

Olfactory sensitivity and sexual desire in young adult and elderly men: An introductory investigation

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ABSTRACT

Background: It has been suggested that olfaction could influence human sexual behavior. Age is negatively associated with many aspects of sexuality and, with increasing age, people tend to show a declining sexual desire. The present pilot study investigated the relationship between sexual desire and olfactory sensitivity in healthy men of two age groups, young adult and elderly (≥ 65 years old), to ascertain whether their sense of smell could determine sexual desire and whether an age-related weaker olfactory sensitivity could correlate with the decline in sexual appetite in elderly patients.

Methods: Sixty-three volunteers were recruited and divided into two groups, one consisting of 48 healthy young adult men, the other of 15 healthy elderly men. All participants were tested to ascertain their odor threshold for n-butanol (Sniffin' Sticks) and their sexual desire using the International Index of Erectile Function (IIEF), presenting only the questions relating to frequency (IIEF1) and level (IIEF2) of sexual desire.

Results: Sexual desire and mean olfactory thresholds were higher in the younger adults than in the elderly men ($p = 0.001$ and $p = 0.02$, respectively). There was a significant association between butanol threshold and sexual desire for the young adult group ($p = 0.02$), but not for the elderly group ($p = 0.35$).

Conclusion: This study found a preliminary association between olfaction and sexual behavior, in young adults at least. More studies are needed to improve our knowledge in this intriguing field, possibly using electrophysiological olfactory methods.

(Am J Rhinol Allergy 27, 157–161, 2013; doi: 10.2500/ajra.2013.27.3879)

Animal noses have evolved to such a degree that they can detect many different types of odorants in tiny concentrations. Many aspects such as gender, modulation of sniff rates, nutritional status, olfactory receptors (ORs), perireceptor events, and central nervous system processing may influence olfactory sensitivity.¹ More than 1000 different types of ORs, a large class of G-protein-coupled receptors, have been identified so far. They function together in combination to enable a wide range of volatile and soluble molecules to be distinguished.^{2–4}

About 10 years ago, it was found that human ORs are expressed not only in the nose, but also in the sperm cells,⁵ prompting the hypothesis that olfaction could influence human sexual behavior.⁶ Furthermore, it has recently been confirmed that human pheromones play a central part in sexual behavior.⁷ Pheromones were defined in 1959 by Karlson and Luscher as substances that are secreted to the outside by an individual and received by a second individual of the same species, in which they release a specific reaction (*i.e.*, a definite behavior or a developmental process).⁸ Recently, pheromones have been more precisely defined as chemical signals between organisms of the same species that communicate mutually beneficial information on the state of one individual to another.⁹ Although pheromones and their role in humans are a controversial subject,¹⁰ recent results seemed to indicate that the chemistry of axillary secretions and their effects on conspecifics in humans appear to be analogous to other mammalian pheromone systems.¹¹

Sexual desire is the sum of the forces that lean a person toward and away from sexual behavior. In terms of physical desire, it represents a person's feelings and needs. Older people often report that they experience desire less frequently and less intensely than in their youth.¹² Age is negatively associated with many aspects of sexuality¹³ and, with increasing age, people tend to experience a declining sexual

desire,¹⁴ a condition believed to have both biological and psychological origins.¹³ One of the biological reasons could be that people >60 years old have a weaker sense of smell^{15,16} and this is most probably caused by a reduction in the number of olfactory neurons.

The aim of the present pilot study was to investigate the relationship between sexual desire and olfactory sensitivity by comparing a group of healthy young adult men with a group aged ≥ 65 years, with a view to establishing whether their sense of smell could trigger sexual desire in both age groups and could be related to the decline in sexual appetite in older people.

METHODS

The study was conducted in accordance with the recommendations of the Helsinki Declaration and was approved by the internal Ear, Nose, and Throat Committee. Written informed consent was obtained from all participants before undertaking any study-related procedures.

Subjects

This prospective study involved 63 volunteers, who were recruited and divided into two groups: one consisted of 48 healthy young adult men (mean age, 24.7 ± 3.3 years; range, 20–36 years) and the other included 15 healthy elderly men, all ≥ 65 years old (mean age, 69.8 ± 6.4 years; range, 65–89 years).

