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"Perfumes as triggers of odor memories"

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1. Introduction

The sense of smell influences human behavior, memory, emotion, and social interactions [1]. Fragrance perception affects emotional and memory[2,3]-related processes through direct olfactory-limbic pathways linked to the amygdala and hippocampus. This special connection [4, 5] triggers immediate emotional and memory responses, often without our awareness, explaining why certain scents can evoke vivid memories and intense emotions.
Numerous publications[6,7], including a meta-analysis, indicate differences between individuals with depression and those without in terms of their olfactory function. Both mental and physiological health appear to play significant roles. Several studies[,8] have suggested that depression may be associated with odor memory impairment, with severe impairments possibly being restricted to severely depressed patients when compared to healthy controls.

However, the extent of the impact on olfactory performance and responses between the two groups remains ambiguous.
This study aims to (1) assess the emotional well-being of female participants, (2) compare olfactory performance between women with and without depression, (3) investigate whether their reactions to various perfumes differ regarding liking, familiarity, and mood impact, and (4) identify fragrance profiles that might offer positive emotional benefits to women with mild depression

For consumers, the connection between scent and emotion is crucial. Positive associations with scents [9,10] can improve mood, enhance emotional well-being, and increase brand loyalty. Using this relationship in consumer products [11], especially fragrances, can strengthen customer engagement, create memorable experiences, and promote emotional wellness[12,13,14]. Effective fragrance products can boost individual well-being and achieve commercial success by resonating emotionally with consumers[15].

2. Materials and Methods

2.1 Participants

The study included **N = 80** healthy female participants aged 18-44 years (M = 24.9, SD = 4.8). Criteria for inclusion required non-smoking status and self-reported normal olfactory function.

2.2 Study Design

The study was designed as follows:

The protocol involved olfactory threshold and identification testing [16] , odor memory tasks assessing hit rates, false alarms, and correct rejections, psychological assessments using WHO-5 and ADS-L questionnaires [17, 18], perfume familiarity and preference ratings, and an odor-evoked autobiographical memory task (TOM)[19].

The test study is a pilot study with psychophysiological measures and then it continues with physiological measurements to explore the topic of the interest.

2.3 Summary of Olfactive Stimuli Families

The study encompassed sixteen commercially available and newly developed perfumes with a diverse range of olfactive families.

3. Results

Our population: 53% of participants rate their olfactory abilities as 8/10 or higher, with 45% of the participants showing minor signs of clinical depression (General Depression Scale > 16).

investigated the relationships between fragrance familiarity, odor-evoked memory, and emotional state. Participants(this study of 80 women (aged 18-44, M = 24.9, SD = 4.8)) exhibited generally excellent olfactory function; a small subset (n=6) had slightly low olfactory identifications. 45% had self-reported depressive symptoms. T-tests indicated no significant differences in olfactory performance between depressed and non-depressed participants, though slight differences appeared in odor memory false alarms. Women who reported depressive symptoms tended to have lower false alarm rates in TOM tests, but this wasn't significant. This may indicate biases in recognizing new odors.

3.1 Participant Characteristics

The participant cohort consisted of healthy young adult women with high self-reported olfactory abilities. The majority scored in the normal range for both olfactory threshold and identification, and overall well-being scores indicated good mental health with some participants showing mild depressive symptoms. The variables and characteristics of the participants were listed in Table 1.

Table 1. The characteristics of the participants.

Variable	Mean (SD)
Age	24.9 (4.8)
WHO-5 Well-being Score	13 (3)
ADS-L Depression Score	15.5 (4.1)

3.2 Olfactory Performance and Depression

Interestingly, the T-test results which showed no significant differences in odor threshold (p = .359) or identification (p = .673) between depressed and non-depressed women (Table 2) depicting no significant difference between depressed and non-depressed participants regarding threshold and identification. A minor difference was observed wherein individuals with depression showed a reduced rate of false alarms (p = .084) compared to non-depressed individuals during odor memory tests. This suggests that cognitive bias might influence memory recall rather than sensory detection.

Table 2. Odor threshold, Identification, and the number of false alarms in TOM odor memory test by depression status.

Group	Odor Threshold (M, SD)	Odor Identification (M, SD)	False Alarms (M, SD)
Non-depressed	7.1 (1.2)	13.6 (1.1)	1.7 (1.1)
Depressed	7.0 (1.3)	13.4 (1.3)	1.2 (1.2)

3.3 Odor-Evoked Autobiographical Memories

Participants in this study reported 1 to 3 memories per odor (M = 2, SD = 0.3). High-memory evoking products included Product A, Product G, and Product P. The results are shown in Table 3. Fragrances categorized A, G, P were most frequently associated with the retrieval of auto-biographical memories, suggesting certain scent profiles are particularly potent memory triggers.

Table 3. : Number of memories evoked per olfactive family.

Product	Mean Number of Memories Evoked
Product A	2.3
Product G	2.5
Product P	2.2

4. Discussion

The study aimed to compare olfactory performance between depressed and non-depressed women and assess the emotional well-being of the participants and the mood impact with different fragrance families and identify fragrance profiles that might offer positive emotional benefits to women with mild depression.

This study involved a sample of healthy young women, who displayed robust olfactory abilities and varying levels of emotional well-being. Olfactory performance showed consistency across varying levels of depressive symptoms. However, participants with depressive symptoms demonstrated marginally different rates of memory biases, including false alarms, which were not statistically significant. This suggests that the decrease in human well-being (depression) did not significantly affect olfactory performance, including threshold and identification, However, numerous studies[16] have shown the relationship between olfaction and depression with olfactory functions and these processes are highly integrated in the brain with emotion and memory in normal daily life. The benefits of olfactory training have been proven and are largely dependent on the severity of depression.[17] In our study, the limit number and narrow spectrum of ages of pools of participants with mild depression and the short exposure of odors could explain our statistical results.

Additionally, these studies will seek to understand how personalized fragrance experiences can be developed to support individuals with mild depression, ultimately promoting a positive emotional state and cognitive engagement. By bridging the gap between olfactory science and emotional health, these investigations hold the promise of revolutionizing the use of fragrances as well-being improvement tools.

5. Conclusion

In summary, these preliminary findings indicate that olfactory performance remains consistent across varying levels of depressive symptoms across participants This suggests that a slight decrease in human well-being, marked by milder depression, may not significantly impact olfactory performance in everyday life, including threshold and identification abilities but could impact memory. To thoroughly understand the threshold at which well-being influences olfactory performance, further research involving a larger global cohort of population is essential.

Nevertheless, this preliminary study lays the foundational groundwork for future research into the mechanisms by which fragrances can enhance emotional well-being. It opens avenues for exploring how specific scent profiles may be tailored to offer positive emotional benefits, particularly for individuals with mild depression[20] By bridging the gap between olfactory science and emotional health, these investigations promise to revolutionize the use of fragrances as tools[21] for promoting well-being and cognitive engagement.

6. Acknowledgments

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7. Conflict of Interest Statement

NONE.

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