DOI Number: 10.5958/2320-608X.2020.00004.9

Effect of Peppermint Aroma on Short Term Memory and Cognition in Healthy Volunteers

B. Deivanayagame[1], A. V. Siva Kumar[2], K. N. Maruthy[3], SK. Kareem[2]

[1]Assistant Professor, Dept. of Physiology, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry,
[2]Faculty/Ph.D Research scholar, Department of Physiology, Narayana Medical College, Nellore,
[3]Professor& HOD, Department of Physiology, Narayana Medical College, Nellore

Abstract

Introduction: Aroma therapy is one of the method used to improve alertness, memory and mood enhancements. The previous study conducted on patients suffering from dementia has shown positive effect sleep and improvement in behavior. This pilot study was conducted with Peppermint aroma to see the effect on psychomotor skill and cognitive function.

Method: This study was carried out in the department of Physiology,Narayana Medical College, and Nellore.26 young male adults were selected for the study age between 20-30yrs. All the subjects underwent battery of psychomotor and cognitive tests. The tests were conducted in the morning hours of the day between 9 A.M. -11.00A.M.

Results: The preliminary analysis of the data showed marked improvement in the Visual and Auditory reaction time which was statistically significant and the p-values are <0.01 and 0.005 respectively. The CFF frequency and the short term memory test did not show any change in the results and also found to be not significant statistically. The counting number test shows remarkable improvement which is significant (P-<0.001) which suggests enhancement in concentration with peppermint aroma exposure.

Conclusion: we found improvement in Auditory and Visual reaction time and Number countdown test which were statistically significant. This suggests peppermint aroma exposure even for a short time such as 5 min improves math function to a great extent.

Key Words: *Peppermint aroma, Cognition, CFFF, ART, VRT, Attention span*

Background

Human senses have significant connection to the increased ability to recall information. Sights, tastes and scents are known to bring back one's memory(1). This is known as the recall process.The sense of smell is important to our well being as it stimulates our memory, feeling of creativity and emotions(2). Putative effects of various aromas on aspects of human behavior can betraced back to ancient Greece, where the extracts of aromatic plants were used for cosmetic, religious, and medical purposes(3). Various plant derived essential oils have traditionally been used in the treatment of mental disorders. Acute exposure to a pleasant fragrance has been shown to facilitate the performance of mathematical tasks and vigilance tasks.Aroma therapy is one of the methods used to improve alertness, memory and mood enhancements(4). The previous study conducted on patients suffering from dementia has shown positive effect on sleep andimprovement in behavior(5). Peppermint is one of the mentha species and it's major components are menthol (29%) and menthone (20-30%) (6). Previous research suggests that peppermint aroma can dramatically influence motivation, task activity and alertness(7-11). The objective of this study was to determine the effect of peppermint aroma on short term

Corresponding Author:
Mr. SK. Kareem,
Faculty & Ph.D Scholar, Department of Physiology, Narayana Medical College, Nellore-524003. Contact: +919885279969, EMAIL: kareem.sb9@gmail.com

memory and cognition in healthy male participants. The measure of influence of peppermint aroma on cognition and short term memory can be evaluated by a battery of tests.

Materials & Method

The study was carried out in the department of Physiology,Narayana Medical College, Nellore. It was a descriptive cross sectional study in which participants were recruited by non-randomized sampling technique. A total of 26 young adult males who are healthy volunteers age between 20-30yrsselected for the study. All the participants were healthy volunteers. They were inquired about past medical history and illness to rule out the current health status. The entire study protocol was verified and approved by Institutional ethics committee. The informed consent was obtained from all the participants as per the declaration of Helsinki 1975.The investigators were explained the entire protocol in detail to each participant. The participants were instructed to abstain from the caffeinated drinks and centrally acting drugs 24 hours prior to the execution of the tests. They also restricted to physical exercise which may influence the recordings of above mentioned test results. All procedures were performed after light breakfast between 9-11 am.The following tests were done before and after exposure to aroma of peppermint oil.

Computer controlled CFFF test: Critical flicker/ fusion frequency (CFF) is the transition point for an intermittent light of increasing temporal frequency, where the flickering ceases and the light is perceived as continuous.CFF stimulus consists of a red light-emitting diode (LED) with a peak wavelength of 625 nm. Before beginning of test, subject was made familiarize to the test. In this test, the subject was asked to look at the flickering red light (LED) and to appreciate the point of fusion of light. Then the frequency at which fusion of flickering light has occurred was noted downwith the help of NETRA CFF Control Device manufactured by MAVOM Labs pvt.ltd(17).