All participants had a normal nasal and paranasal sinus function, having all scored <1 on the 22-item Sino-Nasal Outcome Test¹⁷; they were all nonsmokers and did not suffer from asthma or allergies; and none of them had a history of prior sinonasal surgery or head trauma. They all had a normal genitourinary system and suffered from no prostatic hypertrophy, circulatory diseases, or diabetes (they all underwent internal medicine advice); none were taking β -blocker or salicylic acid therapy (to avoid enrolling volunteers with circulatory changes that might cause an erectile dysfunction affecting their sexual desire); and none of the participants had undergone surgery involving the genitourinary system. Finally, all participants in the elderly group had a steady sexual partner.

Olfactory Test

All participants underwent a quick olfactory screening with the *Nez du Vin* test, which involves identifying six aromas (lemon, mint,

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The authors have no conflicts of interest to declare pertaining to this article

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strawberry, pine, vanilla, and smoke) by giving multiple-choice answers, according to McMahon and Scadding.¹⁸ Because they all revealed a normal sense of smell (scores of 5 or 6), they were then studied to ascertain their odor threshold for *n*-butanol (Solventis, Antwerp, Belgium), using the Sniffin' Sticks test (Burghart Medical Technology, Wedel, Germany) as already described.¹⁹ Odorants were presented in felt-tip pens. Instead of liquid dye the pen's tampon is filled with 4 mL of liquid odorants or odorants dissolved in propylene glycol. For odor presentation the cap was removed for ~3 seconds and the pen's tip was placed ~2 cm in front of both nostrils. Sixteen dilutions were prepared in a geometric series starting from a 4% *n*-butanol solution (dilution ratio 1:2 in deionized aqua conservata as solvent). Three pens were presented in a randomized order, with two containing the solvent and the third the odorant. Subjects had to identify the odor-containing pen. Threshold was defined as the mean of the last four of seven staircase reversals. The subjects' scores ranged between 1 (the lowest olfactory performance) and 16 (the highest olfactory performance).^{20,21}

Sexual Desire

Participants' sexual desire was assessed using an International Index of Erectile Function (IIEF) scale, which is a brief, multidimensional, self-administered, well-validated method developed to measure several dimensions of male sexual functioning. It is considered a standard tool for assessing male sexual function in both clinical and research settings worldwide.²² For the purposes of the present study, participants only answered questions 11, "How often have you felt sexual desire?" (IIEF1), and 12, "How would you rate your level of sexual desire?" (IIEF2). The possible answers for IIEF1 were 1 (almost never or never), 2 (occasionally), 3 (sometimes), 4 (often), and 5 (almost always or always). For IIEF2 they were 1 (very low), 2 (low), 3 (moderate), 4 (high), and 5 (very high).

Statistical Analysis

Pearson's chi-squared test was used to compare IIEF1 and IIEF2 scores' distribution between the two study groups. The two-sample Welch test was used for comparing the distribution of butanol thresholds between the two groups (Welch test was preferred to the two-tailed paired *t*-test because it was assumed a different variance between the two cohorts). Finally, to compare IIEF1 and IIEF2 scores and butanol thresholds, respectively, in elderly and young adults we adopted the analysis of variance test. A value of $p < 0.05$ was considered statistically significant. Values in the range of $0.10 > p \geq 0.05$ were considered as indicating a statistical trend. The R: a language and environment for statistical computing (R Foundation for Statistical Computing, Vienna, Austria) was used for all analyses.

RESULTS

The distributions of the IIEF1 and IIEF2 scores for the two study groups are presented in Table 1.

Although IIEF 1 and IIEF 2 were strongly correlated ($p = 0.0035$), the scores for IIEF1 differed statistically between the young and elderly groups ($p = 0.001$), and the scores for IIEF2 showed only a statistical trend toward a significant difference between the two age groups ($p = 0.07$; Fig. 1, A and B). The mean olfactory threshold for *n*-butanol differed statistically between the young adult (9.1 ± 2.6) and elderly men (6.9 ± 2.1 ; $p = 0.02$; Fig. 2).

