



ORIGINAL ARTICLE

Perception of smell of a perfume applied to the women skin in course of menstrual cycle

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Abstract

Introduction: Perfumes are the cosmetics applied to the skin. Body odor has been shown to be attractive in the fertile days in non-user of contraception. However, contraception pill intake destroy cyclic attractiveness of odors.

Aim: The aim was to test attractiveness and intensiveness of perfume applied to the female skin in course of menstrual cycle.

Material and methods: Diluted vanilla extract was applied on forearm of 18 women (9 women users of contraception and 9 non-users of contraception). Thirty minutes occlusion samples were collected and judged for its attractiveness and intensity by 25 men. Samples were collected at 1st, 8th, 14th, and 22nd day of cyclus.

Results: Attractiveness of smell of perfume in women, which use contraceptive was statistically significantly higher than in non-user. Furthermore, attractiveness of smell at 15th day of menstrual cycle was second best when perfume was applied in women, which use contraceptive.

Conclusions: Perfume on the skin of women, which apply contraceptive, smell better than on non-contraceptive-user skin. Moreover, women body odor together with perfume is highly attractive in contraceptive-user in the middle of the cyclus.

KEYWORDS

attractiveness, menstrual cycle, perfume, skin odor, smell

1 | INTRODUCTION

Perfumes have an integral relationship with cosmetic dermatology as they are cosmetics applied to the skin. In addition, the task of perfume is to increase the attractiveness of a person.

Body odor of women has been shown to be especially attractive in the fertile days in non-user of contraception.^{1,2} However, use of contraception destroy cyclic attractiveness of body odors.¹

On the other hand, it is known that body odor plays an important role in the perception of physical attractiveness and as a regulator of desire, especially around ovulation time.²⁻⁵

The use of perfumes has been rooted in the culture of various continents for millennia.^{6,7} It seems that people are often dissatisfied with their own smell and try to mask it by using perfume. Presumably, the role of perfume is to introduce a new fragrance to increase the attractiveness of the wearer.

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The aim of this study was to examine the expression of perfume applied to the female skin in course of menstrual cycle. For this purpose, we have examined attractiveness and intensity of perfume smell. There are currently no data in the literature that would provide an answer for this question.

2 | MATERIAL AND METHODS

Eighteen women and 25 men participated in the research. Nine of the evaluated women did not use contraception, while a further 9 women were using contraceptives Diane 35 (Bayer) (cyproterone acetate together with ethinylestradiol). The women were 19–38 years old, which means it was reproductive age.

Subjects were asked not to use perfumes, deodorants or lotions for 48 h prior to sampling. The skin at the collection site was not washed for at least 5 h.

Each sampling provided two samples of the smell from every woman: One sample was collected on the left forearm (lower perfume concentration: 0.01% vol/vol in ethanol) and one sample on the right forearm (higher perfume concentration 0.1% vol/vol in ethanol).

On the dry surface of the forearm skin, 20 μ l of vanilla extract: VANILLA HIGH (Synchro, Catalog No.: XPP4052/ET, producer code: 4052SH) was applied in concentrations: 0.01% vol/vol in ethanol or 0.1% vol/vol in ethanol (POCH, catalog No.: 396420113). It was then allowed to evaporate for 15 min and covered with a 5 \times 5 cm gauze bandage and foil occlusion for 30 min. The gauze was sterile and odorless, prepared as in Curran et al.⁸ After this time, the gauze was removed and stored hermetically sealed. Each sample was stored in a separate 25-ml glass jar.

Odor samples were collected once a week on days starting every week of the cycle. It was at 1st, 8th, 15th, and 22nd day of the menstrual cycle. Each of the 25 men aged 23–34 assessed all odor samples obtained from 18 women. For this purpose, they filled in a questionnaire containing an appropriate scale. The questionnaire had two questions concerning (1) the attractiveness of the fragrance and (2) the intensity of the fragrance. Each answer was expressed by putting a dash on the attached stepless scale from 0 to 10 arbitrary units (AU). The worst result was expressed as 0 AU and the best as 10 AU. Each man assessed in one session no more than 5 samples; sessions were separated by at least 1 h break.