Determination of Visual Reaction Time (VRT) and Auditory Reaction Time (ART):

Reaction time is usually defined as the time required for an individual to detect the presence of a stimulus. It is a physical skill precisely related to human performance. Determination of Auditory Reaction Time (ART), Visual Reaction Time (VRT) can be done using a computerized recording device (PC 1000) wherein the subjects were asked to respond by pressing a button when he sees the red LED glowing/ when he hears a tone respectively. Then the reaction time was recorded in milliseconds with the help of Audacity.

Mathematical task: This is a part of mini mental test where the subjects were asked to subtract 3 from 999/subtracting 3 from 998 downwards up to 900. It is a verbal test, the subject being asked to subtract 3 from 999, to take 3 away from the answer obtained, and so on. The subjects were placed as much at ease as possible and encouragement was freely given, but no assistance. Each subtraction is considered as a unit with and the interpretations were made on the basis of 33 possible correct answers.

Memory recall test: In this test 15 common objects were displayed to the subject for 1 minute. After one minute the subjects were asked to recollect names of objects in next minute. Depending on number of objects recalled the scores will be given.

First round of data was collected in a separate room (before exposure to peppermint aroma). For the effect of aroma subjects were seated for 10 minutes on a chair in front of the table which was smeared with Peppermint oil (0.5ml) and the tests were performed later.Every day only one subject was recruited to avoid the effect of aroma dose overlap, and the table was cleaned every day. The tests were conducted in the morning hours of the day between 9 A.M. -11.00A.M. in a closed room without any other significant odour to interfere in the results.

Statistical analysis: The data sets were analyzed by graph pad prism & data was represented as mean and SD. Normality of data was tested using Kolmogorov-Smirnov test. A p value of > 0.05 indicated normal Gaussian distribution. As the data sets were showed normal distribution, paired "t" test was performed and Pearson correlation was done to find out associations.

Results

Table 1: Showing descriptive statistics of basal reaction times and other parameters

	ART(m.sec)	VRT(m.sec)	CFFF(Hz)	Memory test	NCT
Mean ± SD	230.7±71.57	261.3±64.98	39.35±2.24	10.15±1.95	29.04±10.20
Std.Error	14.04	12.74	0.44	0.38	2
Median	222	255	39	10	29.5
95% CI	201.7-259.6	235-287.5	38.44-40.25	9.36-10.94	24.92-33.16

Table 2: Showing the comparison of different parameters between pre and post aroma exposure

Parameter	Pre aroma exposure	Post aroma exposure	P value
ART	230.7±71.57	196.6±49.29	<0.01*
VRT	261.3±64.98	221.7±70.68	<0.01*
CFFF	39.35±2.24	39.12±2.53	0.456
Memory recall test	10.15±1.95	10.54±2.08	0.2
Mathematical task	29.04±10.20	39.69±14.12	<0.001*

ART – Auditory Reaction Time, **VRT** – Visual Reaction Time, **CFFF** - Critical Flicker Fusion Frequency. * Significant

Discussion

This study was done to determine the effect of exposure to peppermint aroma on in healthy male participants. The study was carried out by comparing the performance of participants before and after the exposure of peppermint aroma. The measures of cognition and attention span were obtained with the help of various cognitive tests and task based tests such as Auditory and Visual reaction time, Critical flicker fusion frequency (CFFF), Problem solving ability and Memory recall test. Similar kind of studies was also done by researchers to identify the effects of peppermint aroma on metal performance, physical ability, alertness and pain threshold. In study conducted by Clive Holmes et.al examined the effect of aroma therapy on memory enhancement in patients with dementia in which they have got significant positive results of peppermint aroma therapy(5). S J Manual et.al done a randomized control trial in 2014 in which they have concluded that peppermint scent enhances the attention of the participants(2). In 2012, Michelle Fox et.al conducted a study to assess the effect of peppermint on memory performance and concluded that peppermint mediate improvements in concentration but consumption of it does not show the effect on memory(12).The current research showed that exposure of participants to the peppermint aroma for limited duration of time enhances their cognition and psychomotor skills. The preliminary analysis of the data showed marked improvement in the Visual and Auditory reaction time which was statistically significant and the p-values are <0.01. The CFF frequency and the short term memory recall test did not show any remarkable change in the results and also found to be not significant statistically. The mathematical test showed notable improvements

which is significant (P value <0.001) which suggests enhancement in concentration with peppermint aroma exposure. Indeed, from the data presented here and evidence from other studies seems conceivable that the exposure to peppermint aroma augments cognition, alertness and concentration. The authors of the current study are planning to execute the influence of peppermint aroma on attention span and cognition by measuring the size and response of the pupil, HRV which relatively indicates the activity of Autonomic nervous system and reticular formation (13, 14, 15). We would also take up the familiarity of peppermint oil for a long time using biofeedback mechanism on psychomotor skills(16).