The butanol threshold did not correlate statistically with sexual desire in the elderly group ($p = 0.56$ and $p = 0.35$ for the IIEF1 and IIEF2 scores, respectively; Fig. 3, A and B), but for the young adults there was a direct correlation between the butanol threshold and the IIEF2 score ($p = 0.02$), and a trend toward a statistically significant correlation between the butanol threshold and the IIEF1 score ($p = 0.06$; Fig. 4, A and B).

Table 1 The distribution of IIEF1 and IIEF2 scores for the two groups of study

Young Adults no. of volunteers (%)	IIEF1	Elderly Adults no. of volunteers (%)
0 (0)	1	2 (13.3)
0 (0)	2	1 (6.7)
17 (35.4)	3	8 (53.3)
24 (50.0)	4	3 (20)
7 (14.6)	5	1 (6.7)
IIEF2		
0 (0)	1	0 (0)
0 (0)	2	0 (0)
19 (39.6)	3	11 (73.3)
27 (56.2)	4	3 (20)
2 (4.2)	5	1 (6.7)

IIEF = International Index of Erectile Function.

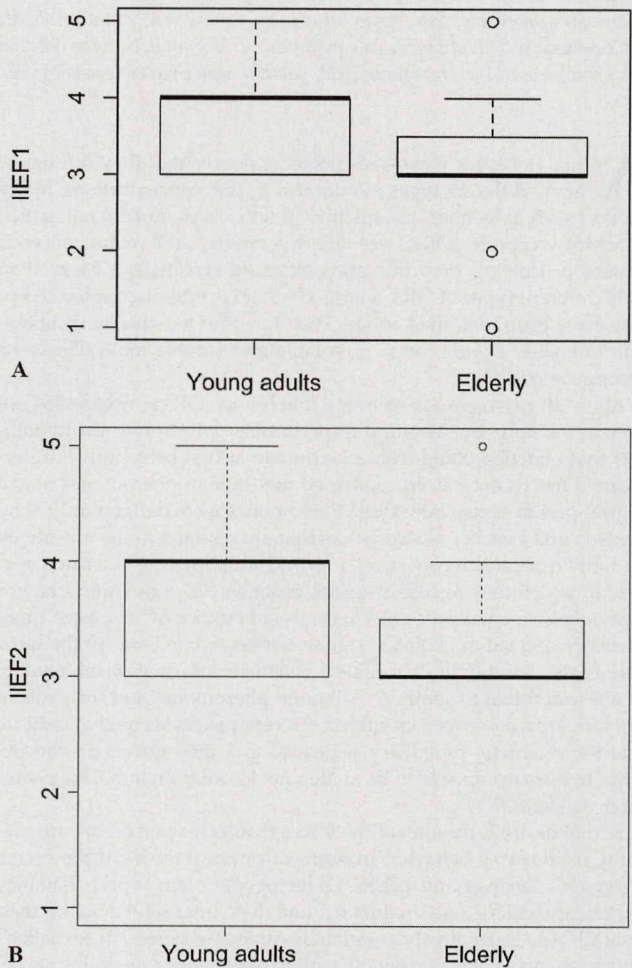


Figure 1. (A) Median International Index of Erectile Function (IIEF1) scores in the young group and in the elderly group ($p = 0.001$). (B) Median IIEF2 scores in the young adult and elderly groups ($p = 0.07$).

DISCUSSION

As expected, the young adult group showed a stronger sexual desire than the elderly group in the present preliminary study, although age and IIEF2 scores showed only a trend toward a