2.1 | Statistic evaluation

Mean values of all assessments were calculated for each woman. These average values were used for further statistical analysis. Effects of the use of contraceptives and the phase of menstrual cycle on attractiveness and intensity of smell were estimated using Generalized Linear Models. Due to correlated data (multiple assessments of the same women in different menstrual cycle phases), the generalized estimating equations framework with exchangeable

covariance matrix structure and Huber-White standard error estimates were applied. The IBM SPSS 20.0 Statistics (IBM Corporation, Armonk, NY, USA) program was applied. $p < 0.05$ were acknowledged as statistically significant.

3 | RESULTS

Figure 1A shows the mean changes in the attractiveness of a perfume fragrance on women's skin as measured once a week over the course of the menstrual cycle. It is the average of the measurements of all women participating in the study. The highest value was determined on day 15 of the cycle and was 6.16 AU (+1.36AU). The least attractive odor was measured on day 1 of the cycle and the mean value was 2.72 AU (+1.72AU). Attractiveness of smell of perfume in women, which use contraceptive was statistically significantly higher than in non-user.

The perfume attractiveness on women skin for the whole menstrual cycle by group without contraception and with contraception is pictured in Figure 1B. In the case of women using contraception, the mean perfume scent attractiveness was 4.73 AU (+1.98AU), while for women not using contraception it was 3.68 AU(+2.39AU).

Volatility attractiveness of perfume on the skin of women during the menstrual cycle in patients without contraception is presented in Figure 1C. The highest value of 7.05 AU (+0.24 AU) was observed on the 15th day of the monthly cycle, and the lowest was 1.14 AU (+0.2AU) on the 1st day of the cycle. However, in the case of people using contraception (Figure 1D), the greater attractiveness of the perfume smell is achieved on the 22 day of the cycle at the value of 6.88 AU (+0.41 AU), while the lowest attractiveness of 2.45 AU (+0.28 AU) occurred on the 8th day of the cycle. Furthermore, attractiveness of smell at 15th day of menstrual cycle was second best when perfume was applied in women, which use contraceptive.

The second parameter assessed was the perfume intensity on women's skin during the menstrual cycle. Figure 2A shows the mean change in perfume odor intensity measured weekly over the course of the cycle, which is the average of all women in the study. The highest value was observed on day 22 of the cycle. It was 5.13 AU (+1.71 AU), while the lowest value was on day 1 of the cycle at 2.76 AU (+1.54 AU).

A comparison of the average perfume odor intensity for the entire monthly cycle in women not using contraception and women using contraception is presented in Figure 2B. These are the results of all women participating in the study. The results of both groups are almost identical; people without contraceptives showed the fragrance intensity of 3.89 AU (+1.80 AU), while users of contraceptives had the intensity of 3.80 AU (+1.58 AU).

The variability of the perfume odor intensity on the skin of women during the cycle in people without contraception is presented in Figure 2C. The most intense scent of the perfume was observed on the 22 day of the cycle and it was 5.99 AU (+0.27 AU). The lowest perfume odor intensity was recorded on the first day of the cycle at 1.9 AU (+0.16 AU). Figure 2D shows the variability

