



The Scent of Monogamy: Self-Reported Olfactory Function Predicts Sexual Well-Being and Infidelity in an Italian Population

Anna Blomkvist¹ · Giulia Izzo² · Maria Grazia Vaccaro^{3,4,5} · Sandro La Vignera⁶ · Antonio Brunetti⁷ · Antonio Aversa² · Marco Tullio Liuzza⁴

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Abstract

Previous studies have shown that olfactory function plays an essential role in the bonding of a romantic relationship. Body odors, in particular, seem involved in both mate choices and other intimate behaviors. Our sense of smell is also crucial to detect possible pathogen threats, by activating a suitable disgust reaction. Previous studies have shown that disgust sensitivity is negatively related to sociosexuality, and disgust generally inhibits our sexual drive. In the present study, we explored the possible relation between olfactory function, pathogen disgust sensitivity, sociosexuality, sexual well-being, and infidelity through a web survey. Our exploratory analyses found that, in a large Italian sample ($N = 1107$), among those in a stable relationship, self-reported olfactory function predicted sexual well-being ($p < .05$) and negatively predicted infidelity ($p < .05$) when controlling for other relevant sociodemographics variables. Moreover, the relation between self-reported olfactory function and sexual well-being was mediated by pathogen disgust sensitivity. Although significant, these results must be interpreted with caution, because the effect sizes were small.

Keywords Olfaction · Sexual behavior · Infidelity · Disgust · Sociosexuality

Introduction

The olfactory system is strongly involved in many neuroendocrine pathways and behavioral processes. In particular, olfaction is interwoven in forming and maintaining critical social relations in mammals and humans, such as the child–mother bond (Cernoch & Porter, 1985). Intimacy and closeness to others are central to humans throughout life, and physical or imaginary nearness with attachment figures is essential for regulating emotions, stress management, and positive thoughts (Selcuk et al., 2012). Olfactory signals are considered a part of the sensory feedback mechanisms in the attachment system for young and adult individuals. For instance, during physical separations, people engaged in romantic relationships often refer to smelling their partners' clothes to facilitate feelings of closeness (McBurney et al., 2006; Shoup et al., 2008). A comparable effect of attenuated stress was shown in a study by Hofer et al. (2018), where for women, the scent of a partner lowered their stress level in a social-lab-stress test. In another study, similar stress regulating effects of partners' scent depended on attachment security (Granqvist et al., 2019). In detail, Granqvist et al. found that the body odor of the romantic partner (attachment figure) helped to reduce psychophysiological responses to stress, specifically among relatively secure adults.

✉ Antonio Aversa
aversa@unicz.it

- ¹ Department of Psychology, Stockholm University, Stockholm, Sweden
- ² Department of Experimental and Clinical Medicine “Gaetano Salvatore”, Università degli Studi “Magna Græcia” di Catanzaro, 88100 Catanzaro, Italy
- ³ Neuroscience Research Center, Università Degli Studi “Magna Græcia” di Catanzaro, Catanzaro, Italy
- ⁴ Department of Medical and Surgical Sciences, Università degli Studi “Magna Græcia” di Catanzaro, Catanzaro, Italy
- ⁵ Neuroimaging Research Unit, Institute of Molecular Bioimaging and Physiology, National Research Council, Catanzaro, Italy
- ⁶ Department of Clinical and Experimental Medicine, University of Catania, Catania, Italy
- ⁷ Department of Health Sciences, Università degli Studi “Magna Græcia” di Catanzaro, Catanzaro, Italy

Thus, olfaction appears to be involved in romantic pair bonding and attachment security. This significant role of olfaction in romantic relationships also shows in populations with smell disorders that report significantly less partnership security and independence than healthy controls (Schäfer et al., 2019).

