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Main Article

What is the short term effect of perfumes on olfactory thresholds?

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Abstract

Objectives: Body sprays and perfumes are commonly worn by patients attending ENT out-patients clinics. Their effect on performance in olfactory testing is unknown. The aim of this study was to determine whether olfactory thresholds are altered by the presence of such fragrances.

Materials and methods: One hundred and sixty healthy volunteers, aged 18 to 65 years, underwent olfactory thresholds testing. Each was then exposed to one of four strong perfumes, applied in a facemask for two minutes, and the thresholds were retested.

Results and analysis: All olfactory thresholds worsened after being exposed to the strong perfumes of Lynx™ and Impulse™ body sprays, with the strongest effect being on olfactory detection of phenylethyl alcohol ($p<0.001$).

Conclusions: Strong perfumes can have a negative effect on olfactory thresholds.

Significance: Patients attending olfactory threshold testing need to be advised not to wear body sprays or perfumes.

Key words: Smell; Perfume; Sensory Threshold; Reproducibility of Results

Introduction

Olfactory disturbances are not uncommon and have a significant impact on people's quality of life.[1–3] There are several validated forms of olfactory tests currently in use, including the University of Pennsylvania smell identification test,[4,5] 'Sniffin' Sticks'[6] and the combined olfactory test.[7] These tests can be used to record sense of smell, particularly in relation to iatrogenic influences such as medical and surgical treatment of rhinological disease. They are most likely to be performed in out-patients clinics, which patients attend having performed their normal daily routine prior to arrival. For many patients, this would include applying aftershaves or perfumes. Moreover, many patients will 'freshen up' prior to seeing the doctor and will reapply fragrances. It would seem obvious that, if a patient is wearing such products, he or she may have altered olfactory thresholds, but this theory has never been tested.

Previous work has been done on odour–odour interactions. Pierce *et al.* found that the decrease in sensitivity to one odorant following exposure to a different odorant was affected by odorant similarity, both perceptual and structural. Further testing, however, found the same effect in odours with both perceptually and structurally different compounds. This study shows that odour–odour interaction relationships remain obscure. This piece of work also demonstrated that a cross-adaptation effect was seen even when an odour was preceded by exposure to a similarly structured but odourless compound.[8] Other studies have observed significant psychological aspects to the perception of odour intensity and familiarity.[9,10]

This study aimed to test the hypothesis that strong fragrances have a negative effect on olfactory thresholds in the short term. If an acute change was demonstrated, further work would be needed to investigate long term changes. If the hypothesis was found to be correct, it may influence the information given to patients prior to attending clinic appointments.

Materials and methods

Ethical approval for the study was granted by the local committee. The study was conducted as a prospective, single-centred study using normal

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volunteers from amongst hospital staff. A statistical consultation established a suitable sample size; hence, 160 subjects were recruited (mean age 38 years, range 18–65 years).

Each subject underwent baseline olfactory threshold measurements for the odours of phenylethyl alcohol (A = roses), mercaptan (B = propane), glacial acetic acid (C = vinegar) and eucalyptol (D = eucalyptus) using 28 ml glass bottles (VWR, Lutterworth, Leicestershire, UK) containing 5 mls of each odour in nine serial logarithmic concentrations. The proportion of fluid used per bottle size gave adequate head space for vapour above each substance. The 28 ml bottles were also useful as they made the test portable. Glass bottles were used as they have been found to give more accurate threshold measurements.[11] Odours A, B and D were diluted in mineral oil, which is a validated carrier for olfactory threshold testing.[12] Odour C was dissolved in sterile water. The concentration for each odour is shown in Table I. Each subject was then exposed to one of four strong perfumes for two minutes via a facemask and the thresholds retested. Two types of male body spray (Lynx Unlimited™ and Lynx Dimension™) and two types of female body spray (Impulse Goddess™ and Impulse Thrill™) were chosen, as they are very commonly used types of fragrance in the UK.