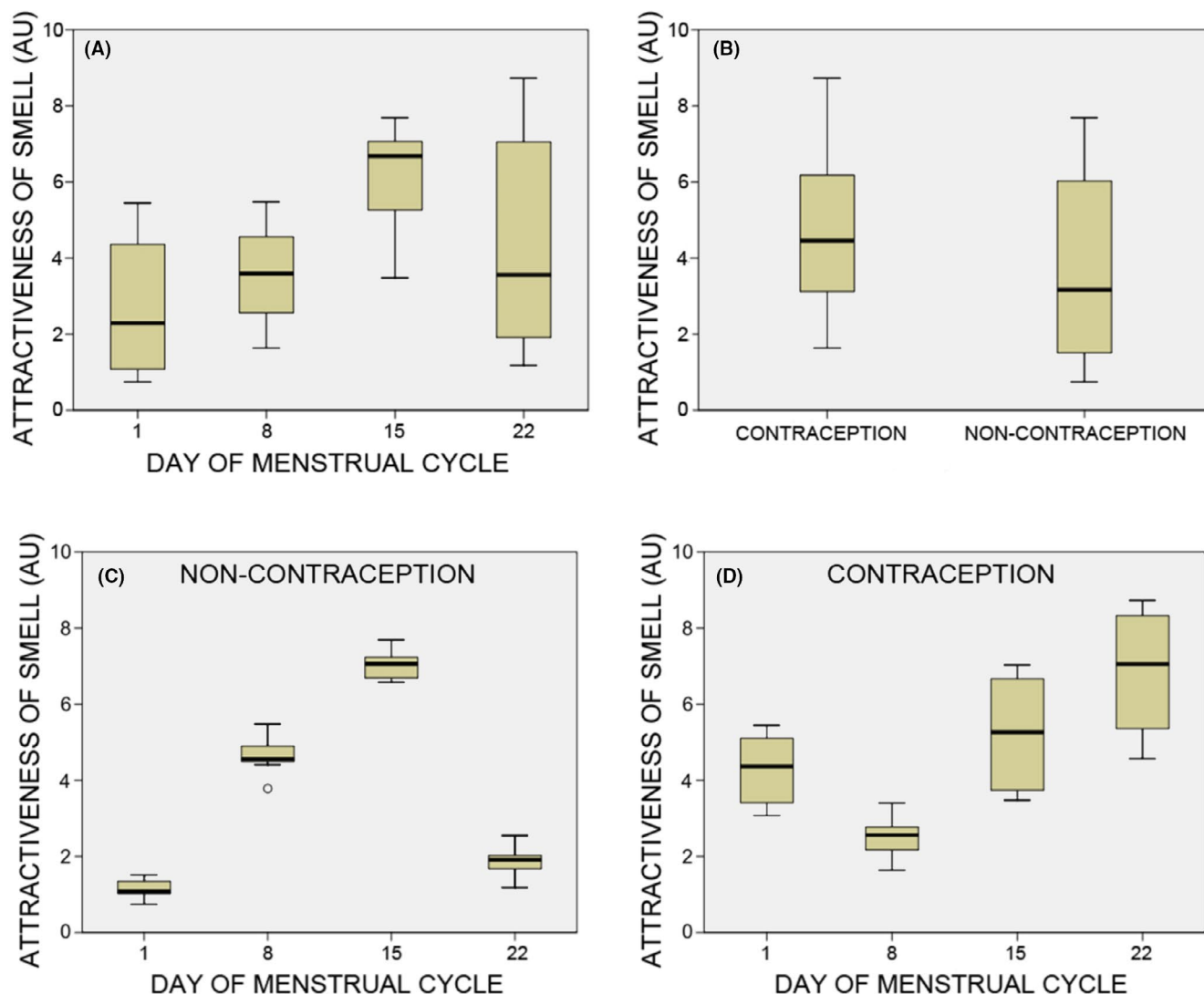


FIGURE 1 (A) Variability of the attractiveness of smell of perfume applied on women skin in course of menstrual cycle. (B) Comparison of attractiveness of smell of perfume applied on skin in course of menstrual cycle in women with or without contraception. (C) Variability of attractiveness of smell of perfume applied on women skin in course of menstrual cycle in women not using contraception. (D) Variability of attractiveness of smell of perfume applied on women skin in course of menstrual cycle in women using contraception. * $p < 0.005$

of the perfume odor intensity in the course of the cycle in women using contraception, the highest on day 23 was 4.25 AU (+ -0.32 AU), and the lowest on the 8 day of the cycle with a value of 3.57 AU (+ -0.28 AU).

Figure 3 shows the dependence of the attractiveness and intensity of a perfume fragrance on women's skin depending on the concentration of the perfume. Figure 3A: With a high concentration of applied perfume (0.1% vol/ vol), the average attractiveness of all subjects was rated at 4.75 AU (+ -2.51 AU), while at a low concentration, the average rating for the attractiveness of perfumes was 3.66 AU (+ -1.81 AU). Figure 3B illustrates the dependence of the fragrance intensity of the perfume on its concentration. At high concentration (0.1% vol / vol), the odor intensity was estimated at 4.91 AU (+ -1.82 AU), and at low concentration (0.01% vol / vol), it was 2.78 AU (+ -1.20 AU).

