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DEGREE: Sport Psychology **YEAR GRANTED:** 2009

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Running Head: THE EFFECTS OF LAVENDER AND PEPPERMINT

The Effects of Lavender and Peppermint Odorants on Tasks that Require High and Low Concentration and Physical Energy

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Abstract

Based on its calming effects, lavender odorants can lower arousal and thereby increase performance for tasks that are concentration demanding. In contrast, peppermint is a stimulating odorant and can increase arousal, and thus performance for tasks that are energy-based. The current study examines the effects of these odorants on tasks that range from very low levels of concentration and physical energy to very high. Forty-four competitive soccer players were exposed to either lavender or peppermint odorants while performing four tasks. As hypothesized, the lavender group performed significantly better on tasks that required more concentration whereas the peppermint group performed slightly better on tasks that required energy and stamina. The findings are congruent with the Yerkes-Dodson Law of Arousal and support the position that certain odors can be effective in improving performance.

The Effects of Lavender and Peppermint Odorants on Tasks that Require High and Low Concentration and Physical Energy

The sense of smell is primal for humans. It is one of the most important means by which our environment communicates with us (Leffingwell, 1999). Odors influence human behavior in a number of ways, including stress reduction and increased alertness (Warm, Dember, & Parasuraman, 1990). This manipulation is essential to enhance performance in variety of settings. In the multi-million dollar sport industry, athletes are always trying to find new and innovative ways to improve their speed, stamina, accuracy and concentration (Gallucci, 2007). And with a suffering economy, the workplace also strives for effective strategies to boost work efficiency and morale. It's an on-going competition to perform the best and thus, it is imperative to find fast-acting, on-site strategies to alter or improve performance.

Task performance is dependent on changing levels of arousal (Bridger, 2003). Arousal is the degree of physiological and psychological activation or alertness that varies along a continuum from deep sleep (low arousal) to intense excitement (high arousal) (Shea & Wright, 1997). According to the Yerkes-Dodson Law, performance increases with physiological or mental arousal, but only up to a point. When levels of arousal become too high, performance decreases (Yerkes & Dodson, 1908). The process is often illustrated graphically as a curvilinear, inverted U-shaped curve which increases and then decreases with higher levels of arousal Research has found that different tasks require different levels of arousal for optimal performance. These tasks are considered "difficult or complex" and "easy or simple". Difficult tasks are often intellectually demanding and require a lower level of arousal (to facilitate concentration), whereas simple tasks which often require stamina or persistence may be

performed better with higher levels of arousal (to increase energy). Because of task differences, the shape of the curve can be highly variable (Weinburg, 1978). For simple or easy tasks, the relationship can be considered linear with improvements in performance as arousal increases. For difficult or complex, or tasks that require cognitive processing, the relationship between arousal and performance becomes inverse, with declines in performance as arousal increases.

With research supporting the need to alter levels of arousal depending on the task, it is essential to find fast-acting onsite aides to improve performance. One strategy to calm or stimulate arousal levels is "aromatherapy". The word aromatherapy means "treatment using scents". It is based on the use of essential oils to improve physical and emotional health, and to restore the natural balance in a person (Shealy, 2002). It has been theorized that receptors in the nose convert smells into electrical impulses which are transmitted to the limbic system of the brain. Smells reaching the limbic system can directly affect our emotions, and improve our mental alertness, concentration and physical energy (Demick, 2002). Exposure to some smells such as lavender tend to increase concentration and are often described as calming, relaxing and emotionally balancing (Yagyu, 1994). Sakamato, Minouro, Usui, Ishizuka, and Kenoba, 2005 examined the effects of lavender on work performance. The results indicated significantly higher concentration levels for the lavender group compared to the group with no odor. Other odors have a stimulating effect such as citrus and peppermint (Komori, Fujiwara, Tanida, Nomura & Yokoyama, 1995). In a study led by Raudenbush, 2001, he found peppermint increased the participants' performance in tasks that required high levels of energy such as sprinting, push-ups and hand grip strength. However, when the participants were asked to perform basketball free throws, a task that requires concentration, their scores decreased.