The first 100 subjects were tested with Impulse Goddess, a further 20 subjects with Impulse Thrill, and then two further sets of 20 with Lynx Unlimited and Lynx Dimension. In the 100 subjects tested with Impulse Goddess, odour presentation was rotated after the perfume to determine effect on results. Twenty subjects were tested with odours presented after the perfume in the order D, C, B, A, 20 subjects in the order B, C, D, A, and twenty in the order C, D, A, B. Eighty subjects from the Impulse Goddess group and 20 from the Lynx Unlimited group were also tested with a mask with no perfume, to exclude a placebo effect. Standard dust masks were used (Workranger, Wigston, Leicester, UK).

Previous studies have shown no significant variability between olfactory thresholds and humidity, temperature or nasal peak inspiratory flow rate; therefore, these factors were not measured in this study.[13]

Pre- and post-exposure results were analysed using paired *t*-tests on Strata 9.1/SE software (www.strata.com, Texas, USA).

TABLE I

CONCENTRATION OF TEST ODOURS

Bottle no	A*	B†	C‡	D**
1	10^{-2}	10^{-5}	10^{-1}	10^{-1}
2	10^{-3}	10^{-6}	10^{-2}	10^{-2}
3	10^{-4}	10^{-7}	10^{-3}	10^{-3}
4	10^{-5}	10^{-8}	10^{-4}	10^{-4}
5	10^{-6}	10^{-9}	10^{-5}	10^{-5}
6	10^{-7}	10^{-10}	10^{-6}	10^{-6}
7	10^{-8}	10^{-11}	10^{-7}	10^{-7}
8	10^{-9}	10^{-12}	10^{-8}	10^{-8}
9	10^{-10}	10^{-13}	10^{-9}	10^{-9}

*Phenylethyl alcohol; †mercaptan; ‡glacial acetic acid; **eucalyptol. No = number

Results and analysis

All olfactory thresholds worsened after subjects were exposed to the strong perfumes of Lynx and Impulse body sprays (Table II). The effects of Impulse Goddess and both types of Lynx on the detection of all four odours were statistically significant ($p < 0.001$). The greatest effect was on odour A (phenylethyl alcohol), for all four perfumes ($p < 0.001$). This effect was independent of the order of presentation of smells A to D and of the perfume used. For three of the four perfumes (Impulse Thrill, Lynx Unlimited and Lynx Dimension), the odour least affected was B (mercaptan).

The group also tested for a placebo effect of the mask alone showed no significant such effect. In order to exclude any differences between the sexes, 10 male and female subjects from the Impulse goddess group were randomly compared; no significant difference between the two groups was identified (Tables I, II, III and Figures 1 and 2).

Discussion

It is clear from these results that even a body spray can adversely affect the potential thresholds achieved during olfactory testing. All four perfumes tested had their strongest effect on the detection of phenylethyl alcohol; this has a floral smell, so it is not surprising that the body spray fragrances affected this most. On the other hand, detection of mercaptan, which smells like common household

TABLE II

RESULTS OF PRIMARY DATA ANALYSIS

Odour	Perfume	Mean difference	95%CI	*p*
A	Impulse Goddess	−1.06	−1.30, −0.82	<0.001
	Impulse Thrill	−1.95	−2.49, −1.41	<0.001
	Lynx	−0.75	−1.09, −0.41	<0.001
B	Impulse Goddess	−0.83	−1.06, −0.60	<0.001
	Impulse Thrill	−0.60	−1.33, 0.134	0.104
	Lynx	−0.73	−1.02, −0.43	<0.001
C	Impulse Goddess	−0.66	−0.86, −0.46	<0.001
	Impulse Thrill	−0.45	−0.99, 0.09	0.095
	Lynx	−0.78	−1.14, −0.40	<0.001
D	Impulse Goddess	−0.65	−0.83, −0.47	<0.001
	Impulse Thrill	−0.50	−0.83, −0.18	0.004
	Lynx	−0.63	−0.93, −0.32	<0.001

CI=confidence intervals; A=phenylethyl alcohol; B=mercaptan; C=glacial acetic acid; D=eucalyptol; Lynx=Lynx Unlimited and Lynx Dimension

TABLE III

AVERAGE OLFACTORY THRESHOLDS CHANGES AFTER IMPULSE GODDESS EXPOSURE, BY GENDER

Gender	Odour A	Odour B	Odour C	Odour D
Women	−1.6	−0.4	−1.0	−1.1
Men	−1.9	−0.3	−0.7	−0.9