Limitations: In our study the sample size was limited and it addresses the population of limited geographical area and a separate study needs to describe gender variation in the results. A multicentric study with larger sample size is warranted to understand the effect of peppermint aroma by exploring different domains of cognition and psychomotor skills.

Conclusion

The results of this study support the effectiveness of peppermint essential oil on individual's alertness, problem solving ability and focus.Our study with limited clinical evidence concluded that peppermint aroma exposure can influence the individual's cognitive ability and attention span to some extent. Therefore, it is clear that more well-designed studies are required to establish the effectiveness of peppermint aroma. And similar kind of studies needs to be done in patients to establish the pharmacological efficacy of exposure to peppermint aroma.

Conflict of Interest: On behalf of all authors, the corresponding author states that there is none declared any type of conflict regarding this research work.

Funding: There is no financial support for this work to be carried out and publication.

References

1. Mishkin M, Appenzeller T. The anatomy of memory. Scientific American. 1987 Jun 1;256(6):80-9.
2. Manuel SJ, Syazwan M, Han CW, Fazliyana WN, Awal MB. Peppermint and Lavender Essential Oils : Are They Therapeutic Aromas for Attention and Memory ? 2014;9(1):6–11.
3. Moss M, Hewitt S, Moss L, Wesnes K. MODULATION OF COGNITIVE PERFORMANCE AND MOOD BY AROMAS OF PEPPERMINT AND. 2008;(July 2006):59–77.
4. Gaygen DE, Hedge A. Effect of Acute Exposure to a Complex Fragrance on Lexical Decision Performance. 2009;85–91.
5. Holmes C, Ballard C. Aromatherapy in dementia. 2004;10:296–300.
6. Meamarbashi A, Rajabi A. The effects of peppermint on exercise performance. 2013;1–6.
7. Raudenbush B, Grayhem R, Sears T, Wilson I. Effects of peppermint and cinnamon odor administration on simulated driving alertness, mood and workload. North American Journal of Psychology. 2009 Jul 1;11(2).
8. Herz RS. Aromatherapy facts and fictions: a scientific analysis of olfactory effects on mood, physiology and behavior. International Journal of Neuroscience. 2009 Jan 1;119(2):263-90.
9. McCombs K, Raudenbush B, Bova A, Sappington M. Effects of Peppermint Scent Administration on Cognitive Video Game Performance. North American Journal of Psychology. 2011 Dec 1;13(3).
10. Ilmberger J, Heuberger E, Mahrhofer C, Dessovic H, Kowarik D, Buchbauer G. The influence of essential oils on human attention. I: Alertness. Chemical Senses. 2001 Apr 1;26(3):239-45.
11. Morgan R. The Effects of Peppermint and Orange Aromas on Mood and Task Performance: A Research Study and Process Narration.
12. Fox M, Krueger E, Putterman L, Schroeder R. The Effect of Peppermint on Memory Performance. Journal of Advanced Student Science.. 2012;1:1-7.
13. Kumar AS, Padmavathi R, Maruthy KN, Sowjanya B, KUMAR K. An Innovative Technique to Evaluate Quantitative Pupillary Light Reflex by Dynamic Pupillometry using Infrared Videography. Journal of Clinical & Diagnostic Research. 2019 Apr 1;13(4).
14. Ramadevi P, Maruthy KN, Padmavathi R, Kumar AV, Kareem SK. Evaluation of Static Pupil Size Using Digital Web Camera through Image Analysis. International Journal of Physiology. 2019;7(3):7-11.
15. Pullaganti M, Kumar SA, Maruthy KN, Gurja JP, Chintala KK. Association of stress with heart rate

variability in different phases of the menstrual cycle. National Journal of Physiology, Pharmacy and Pharmacology. 2019;9(3):256-60.

16. Kumar CK, Kumar AS, Madhurima P, Maruthy KN, Preetham GJ. Assessment of psychomotor skills using finger pulse guided biofeedback tool in young medical students. Annals of Medical Physiology. 2018 Dec 31;2(4):36-9.
17. Kumar CK, Maruthy KN, Sasikala P, Gurja JP, Kumar AV, Kareem SK. Impact of chronic alcoholism on temporal cognition and coordination of motor activity. International Journal of Physiology. 2018;6(4):124-7.