Concentration tasks require continuous cognitive processing, a large attention span and can be complicated unless practiced repeatedly. Tasks that require physical energy are straightforward with very few subsections. They are very energy-based and require little cognitive ability and attention (Shea et al.,1997).

Past studies have examined the effects of odors on tasks that require high levels of concentration or energy. However, it lacks research on performance for tasks that combine different levels of concentration and energy. For example, exposure to peppermint has shown to increase performance for tasks that require high levels of energy and low levels of concentration such as sprinting but what effect would there be if we added an obstacle to the sprint? If the task was high in concentration and high in energy would a calming odor such as lavender improve performance or would a stimulating odor such as peppermint be more effective?

The present study is an attempt to replicate previous findings and discover new ones on task performance using lavender or peppermint odorants. Based on Raudenbush (2004) and Sakamato et al. (2005), it is proposed that peppermint odorants will increase performance on tasks that require high levels of energy and low levels of energy and lavender odorants will increase performance for tasks that require high levels of concentration and low levels of energy. Since there are no preceding studies that have examined the effects of odorants on tasks that require a combination of concentration and energy levels, it is uncertain as to what the results will be.

Method

Participants

Forty-four experienced soccer players (19 females and 25 males, mean age = 26.1 years, SD = 7.3) volunteered to participate in this study. The participants were selected from the Sault Amateur Indoor Soccer League and had a minimum of ten years competitive playing experience.

Materials

Odorized adhesive strips containing 2 ml of pure lavender or peppermint oil was used. The dose and brand of the purified oils used in this study were based on the work of Raudenbush (2001). In the testing phase, participants were required to perform four tasks that required different combinations of concentration and energy. The materials needed for the tasks included a stop watch, a size-3 indoor soccer ball, indoor florescent training cones, and black, indoor masking tape. As well, this study included a regulation size indoor soccer goal that is 3m wide, 2m high and approximately 1.4m deep, and four 10x10in target boxes hung at the corners of the goal.

Design and Procedure

A 2x2x2 mixed factorial design was used for this study. Prior to the study, participants filled out a Physical Readiness Questionnaire (PAR Q), an information sheet and were asked not wear any other perfumes or scented sprays the day of testing. The participants were randomly assigned (gender and age were balanced) to either a lavender or peppermint group. In both groups, each participant wore an adhesive strip under their nose which contained 2ml of either pure lavender or peppermint oil, depending on which group they were in. Within each group, the

participants were required to perform four tasks which required different levels of concentration and energy. Before performing each task, they were instructed to inhale the odor. To prevent the carry-over effect, a Balanced Latin Square formula was used to determine the order of the tasks for each participant.

The tasks were classified as easy, moderate or difficult depending on the concentration and energy requirements. Task one was a broad target shooting drill. For this, participants were required to kick four soccer balls into a wide-open goal from a short distance away. This task was classified as "easy" because it required low levels of energy and concentration. Task two was a 35m sprint. In this task, participants were required to run as fast as they could for 35m. This task was classified as "moderate" because it required low levels of concentration but high levels of energy. Task three was a narrow target shooting drill. For this task, participants were required to kick a soccer ball at four small targets along the corners of the goal in the least amount of time. This task was also classified as moderate because it required high levels of concentration and low levels of energy. The fourth and final task was a sprint and weave. For this task, participants were required to dribble through ten cones measured 1m apart as fast as they could. This task was classified as difficult because it required both high levels of concentration and energy.

Scoring

The scoring was based on a 4.0 point scale. Prior to the present experiment, a pilot study took place to average the time and accuracy of the four tasks. Based on this information an average score was ranked as 2.5. Anything below the average score of 2.5 was considered a decrease in performance and anything higher than 2.5 was considered an increase in

performance. Speed and mistakes (for example there would be an increase in time if a participant hit cones during the weaving task).