4 | DISCUSSION

The results of our present study has been shown that perfume together with body odor is most attractive in the fertile days of women. Studies of other authors report similar effect when body odor alone was examined.^{1,2} Others, found comparable phenomenon for body odor alone by measuring the level of hormones in the subjects.^{3,4}

The human body is obviously able to send physiological olfactory signals acting as an attractant or information about the readiness to pair.¹⁻⁵ It is, therefore, a factor that plays an important role in reproduction.

The importance of this issue is evidenced by the studies of other authors, who have shown that olfactory disorders effectively disorganize the functioning of the olfactory system of attractants secreted by the skin and negatively affect sexual life, impairing it by about 29%.

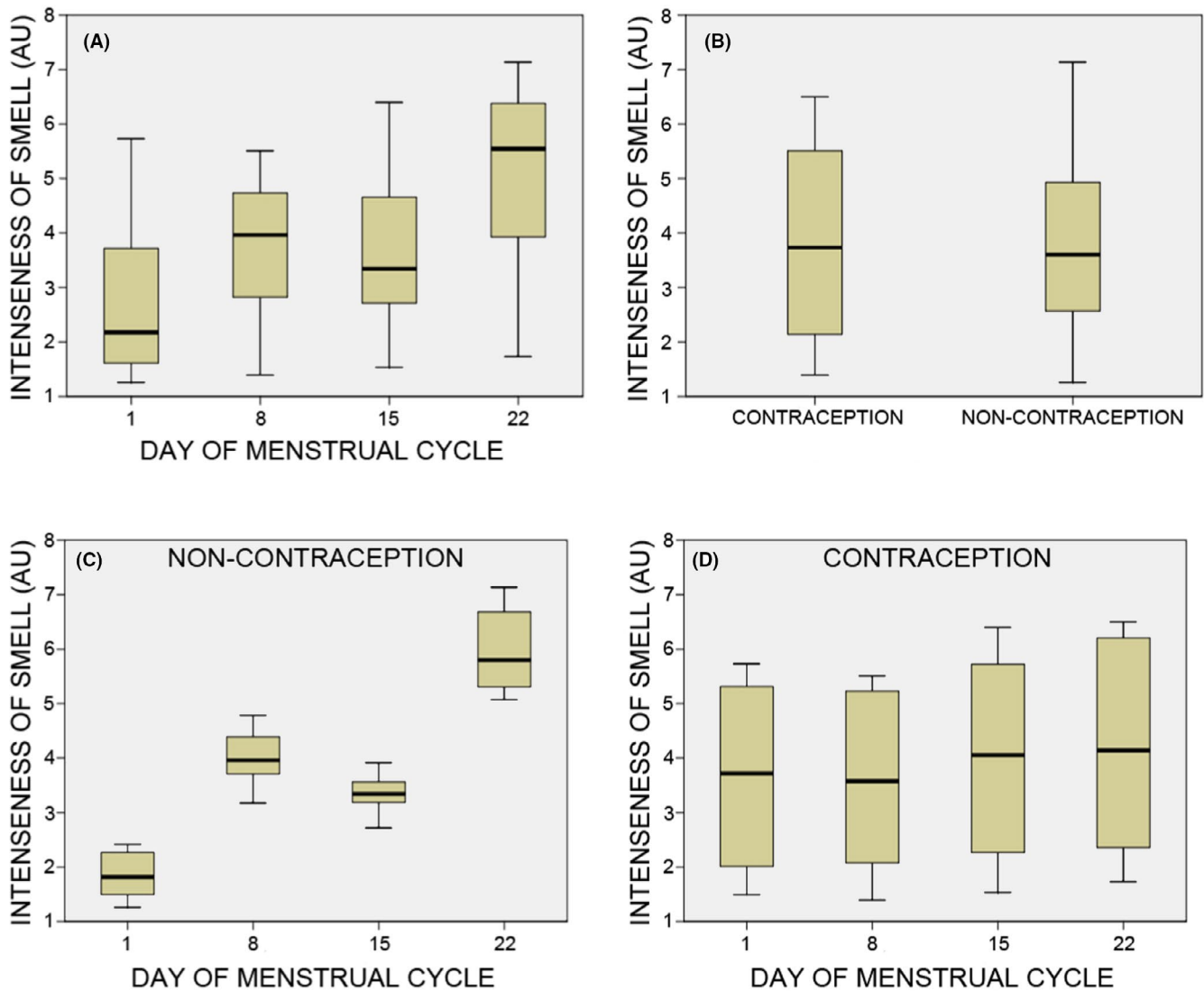


FIGURE 2 (A) Variability of intensiveness of smell of perfume applied on women skin in course of menstrual cycle. (B) Comparison of intensiveness of smell of perfume applied on skin in course of menstrual cycle in women with or without contraception. (C) Variability of intensiveness of smell of perfume applied on women skin in course of menstrual cycle in women not using contraception. (D) Variability of intensiveness of smell of perfume applied on women skin in course of menstrual cycle in women using contraception. * $p < 0.005$

The study performed by Schäfer et al.⁹ 2019 proved that 29% of patients lost their sense of smell and had a decrease in sexual desire.

