Peppermint and Lavender Essential Oils: Are They Therapeutic Aromas for Attention and Memory?

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Citation

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Abstract

Introduction –Previous study showed that aroma has direct and indirect psychological effects and the sense of smell stimulates our memory, feeling of creativity as well as emotions. Peppermint enhances memory and increases alertness in terms of mood while lavender has calming and sedating properties which decreases memory and attention based tasks. The aim of our study is to determine the effect of peppermint and lavender scents on the memory and attention of participants.

Methods – A randomized control trial was conducted and a total of 45 undergraduate students participated. Participants were stratified into male and female and then they were randomly assigned to three groups. The two intervention groups were exposed to either peppermint or lavender scent while the control group was not exposed to any scent. The first part of assessment was on the familiarity of 20 brands. The second part assessed the memory of participants to recollect all 20 brands. The third part assessed the attention of participants to identify the odd symbol from the grid picture. The data were analysed using Chi square, Fisher's exact test, Independent sample T test ans ANOVA.

Results – In the attention test, the findings were significant (P<0.013) with mean score of peppermint group being 11.7, lavender group being 8.3 and control group being 8.9. Based on Bonferroni test in ANOVA, there is significant difference of attention score between peppermint and lavender groups (P < 0.018). However, the memory test was not significant with peppermint group scoring a mean of 8.0, lavender group being 7.6 and control group being 7.9

In conclusion, peppermint scent enhances the attention of the participants and lavender reduces the concentration and working memory of the participants.

INTRODUCTION

Human senses have significant connection to the increased ability to recall information. Sights, tastes and scents are known to bring back one's past memory. [1] This is known as the recall process. It is quite selective, and does not represent the original image, but reconstructed. [2] At times, the recalling process occurs unexpectedly and presents with an 'uncalled-for' memory because of the trigger of a stimuli (scent), often as a result of its association. [2] According to Green in 1993, the sense of smell is important to our well being as it stimulates our memory, feeling of creativity and emotions. [3] The effects of aroma can include both direct and indirect psychological effect – even thinking about the smell have a similar effect to the actual smelling of the aroma.[4] Lavender has strong effect of stress relieving, relaxing, calming and sedative action while rosemary promotes alertness, analgesic effect as well as useful for fatigue and stress. [5] Studies conducted by Moss et al in 2003 revealed that lavender produced a decrease in the reaction time for memory and attention-based task. However, studies have shown that with regard to mood, the rosemary group was more alert when compared to the lavender group and reason for it being is because lavender's sedating effect. [3, 5, 6] In fact, inhalation of lavender also helps in improving letter counting and mathematical tasks relative to inhalation of jasmine. [7] On the other hand, peppermint stimulates on the senses and is an excellent analgesic (headache). [5] A study done in Japan shows that peppermint helps in maintaining performance precision by directly raising the level of stimulation of subjects. [8]

Ylang-ylang helps in relaxation by providing a harmonizing effect (stress, frustration, tension and insomnia). [5] A study conducted by Moss, Hewitt, Moss and Wesnes in 2008 showed that peppermint enhanced memory and in terms of mood, peppermint increased alertness while ylang-ylang increased calmness. [7, 8]

The objective of this study is to determine the effect of peppermint and lavender scents on the memory and attention of the participants.

METHODOLOGY

This was a randomized controlled trial (RCT) study done on the effect of various scents on attention and memory among the undergraduate medical students from a private medical college in Malaysia on June 2013.

We planned to study the effect of peppermint and lavender on attention and memory therefore two experimental groups (peppermint and lavender) and a control group was required. 15 experimental subjects and 15 control subjects were needed with a power of 80% and level of significance of 0.05.

Students of age ranging between 17 to 26 years old were included and students who had running nose on that day of experiment or with mental disabilities were excluded. A total of 48 volunteers were stratified into male and female and then randomized to three groups of peppermint, lavender and control group.

Data was collected using self-administered questionnaire and written consent was taken from each participants. In addition to basic demographic details, participants were also asked regarding their health status, sleep and knowledge on various aromas, essential oil and candles as well as their usage in their daily living.

Half an hour before the experiment started, we scented the room with either peppermint scent or lavender using the electric diffuser (GreenAireTM Air Revitalisor, rotating at 2300 revolution per minute) or unscented. The electric diffuser was placed at the corner of the room and it was not seen by the participants. Then, we asked the participants to enter the room and they were seated accordingly. They were not allowed to talk and discuss throughout the experiment.

For part 1, we used a brand game whereby participants were shown 20 pictures of brands comprising of 15 familiar and 5 unfamiliar brands. [9] They were given 10 seconds for each slide to identify the familiarity of the brand or logo and then tick them in the answer sheet. After that, we distributed questionnaires to all participants and they were given 5minutes to complete the questionnaires. This was also used as a way to distract the participants for the second part of the experiment.

For part 2, we gave a memory test to all participants in which they were required to recall back all the 20 brands seen in part 1 and write them on the answer sheet given. [9] Each correct answer contributes to one mark. More than one alphabet spelling mistake was considered as wrong answer and the total mark was 20.

