Olfaction-pain interactions: A familiar odor enhances pain tolerance
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Abstract
Previous research suggests that odors, in particular pleasant and sweet ones, enhance pain tolerance (Marchand & Arnasend, 2002; Prescott & Wilkie, 2007). In neonates the familiarity of an odor is instrumental in lowering pain responses (Goubet et al., 2007). This current study examined the impact of a moderately sweet familiar odor on pain tolerance in women. First, all participants (N = 62) watched a short movie. Half the sample was unknowingly exposed to an odor while the other half was not. Participants were then asked to immerse their hand in cold water for as long as they could tolerate (cold pressor test, CP) while being exposed to an odor or no odor. Participants were randomly assigned to one of four conditions: Olfactory familiarization/same odor during CP (O/N, n = 16), Olfactory familiarization/No Odor during CP (O/N, n = 15), No odor familiarization/Olfactory odor during CP (N/O, n = 16), No odor familiarization/No odor during CP (N/N, n = 15). Measures included pain tolerance (time spent in water), pain perception at immersion, 20 s later, and at removal, and mood ratings before and after the CP task. Pain perception increased in all groups with pain being most acute at removal, ps. < .01. Mood was significantly lower after the CP test. Participants in the O/N or odor group tested kept their hand in cold water significantly longer compared to participants in the O/N and N/N groups ps. < .05. Participants in the N/O group showed no difference in tolerance compared to the other groups.

Introduction

• Exposure to an odor affects pain perception and tolerance positively or negatively depending on odor hedonics (Villenure, Stolnick, & Bushnell, 2003; Marchand & Arnasend, 2002).
• Villenure et al. (2003) have proposed that the presence of odors affects pain tolerance via the induction of a positive or negative mood (but see Marchand & Arnasend, 2002).
• Prescott and Wilkie (2007) found that tolerance to icy water increased during exposure to a sweet odor (caramel) compared to exposure to a pleasant but non sweet odor. They propose that the increased tolerance to pain is based on the associative pairing of an odor with tasted sweetness.
• Listening to familiar music increases pain tolerance in adults (Mitchell, MacDonald, & Brodie, 2006) compared to listening to unfamiliar music.

Current Study - Hypotheses

• In adults, would a familiar odor increase pain tolerance?
• In addition or alternatively, would a novel odor judged moderately sweet increase pain tolerance?

Method
Participants: 62 females aged 18-22 years randomly assigned to 4 different groups:
• A 15-min odor familiarization followed by a cold pressor (CPT) task with exposure to the same odor (O/O) n = 16
• A 15-min odor familiarization followed by CPT with no odor exposure (O/N) n = 15
• No odor familiarization followed by CPT with odor exposure (N/O) n = 16
• No odor familiarization followed by CPT with no odor exposure (N/N) n = 15

Stimuli and Materials
• Olfactory stimulus and delivery mode: Earl Gray essential oil (Nature’s Flavor, model number NF-4389) released via a hidden Stelkin & Co. SCENTBLO™ Home Fragrance Oil Fan.
• Inhaled water for Cold Pressor Task (CP). A cylindrical aquarium tank containing two gallons of water and ice kept at the constant temperature of 4°C by a Whisper In-Tank Power-Aquarium Filter (Tetra).

Pain tolerance

A 4 [condition (N/N, N/O, O/N, O/O)] between-subjects ANOVA conducted on the time spent in water (s) yielded a main effect of condition (Table 1). The familiarity of the odor seems to have been instrumental in increasing tolerance. It is proposed that the re-encounter of the same odor with taste significance led to increased pain tolerance. More research is needed to understand the underlying effects of familiarity on behavior.

Pain perception

A 2 [period (immediate, 20 s, removal) x 4 condition (N/O, N/N, O/N, O/O)] mixed ANOVA yielded a main effect of period, F(2, 116) = 8.97, p < .01, η² = .09. Pain was weakest at immersion and was shortest at removal (see Figure 2).