not significantly alter HRV indices in young, healthy individuals. This may reflect the robustness of autonomic function among young adults or indicate that the duration, type, or method of aromatherapy applied was insufficient to elicit a measurable change in autonomic regulation as captured by HRV.

Given the absence of significant results and considering the variability in individual responses as indicated by the data, further research is warranted. Future studies might explore different types of aromatherapy, longer or more frequent exposure, or diverse population groups.

This research contributes to the existing body of knowledge by highlighting the conditions under which aromatherapy may or may not influence physiological parameters like HRV. It sets the stage for more detailed investigations that could help delineate the potential therapeutic benefits of aromatherapy in stress management and cardiovascular health.

References:

1. D. Wheatley, “Medicinal plants for insomnia: a review of their pharmacology, efficacy and tolerability,” Journal of Psychopharmacology, 2005; 19(4): 414–421.
2. C. Pittenger and R. S. Duman, "Stress, depression, and neuroplasticity: A convergence of mechanisms," Neuropsychopharmacology, Jan 2008; 33: 88-109.
3. Fred Shaffer and J. P. Ginsberg “An Overview of Heart Rate variability Metrics and Norms Review” published: 28 September 2017 Frontiers of Public health.
4. Yu-Hao Lee, Vincent Shieh, Chih-Lung Lin and Yung-Jong Shiah “A Stress Evaluation and Personal Relaxation System Based on Measurement of Photoplethysmography” 2013 Second International Conference on Robot, Vision and Signal Processing
5. Jong-Seong Park “Effects of Juniper Essential Oil on the Activity of Autonomic Nervous System” Biomedical Science Letters 2017, 23(3): 286~289 eISSN: 2288-7415
6. Pongmada Damapong, Peerada Damapong and Kanyamanee Koomhangsung College of Allied Health Science Suan Sunandha Rajabhat University, Bangkok, Thailand “Immediate Effectiveness of The Lavender Essential Oil to Reduce Stress In The Elderly” The 2019 International Academic Multidisciplines Research Conference in Tokyo 603.
7. Lee Ya-Ting. “A Study of The Effect of Lavender Floral-Water Eye-Mask Aromatherapy on The Autonomous Nervous system”. European Journal of Integrative Medicine http://dx.doi.org/10.1016/j.eujim.2016.05.008
8. Ya-Ting Lee, JiA Lee, Myung-HaengHur “The Effects of Aroma Essential Oil Inhalation on Stress, Pain, and Sleep Quality in Laparoscopic Cholecystectomy Patients: A Randomized Controlled Trial, Asian Nursing Research 16 (2022) 1-8
9. S. Geethanjalia, V. Venugopalb, S. Poonguzhalic, K. Maheshkumard “Effect of clary sage oil as an aromatherapy on cardiac autonomic function among patients with premenstrual syndrome – A randomized controlled study” Obesity Medicine. 2020;18: 100193.
10. Lin P-H, Lin Y-P, Chen K-L, Yang S-Y, Shih Y-H, Wang P-Y “Effect of aromatherapy on autonomic nervous system regulation with treadmill exercise-induced stress among adolescents”. PLoS ONE 16(4): e0249795.
11. Wang H-M, Huang S-C. “SDNN/RMSSD as a surrogate for LF/HF: a revised investigation”. Modelling and Simulation in Engineering. 2012; 2012:16
12. Javorka M, Trunkvalterova Z, Tonhajzerova I, Javorkova J, Javorka K, Baumert M. Short-term heart rate complexity is reduced in patients with type 1 diabetes mellitus. Clin-Neurophysiol. 2008; 119 (5):1071–81.
13. Joo HM, Lee SJ, Chung YG, Shin IY. Effects of mindfulness based stress reduction program on depression, anxiety and stress in patients with aneurysmal subarachnoid hemorrhage. J Korean Neurosurg Soc. 2010; 47(5):345.