For part 3, we gave an attention test consists of 20 pictures. Each picture consists of several grids in which there will be one odd component in those grids. They were shown the odd component for three seconds followed by the grid picture. They had to find the odd component in the respective picture within seven seconds [10]. Each question contributes one mark. Total mark was 20. The diffusing rate and volume of aromatherapy were constant for all groups.

ANOVA test and Bonferroni test were used for analysis of quantitative variables whereas Chi square and Fisher's exact were used to compare the qualitative variables. P value of <0.05 were considered statistically significant. Descriptive statistics such as mean, standard deviation, frequency and percentage were described.

Our study was approved by the ethic and consent committee from Melaka Manipal Medical College. The informed and written consent was taken from the participants through the questionnaire. Their privacy and confidentiality is maintained.

RESULTS

Table 1

Baseline characteristics between three intervention groups

Independent Variables	Peppermint	Lavender	Unscented	P value
Age (years) Mean±SD[#]	21.3±2.0	21.1±2.8	21.4±2.7	0.920
Sleep hours Last Night Mean±SD	5.7±0.9	6.5±1.9	5.7±1.6	0.189
Exercise in a week (hours) Mean±SD	3.7±1.6	3.1±1.3	3.1±1.5	0.444
Gender n(%)[@]				
Female	10 (35.7)	8 (28.6)	10 (35.7)	0.744
Male	8 (30.8)	10 (38.5)	8 (30.8)	
Ethnicity n(%)[@]				
Malay	4 (33.3)	5 (41.7)	3 (25.0)	
Chinese	8 (50.0)	6 (37.5)	2 (12.5)	0.162
Indian	5 (22.7)	7 (31.8)	10 (45.5)	
Others	1 (25.0)	0 (0)	3 (75.0)	
Smoking n(%)				
Yes	1 (100.0)	0 (0)	0 (0)	0.333
No	17 (32.1)	18 (34.0)	18 (34.0)	
Use of Essential oils/candles n(%)				
Yes	2 (28.6)	3 (42.9)	2 (28.6)	0.784
No	16 (34.0)	15 (31.9)	16 (34.0)	

'#' ANOVA; '@' Chi-square test; ' ' Fisher Exact test;

Based on table 1, there are no significant difference of the participants age, duration of sleep previous night before participation, duration of exercises, their ethnicity, smoking

habits and use of essential oils or candles at home between three intervention groups.

Table 2

Independent Variables	Peppermint Mean ±SD (95% CI)	Lavender Mean ±SD (95% CI)	Control Mean ±SD (95% CI)	P value
Memory Score Mean ±SD	8.00 ±1.68 (7.16-8.84)	7.61 ±2.61 (6.31-8.91)	7.94±1.79 (7.05-8.84)	0.831
Attention Score Mean ±SD	11.67± 2.76 (10.29-13.04)	8.33 ±4.71 (5.99-10.68)	8.88±2.58 (7.60-10.18)	0.013*

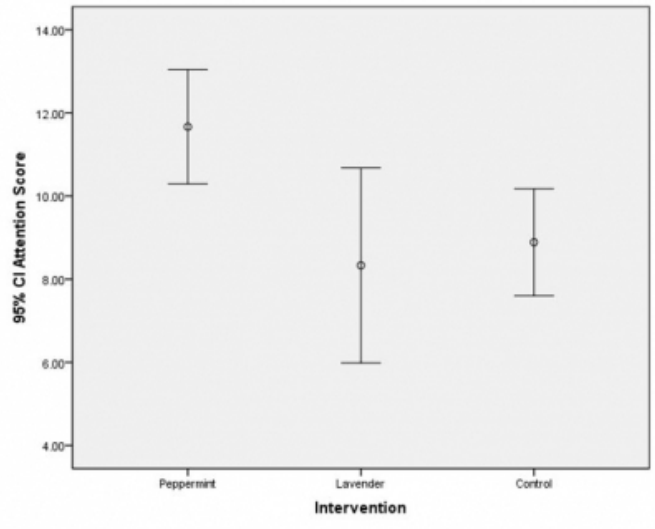
* P value is significant (P<0.05)

Based on table 2, the mean memory score in peppermint group is 8.0, lavender group is 7.6 and in control group is 7.9. The participants in the peppermint group scored the highest, followed by the control group and then the lavender group. However, there is no significant difference of the memory score between the peppermint, lavender and control group.

Regarding attention, the mean score in the peppermint group is 11.7, lavender group 8.3 and unscented group 8.9. There is significant difference of attention score (P value 0.013), and the participants in the peppermint group scored the highest, followed by the control group and then the lavender group.

Figure 1

Attention among three intervention groups



Based on Bonferroni test in ANOVA, there is significant difference of attention score between peppermint and lavender groups (P value 0.018) as the mean score in peppermint group is 11.67 and lavender group is 8.33.

