The Effects of Low Dose Salvia Lavandulaefolia on Objective and Subjective Measures of Alertness

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Introduction

S. Lavandulaefolia has long been used for enhancing cognitive and memory performance in traditional and Ayurvedic medicine (Orhan and Aslan, 2009). Previous research has suggested S. Lavandulaefolia as a cognitive enhancer and aid to memory in both clinical and non-clinical samples (Perry et al., 2003). Behavioural work has also suggested that S. Lavandulaefolia has memory enhancing properties (Tildesley et al., 2003; Tildesley et al., 2005). In addition to improvements in memory, at a 50mg dose participants also reported significant elevations in feelings of calmness, contentedness and alertness 2.5 hours post consumption. These findings suggest that not only does S. Lavandulaefolia enhance aspects of cognitive function, but that it is also capable of acute positive modulation of mood (Tildesley et al, 2005). The current study aimed to degrade alertness by inducing daytime sleepiness and examined the effect of S. Lavandulaefolia on attenuating reduced alertness.

Experimental Paradigm

The current study employed pupillometry as an index of physiological alertness (using the Pupillographic Sleepiness Test: PST) and both the Stanford Sleepiness Scale (SSS: Hoddes et al., 1973) and Bond-Lader Visual Analogue Mood Scale (VAMS: Bond and Lader, 1974) as measures of subjective alertness.

(i) Pupillometry: Theory

Pupil diameter is regulated by central sympathetic inhibition of the parasympathetic Edinger Westphal nuclei (PSEWN) (Loewenfeld, 1999; Wilhelm et al., 2001). Reductions in alertness suggest attenuation of central sympathetic nervous system (CSNS) activity and as a consequence reduction in CSNS reduces inhibition of the PSEWN. Less inhibition of PSEWN results in greater relaxation of Edinger Westphal nuclei and increased pupillary oscillation.

At test, pupillary fatigue oscillations are measured and provide a pupillary unrest index (PUI) (e.g. Norrish and Dwyer, 2004). PUI has been demonstrated to correlate significantly with self-rated alertness (e.g. Wilhelm et al., 2001).

(ii) Pupillometry: Method

In a within-participants placebo-controlled crossover design, thirty non-smoking participants (8 males, 22 females, mean age = 21.67 years) completed the 11-minute Pupillographic Sleepiness Test (PST) following consumption of S. Lavandulaefolia (50mg) or placebo (sunflower oil: 50mg) on two testing days between 14:00 and 17:00 (separated by a 7-day washout).

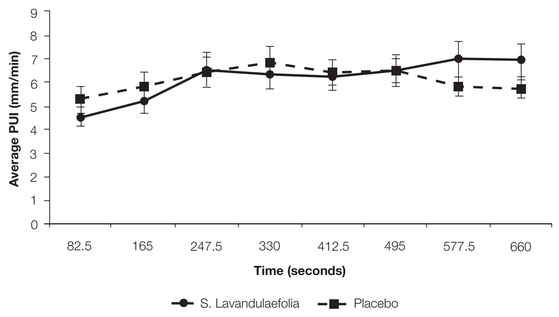
Self-rated measures of mood (VAMS: Bond and Lader, 1974) and sleepiness (SSS: Hoddes et al., 1973) were taken at three testing epochs: baseline, 2.5 hours following supplement administration (i.e. immediately pre-PST), and immediately post-PST. Pupillary oscillations were recorded over an 11-minute period in quiet and darkened conditions. Maximum PUI magnitude is reached after 4 minutes (e.g. Lüdtke et al., 1998; Wilhelm et al., 1999, 2001); therefore the test PUI score was computed using an average PUI from minutes 4-11.

Results

(i) Physiological Alertness: PUI Test Scores

Figure 1 demonstrates that PUI increased over the 11-minute PST, However, S. Lavandulaefolia was found not to attenuate the decline in alertness induced by the PST.

Figure 1: Mean PUI for each 82.5s epochs of the PST for the S. Lavandulaefolia and placebo conditions. Error bars denote the mean standard error.



A two-factor (2x2) within-subjects ANOVA revealed a main effect of experimental stage ($F(1,29)=23.62$, $p<0.001$, partial eta squared = 0.45), demonstrating that PUI increased over the 11-minute PST. However, there was no significant main effect of substance ($F(1,29)=0.36$, $p=0.55$, partial eta squared = 0.01) and no significant interaction between stage and substance ($F(1,29)=3.61$, $p=0.07$, partial eta squared = 0.11). (Figure 2).

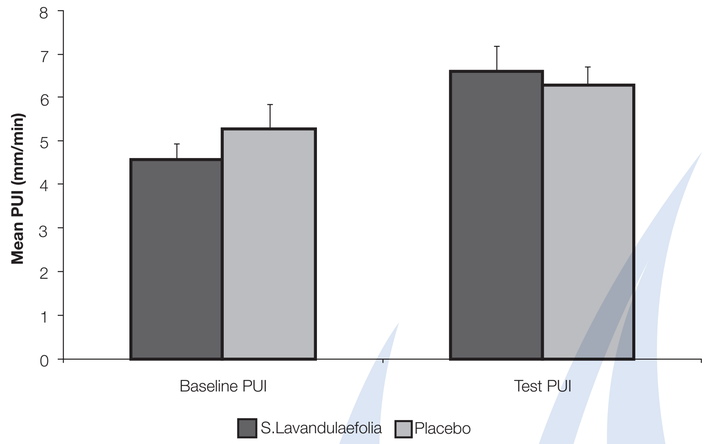


Figure 2: Mean baseline and test PUI for the S. Lavandulaefolia and placebo conditions. Error bars denote the mean standard error.

(ii) Subjective Alertness: SSS and VAMS

The 11-minute PST was found to significantly increase sleepiness and significantly reduce alertness. However, S. Lavandulaefolia was not found to attenuate these effects. No significant effects of time or substance were found for self-rated contentedness or calmness (all p-values > 0.1).

Discussion

The present study demonstrated that PST significantly increased pupillary unrest (i.e. increased daytime sleepiness), increased self-rated sleepiness, and decreased self-rated alertness. However, S. Lavandulaefolia was found not to attenuate the decline in alertness induced by the PST. These findings are inconsistent with cognitive enhancements reported in previous research (e.g. Perry et al, 2003 and Tildesley et al, 2003; 2005). It is possible that the deceases in alertness produced by the PST are fundamentally different to those induced by cognitive load (Tildesley et al, 2003; 2005) and may be affected by differential dosage levels. Furthermore, the present findings may be an artefact of limitations in the design of the study (i.e. participant freedom during the 2.5 hours following substance administration). Further work including more stringent control is necessary.

Key References

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