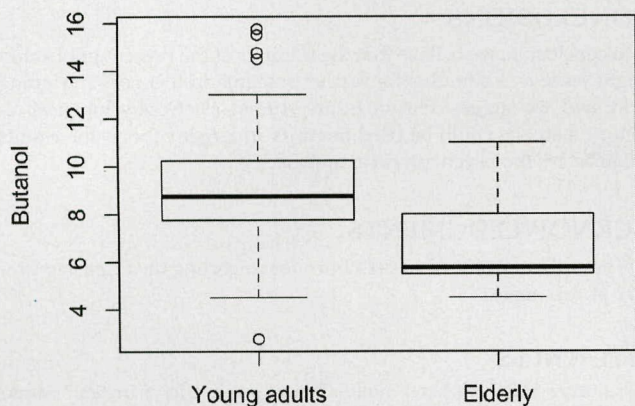
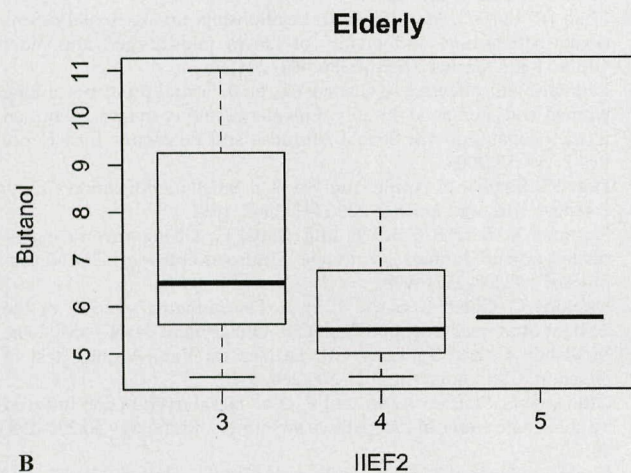


Figure 2. Mean butanol thresholds in the young adult and elderly groups ($p = 0.02$).



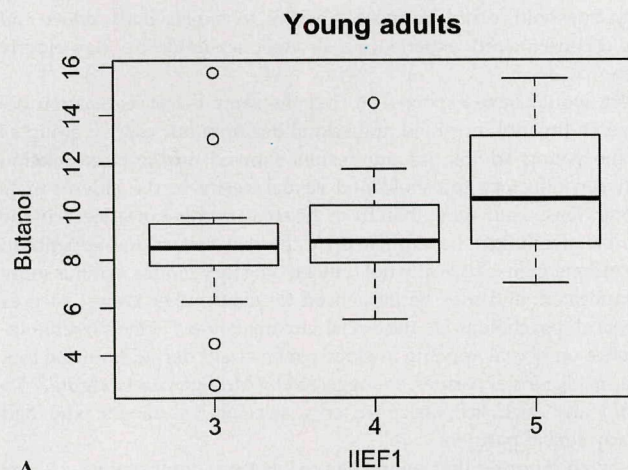
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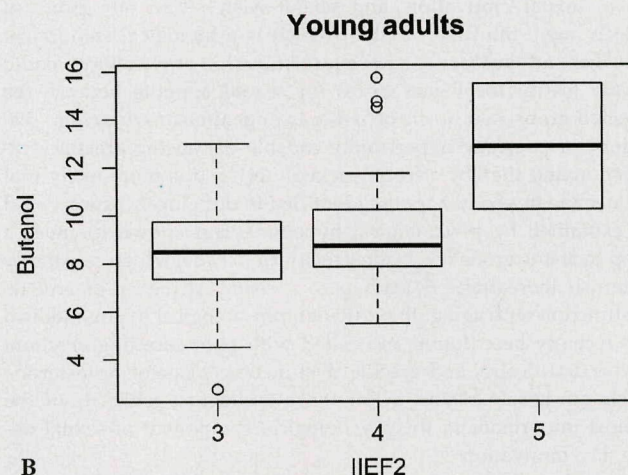
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Figure 3. (A) Mean butanol thresholds and Mean International Index of Erectile Function (IIEF1) scores in the elderly group ($p = 0.56$). (B) Mean butanol thresholds and IIEF2 scores in the elderly group ($p = 0.35$).

correlation. Although IIEF1 and IIEF2 are only 2 of the 15 questions that compose the IIEF scale, those 2 questions are the only related to sexual desire. Because no validated tests are available in literature to stage sexual appetite in men, authors believe that present-



A



B

Figure 4. (A) Mean butanol thresholds and Mean International Index of Erectile Function (IIEF1) scores in the young adult group ($p = 0.06$). (B) Mean butanol thresholds and IIEF2 scores in the young adult group ($p = 0.02$).

ing IIEF1 and IIEF2 could represent a good compromise to assess sexual desire.