Our results show, that the high degree of smell attractiveness is independent of using contraceptive. Our findings are in opposite to the results of Kuukasjärvi et al.¹ who reports that intake of contraceptive by subjects demolish the cyclic attractiveness of odors. Their findings indicate especially, that attractiveness of body smell falls down in the middle of the cyclus, in contraception users.¹ Study of Kuukasjärvi concerned body odor alone, while our experiment included additionally perfume component.¹ It can be assumed that the perfume could play the role of scent masking, or at least throw effectively false information into this puzzle.

Our study documented also, that attractiveness of smell in the middle of menstrual cycle is second the best, hence is in high level when perfume is applied in contraceptive users.

Composition of body scent with perfume on smell attractiveness was already examined by Lenochova et al.¹⁰ 2012. She

has shown in men that composition of perfume with own body odor results in excellent attractiveness of smell. It happens particularly when subjects perform individual selection of perfumes. However, work of Lenochova dealt with men, therefore, is not useful to compare with smell attractiveness during women menstrual cycle.

We acknowledge, that the small sample size is a limitation of this study.

This is the first report, showing that attractiveness of perfume in women taking contraceptive was statistically significant better than in non-user of contraception.

5 | CONCLUSIONS

Perfume on the skin of women, which apply contraceptive, smells more attractive than on non-contraceptive-user skin. Moreover,

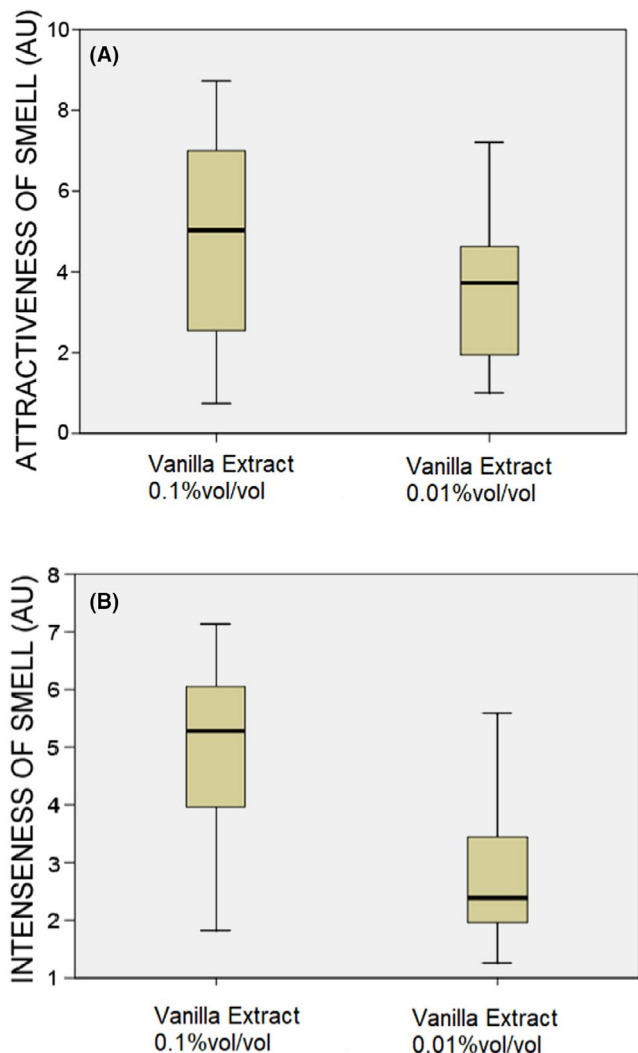


FIGURE 3 (A) Attractiveness of a perfume fragrance on women's skin depending on the concentration of the perfume. (B) Intensiveness of a perfume fragrance on women's skin depending on the concentration of the perfume

women body odor together with perfume is highly attractive in contraceptive-user in the middle of the cyclus.