A = phenylethyl alcohol; B = mercaptan; C = glacial acetic acid; D = eucalyptol

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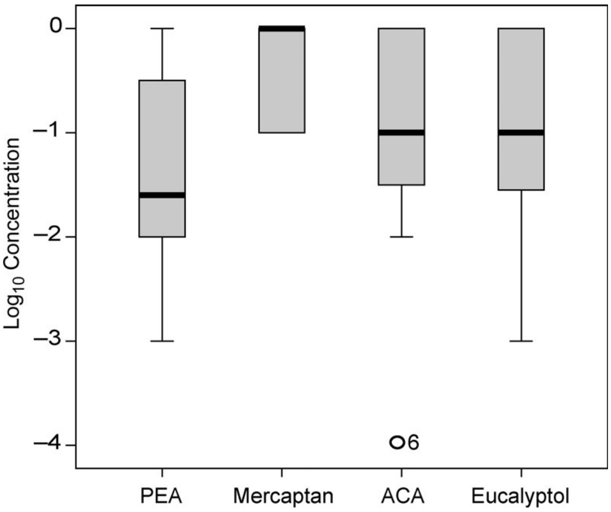

FIG. 1

Box plot showing short term effect of perfumes on female subjects' olfactory thresholds.

gas, was least affected by three of the four perfumes. Perhaps this is because it is a pungent odour for which we develop a more acute sense of smell, as it is potentially harmful. Placebo testing with a mask alone had a negative effect on olfactory thresholds, and the reason for this was unclear. However, this result was not significant when compared with the perfume effect. There was no significant difference between male and female changes in olfactory threshold in response to the same perfume. Therefore, both genders' olfactory thresholds may be equally affected by perfumes and aftershaves. This could have wider-reaching implications, for example, regarding fragrances worn by other family members prior to patients' olfactory testing. This would of course need further investigation to clarify, as only small numbers were compared in this study.

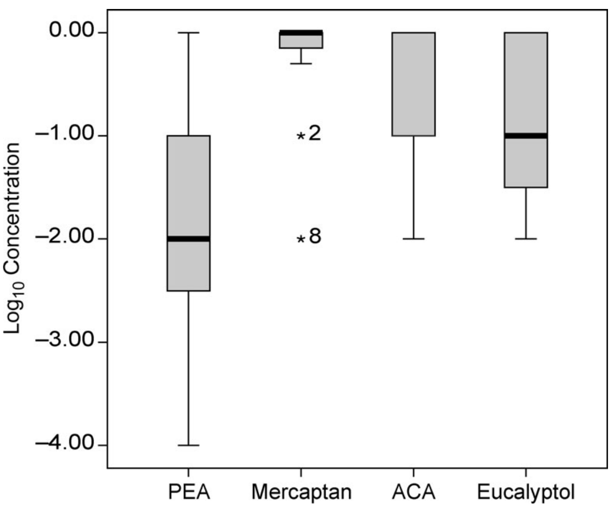

FIG. 2

Box plot showing short term effect of perfumes on male subjects' olfactory thresholds.

Overall, it was felt that the hypothesis that strong perfumes negatively affect olfactory thresholds in the short term was correct.

The effect of body sprays on olfactory thresholds testing is one of many potential variables. Dawes listed several other notable variables.[14] Some of these variables have been examined in other studies, such as temperature and humidity,[13] peak inspiratory flow rate,[13] glass versus plastic bottles,[11] and solvents used.[12] To date, the variable of the patient's body spray or perfume does not appear to have been considered.

- **This study compared olfactory thresholds before and after exposure to strong odourants in perfume**
- **The results showed a threshold shift following perfume exposure**
- **The authors conclude that patients attending for olfactory testing should be advised not to wear body spray or perfume**

It was the authors' intention to establish whether there was an acute change in olfactory thresholds in the presence of body sprays and perfumes; this was found to be the case.

The limitation of this study was that subjects may well adapt to their own body spray shortly after application; further work will be required to investigate the existence and duration of this effect.

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