Confirming previous reports, the *n*-butanol threshold was higher in the young adults than in the elderly men in our sample.²¹ The *Nez du Vin* test, which showed a good correlation to University of Pennsylvania Smell Identification Test,¹⁸ has been chosen (as we previously did¹⁹) to quickly screen volunteers' smell capacity. The volunteers who did not suffer from smell loss underwent the olfactory threshold evaluation. Olfactory threshold was chosen for the present study, rather than the other possible tests (odor identification or odor discrimination), because it was largely age related and decreased more markedly with age than the other two as it expressed the age-related deterioration of the olfactory epithelium.²¹

Preliminary investigations showed that nasal function has an impact on sexual function.^{23,24} Our results showed an association between olfaction and sexual behavior (in young adults at least), in particular, an association emerged between olfactory threshold and sexual desire (as measured by means of the two questions posed IIEF1 and IIEF2). In 2004, Vossall investigated the hypothesis that olfaction influences human sexual behavior and even the choice of partner and suggested that a potential female partner produces a particular body scent capable of attracting a male partner by stimulating the latter's olfactory system.⁶ Young adult men, with their higher olfac-

tory threshold, could be more sensitive to female body odors and could consequently experience a stronger sexual desire than elderly men.

We would have expected to find the same direct association between *n*-butanol threshold and sexual desire in our elderly group as in the young adults, but our results showed no direct correlation between olfactory threshold and sexual desire in the elderly male group. This result, more than from the small number of subjects in the sample size, might be explained by the fact that sexual appetite in the elderly men is basically not only an olfactory matter, but it is more complicated, and may be influenced by many other issues, such as physical, psychological, and social circumstances.¹³ One possible influence on sexual appetite in elderly men could derive from the lack of a steady sexual partner, as suggested by Mulligan and Palguta.²⁵ To avoid any such influence, we only selected volunteers who had steady sexual partners.

Levine reported that sexual desire has three components, *i.e.*, sex drive, sexual motivation, and sexual wish.^{12,26} In our group of elderly men, the first variable (which is a biological component that has an anatomic and neuroendocrine physiology) could hardly justify the lower scores for sexual appetite because the selected group had no chronic diseases, genitourinary system disorders, or prostatic hypertrophy capable of causing erectile dysfunction and thereby affecting sexual desire. It is more likely that the decline in sexual appetite identified in our elderly group could be explained by physiological hypogonadism known to cause a drop in testosterone levels after the third decade, which constantly diminish thereafter,^{27,28} leading to a rising incidence of erectile dysfunction with aging. In particular, physiological hypogonadism has recently been found associated with poor morning erection, low sexual desire, and erectile dysfunction.²⁹ Lower testosterone levels are surely bound to influence mood too, which is of the utmost importance in the psychological component of sexual desire, *i.e.*, motivation.³⁰

There is a relative paucity of literature available to enable any comparison between the present results and those of other reports. Studying a group of hyposmotic patients, Gudziol and coworkers recently reported that the loss of olfactory function did not have a direct impact on their sexual appetite.³¹ Nevertheless, those authors also found that sexual desire was significantly greater before the loss of sense of smell,³¹ which agreed with a previous report by Van Toller, who emphasized that anosmics often stated that their interest in sex has dwindled.³²

Our results seem to be in line with other literature data^{6,31,32} showing an association between olfaction and sexual desire in the normosmic young adult population. Aging coincides with a decline in the capacity to smell and in olfactory thresholds in particular. However, although the elderly group in our study revealed a lower sexual desire than the young adult group, this could not be justified only by their more limited olfactory capacity. Other variables, such as psychological issues or even hormonal status, could probably influence sexual desire more than olfaction in elderly men. In the next future studies providing a psychological investigation besides hormonal status evaluation (*e.g.*, testosterone dosage) and to olfactory sensitivity determination should be conducted in elderly patients to better understand this very intriguing issue.

In young adult men, our preliminary results found an association between olfaction and sexual desire, as reported by Grammer and coworkers in 2005.³³ Although our study involved a cohort of volunteers very homogeneous from a rhinologic viewpoint and included standardized olfactory threshold measurements, the limited number of considered cases and the methodological approach did not allow to rule out the involvement of other nonrhinologic variables in determining sexual desire in young adults.

CONCLUSIONS

In conclusion, we believe that the findings of the present pilot study might serve as a stimulus for further research in this very intriguing field, and we suggest that in future studies electrophysiological olfactory methods could be used to verify in larger cohorts the results obtained by the psychophysical approach.

ACKNOWLEDGMENTS

The authors thank Frances Coburn for correcting the English grammar of this article.

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