DISCUSSION

The purpose of this study was to determine the effects of peppermint and lavender on memory and attention of the participants. Based on the study conducted, we found that there is significant difference of attention test score when compared with the peppermint, lavender and the control group. It indicates that these scents help in the performance and learning of the participants. Peppermint helps in increasing the attention span of the person. [7] With the exposure to peppermint aroma there is maintenance of performance and its function more directly by raising the level of stimulation in subjects. [11] A study by Brand & Ydstie 2007 further suggested that experimental subjects who were exposed to the scent of peppermint showed increased performance on tasks requiring sustained focus. The element of menthol in peppermint enhances the oxygen utilization by the brain which helps in boosting thinking and alertness. [12] Based on the study done by Victoria Anisman – Reiner's, inhalation of peppermint essential oil stimulates and refreshes the mind and its fragrance awakens the mind as well as enhancing learning capacity.

The study conducted by Sakamoto showed that lavender positively effects the attention ability of the participants because it decreased the arousal of participants during the break period given in order to perform better in the later next task. [8] Fatigue, anxiety and stress tend to accumulate during the break period, hence reduced arousal during the break period maintained the higher working efficiency in the following task. [8] In our study the attention test was performed last and short break the participants had while we collected the answer sheet of the previous task could have reduced their arousal which helped the participants to perform better in the attention test. In fact, participants in our study from the peppermint group scored the highest mean score, followed by the control group and then the lavender group. The reason to it is because of the sedating effect of lavender that has reduced the ability of participants to pay attention. Studies revealed that lavender produced a decrement in performance for attention based tasks. [13] Similarly, study done by Ilmberger et al 2008 also shows the lavender's calming and sedative effect. [14] With exposure to lavender, subject calculation rates initially dropped while performing mathematical equations and that may be interpreted as the relaxing effects of lavender to reduce cognitive function such as attention. [15] Futhermore, the electroencephalogram (EEG) study of normal human brain shows that alpha wave activity disappears with attention and theta waves are normally seen in sleep at any age. [16] Studies show lavender oil increased the power of theta (4-8 Hz) and alpha (8-13 Hz) brain activities. The topographic map showed more scattering power in alpha range waves

particularly in bilateral temporal and central area. [17] Inhalation of lavender for 3 minutes increases alpha power of EEG as it decreases anxiety. The increase in theta (4-8Hz) and alpha (8-13Hz) may cause a range of general relaxation effects and waves significantly increased in all brain regions. This study indicates the EEG evidence of relaxation by lavender aromatherapy. [18]

Lavender has been found to influence activity of cyclic adenosine monophosphate whereby reduction of this cAMP with sedation. [19, 20] The mean score of the lavender group in our study was lower than the control group. Similarly in other study, attention was significantly slower in the lavender condition relative to the unscented group (control). [19] Paradoxically, lavender has also been found to attenuate the deterioration of work performance under conditions of fatigue. [8] On the other hand, Moss et al (2003) in their studies on analysis of performance of computerized cognitive assessment revealed that lavender produced a significant decrement in performance of working memory, and impaired reaction times for both memory and attention based tasks. [11]

Previous study showed that there was a connection between peppermint scent and the increased ability to recall memory. Peppermint was found to be effective in enhancing the tasks related to attention, virtual recognition memory, working memory and visual-motor response. [21] It also showed a marked increase in word recall accuracy enhanced learning and memory recall tasks. [22] However, as shown in other studies, [19] we found that there is no significant difference of memory score between three intervention groups. In the study by M. Moss, all the immediate, working and delayed memory were not significantly affected by the peppermint scent. In contrast, there are studies that showed peppermint enhanced the memory component and in terms of mood increased alertness. [7] Similarly, Raudenbush showed that peppermint has been demonstrated to enhance performance, in which the authors propose that this is due to the change in mood and consequently change in the level of motivation of the participants by the aroma. [23] It is therefore unlikely that the recorded improvement in memory test was due to the changes in mood and motivation. [19] In the study done by M. Morrin, it stated that the presence of a pleasant ambient odour caused subjects to expend additional processing efforts on particular tasks, so as a result, subject in the pleasantly scented condition exhibited superior recall function. [24] Similarly, The null effects of lavender on memory are consistent with Ludvigson and Rottman who found no effect of both lavender and cloves on memory. [25] This is due to damaging effect of lavender on memory. [22]

The limitation that we could acknowledge in this study is the amount of sleep in the previous night may affect the participants' alertness during the experiment. The range of sleep our participants had been from 4.5-12 hours and majority of them had 5-6 hours of sleep. By ensuring participants to have equal hours of sleep during the night before the experiment would maintain the consistency in the alert level during the experiment. [26] Insufficient sleep leads to general slowing of the response level as well as increase in the variability of the performance. [27] Other limitation to consider is the limited number of test we used to access the memory performance. Further research on how the odor intensity affects the awareness on attention and memory of the participants could have been conducted.

CONCLUSION

Aroma has direct and indirect psychological effects and the sense of smell stimulates our memory, feeling of creativity as well as emotions. Peppermint helps in increasing the attention span but memory was not significantly affected. As lavender scent having its sedative effect, it decreased the participants' working memory and ability to concentrate.

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