Results

The scores of the four tasks completed within each group were analyzed using a 2x2x2 mixed factorial design. The independent variables are odorants (lavender/peppermint), concentration (low/high), and energy (low/high). The dependent variable is task performance. There were no main effects of odor, concentration and energy. There was also no interaction between energy and odor or between concentration, energy and odor. There was a significant interaction between concentration and odor, $F\ (1, 42) = 6.63, p = 0.014$. For tasks that required concentration, the group that inhaled lavender performed better than the peppermint group. Also obtained was an interaction between concentration and energy, $F\ (1, 42) = 7.41, p = 0.009$. The participants performed better in the tasks that required concentration compared to the tasks that were energy based.

The performance scores of the four tasks are depicted in Figure 1. There was a very significant increase in scores for the broad target task, $F\ (1, 42) = 9.06, p = 0.04$. Due to the simplicity of the task, there was a ceiling effect indicating that despite the type of odor exposure, participants were still going to perform well. The lavender group scores were significant (mean=3.7, SD =.527) compared to the peppermint scores (mean = 2.1, SD = 1.02). This suggests that inhaling lavender is more effective for tasks that require high level of concentration. The lavender group also had significant scores for the fast weave task (mean = 3.0, SD = .992) compared to the peppermint group scores (mean = 1.92, SD = .957). In other words, lavender is more useful for tasks that require a combination of high concentration and

high energy whereas peppermint may decrease performance. Finally, there were slightly significant scores for the sprinting task for the peppermint and lavender group (mean = 2.78, SD = .785). This indicates that stimulating odors such as peppermint will increase performance for tasks that are energy based and calming odors such lavender will decrease performance.

Discussion

These results are congruent with the Yerkes Dodson Law on task specificity. When a task is complex, an increase in arousal can decrease performance and when a task is simple, it requires higher levels of arousal to increase performance. This may justify the non-significance in the main effects. Since performance is based on task specificity, there may need to be an interaction in order to have change in performance.

Previous research suggests that peppermint odorants will increase performance in tasks that require high energy and low concentration (Raudenbush, 2004) and that lavender odorants can enhance performance for tasks that require high levels of concentration (Sakamato, 2005). Based on the results, the hypotheses were met for these types of tasks. As also hypothesized, the lavender odorant decreased performance in the high-energy task.

The present study also provided new findings. There was no previous research on tasks that required a combination of energy and concentration. A ceiling effect occurred for the low concentration and low energy task. All of the participants scored significantly high ($p= 0.04$) and this could be the result of the simplicity of the skill. In this case, regardless of the odor, the performance was going to be high. The task design can be re-examined for future research, or

perhaps this study suggests for very easy tasks, performance will be high and may not require enhancement. The second finding was a task combined with high energy and high concentration. The lavender scores were significantly higher than the peppermint indicating that lower arousal levels are necessary to perform well in a difficult task.

There were some limitations to this study. First, the types of tasks may need to be re-evaluated. Although it takes concentration and energy to weave through cones, it may not have been challenging enough for the population being studied. The longevity of the tasks averaged less than a minute to perform. Perhaps there needs to be a longer duration to determine whether time has an effect on the odors. For example, the peppermint odor may have been distracting instead of stimulating which would justify the decrease in performance for many of the tasks. Another question that may need to be looked at for future research is whether there is a neurological reaction to the odors or is it the possibility that people associate certain odors with certain feelings. For example, many people have lavender-scented candles or bubble bath and may automatically think the smell should act as calming.