CONFLICT OF INTEREST

There is no conflict of interest.

AUTHOR CONTRIBUTIONS

Chróst Natalia: design of the study, data acquisition, data analysis, interpretation of data, drafting of the work, revision. Mościcka Patrycja: design of the study, data acquisition, data analysis, interpretation of data, drafting of the work. Pliszka Klaudia: design of the study, data acquisition, data analysis, interpretation of data, drafting of the work. Piskorz Wiktoria Monika: design of the study, data acquisition, data analysis, interpretation of data, drafting of the work. Terlikowski Robert: design of the study, data acquisition, data analysis, interpretation of data, drafting of the work. Jamiołkowski Jacek: design of the study, data acquisition, data analysis, interpretation of

data, statistics, drafting of the work. Przyłipiak Andrzej: design of the study, data acquisition, data analysis, interpretation of data, drafting of the work, revision.

ETHICS STATEMENT

Study was approved by Ethics Commission of Medical University of Białystok with the decision number: APK.002.82.2021. Work was supported by Medical University of Białystok with the Grant number: SUB/1/DN/19/001/2230.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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REFERENCES

1. Kuukasjärvi S, Eriksson CJP, Koskela E, Mappes T, Nissinen K, Rantala MJ. Attractiveness of women's body odors over the menstrual cycle: the role of oral contraceptives and receiver sex. *Behav Ecol*. 2004;15:579-584. [10.1093/beheco/arh050](https://doi.org/10.1093/beheco/arh050)
2. Havlicek J, Dvorakova R, Bartos L, Flegr J. Non-advertized does not mean concealed: body odour changes across the human menstrual cycle. *Ethology*. 2006;112:81-90.
3. Gildersleeve KA, Haselton MG, Larsona CM, Pillsworth EG. Body odor attractiveness as a cue of impending ovulation in women: evidence from a study using hormone-confirmed ovulation. *Horm Behav*. 2012;61:157-166.
4. Lobmaier JS, Fischbacher U, Wirthmüller U, Knoch D. The scent of attractiveness: levels of reproductive hormones explain individual differences in women's body odour. *Proc Biol Sci*. 2018;285(1886):20181520. [10.1098/rspb.2018.1520](https://doi.org/10.1098/rspb.2018.1520)
5. Gildersleeve KA, Haselton MG, Fales MR. Do women's mate preferences change across the ovulatory cycle? A meta-analytic review. *Psychol Bull*. 2014;140(5):1205-1259. [10.1037/a0035438](https://doi.org/10.1037/a0035438)
6. Chróst N, Adamczyk A, Wołosik K, Mościcka P, Przyłipiak A, Galicka E. Historia perfumiarstwa w Azji. *Pol J Cosmetol*. 2019;22:284-287.
7. Adamczyk A, Chróst N, Przyłipiak A, Galicka E. Historia perfumiarstwa w Europie. *Pol J Cosmetol*. 2019;22:103-109.
8. Curran AM, Rabin SI, Prada PA, Furton KG. Comparison of the volatile organic compound present in human odor using DSPME-GC/MS. *J Chem Ecol*. 2005;31:1607-1619. [10.1007/s10886-005-5801-4](https://doi.org/10.1007/s10886-005-5801-4)
9. Schäfer L, Mehler L, Hähner A, Walliczek U, Hummel T, Croy I. Sexual desire after olfactory loss: quantitative and qualitative reports of patients with smell disorder. *Physiol Behav*. 2019;201:64-69.
10. Lenochova P, Vohnoutova P, Roberts SC, Oberzaucher E, Grammer K. Psychology of fragrance use: perception of individual odor and perfume blends reveals a mechanism for idiosyncratic effects on fragrance choice. *PlosONE*. 2012;7:e33810. [10.1371/journal.pone.0033810](https://doi.org/10.1371/journal.pone.0033810)

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