This was the first study to examine two odorants on different concentration and energy task requirements. The effects of peppermint and lavender are potentially substantial but task dependent. Performance enhancement is ongoing in sports, the workplace and in society. Developing a fast-acting on-site technique to increase concentration and energy could be helpful and produce faster and quicker thinking athletes, better work efficiency and more and may change arousal for anyone depending on the situation or task. While the mean difference for the peppermint group was smaller, past research has shown consistent findings of increase in performance. The use of peppermint as an ergogenic aid appears to be associated with larger

effect sizes than other aids such caffeine (Spriett, 1995) and "psyching up" (Weinberg, Gould & Jackson, 1980). The use of lavender appears comparable to aids such as relaxation and imagery (Meyers & Schleser, 1980).

Experimental research on the effects of peppermint and lavender odorants on task performance will continue to grow. With the ability of certain odors to enhance both concentration and energy energy-based tasks, there may be a variety of new products marketed to capitalize on the all-natural, non-pharmaceutical properties of pure oils. So breathe and relax or energize - you decide.

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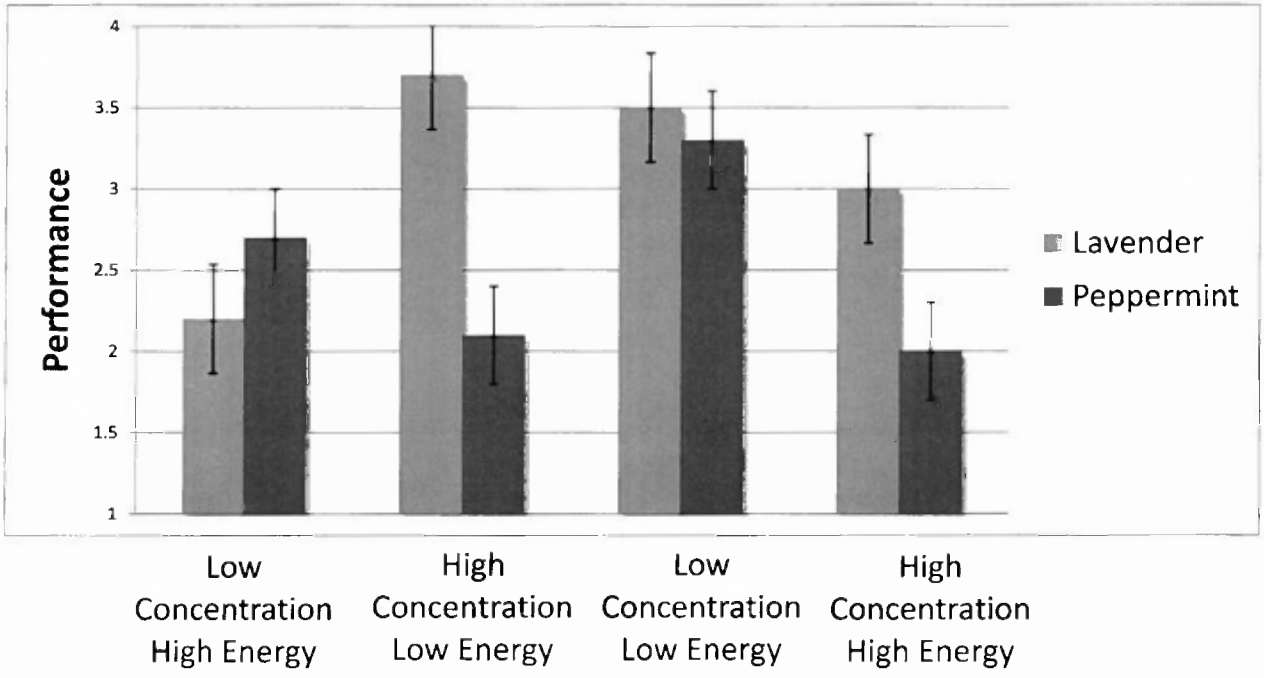
Figure Caption

Figure 1. Performance scores of the four tasks.


Performance
4
3.5
3
2.5
2
1.5
1
Lavender
Peppermint
Low Concentration High Energy
High Concentration Low Energy
Low Concentration Low Energy
High Concentration High Energy