Olfaction and Sex

Besides being a safety cue in romantic relationships, the olfactory system is essential in other dimensions of intimate relationships, such as reproductive behavior and sexual life. This importance is highlighted in studies with populations with a compromised sense of smell. For example, people with a scant sense of smell have fewer social interactions (Boesveldt et al., 2017), report lower sexual satisfaction (Ottaviano et al., 2013), and feel less secure about their current relationship (Croy et al., 2013a). Furthermore, men with rhinologic diseases (e.g., nasal polyps, rhinosinusitis, and allergic rhinitis) complain of reduced erectile function, which improves significantly after treatment (Deng et al., 2020). Also, individuals with smell disorders show an impairment of mood, decreased sexual desire, and fewer social relationships, which possibly heightens patients' depressive symptoms and dependence on partners (for a review, see Croy et al., 2014). Thus, olfaction might influence sexual activity, libido, and arousal in various ways. Another example is that higher olfactory sensitivity has been related to better sexual experience, more sexual pleasure for males and females, and more frequent orgasm for females (Bendas et al., 2018).

Body odors are important influencers for sexual interest in both women and men (Herz & Inzlicht, 2002), thus highlighting their relevance for mating behaviors. Every human has an individual body odor, and the genotype for each body odor is coded within genes in the immune system called major histocompatibility complex (MHC). Previous evidence (Havlíček & Roberts, 2009; Lobmaier et al., 2018) reported that olfactory attractiveness in humans seems to promote mating with people having a dissimilar MHC to obtain an increased pathogen resistance in the progeny. Additionally, sexual communication is found to be moderated by olfactory cues (Lübke & Pause, 2015) and chemosignals (e.g., axillary and/or genital odors) (Cerdá-Molina et al., 2013; Schäfer et al., 2019) to provoke hormonal changes and hypothalamic arousal (Burke et al., 2012). These hormonal changes and hypothalamic arousal affect sexual function and desire. Accordingly, both olfactory ability and specific body odors relate to intimate relationships and sexual behaviors.

Olfaction and Disgust

Humans have evolved a set of psychological mechanisms to detect, react, and avoid potential pathogen threats, named the behavioral immune system (BIS). BIS works as support to our physiological immune system in combating pathogens (Schaller & Park, 2011). Furthermore, the sense of smell works as a

gatekeeper in detecting invisible pathogens (Olsson et al., 2014; Stevenson, 2010) before they come in contact with our bodies, for instance by avoidance behaviors. Especially, olfactory-induced disgust sensitivity is pointed out to be crucial in the BIS (Liuzza et al., 2017). In detail, disgust sensitivity to body odors displays a strong association with perceived vulnerability to disease, even more so than traditional disgust sensitivity measures that place less emphasis on body odors (Liuzza et al., 2017).

A set of studies (Chan et al., 2016, 2020) show that disgust lowers olfactory sensitivity thresholds (i.e., that the dilutions are milder, requiring a higher sensitivity). However, when testing three olfactory tests—discrimination, identification, and threshold with different disgust domains: moral, sexual, pathogen, Prokosch et al. (2021) only found a relation between greater ability to discriminate odors and higher sexual disgust. These results with disgust fit well with olfactory neurological findings, suggesting that unpleasant odors are processed through a direct route in the brain (Croy et al., 2013b), where emotional reactions to unpleasant odors consist of smell-evoked disgust, which is less permeable to top-down influences (Ferdenzi et al., 2013). In addition, smell-evoked disgust is harder to suppress than disgust evoked by visual stimuli (Adolph & Pause, 2012). Thus, olfaction might be the sense more closely connected with the brain areas involved in emotional reactivity (Walliczek-Dworschak & Hummel, 2017), such as disgust reactions.

Present Study

To sum up, a few studies indicate a connection between olfaction and disgust and its potential importance in sexual behavior, especially so when the necessity to avoid diseases is balanced with the motivation to reproduce. However, the association across disgust, sexual behavior, and promiscuity goes in the opposite direction since people with higher disgust sensitivity are less prone to sexual promiscuity to minimize contact with pathogens (Tybur et al., 2009, 2015). Thus, the impact of olfactory-induced disgust on sexual behavior is still poorly understood. On the one hand, a lower olfactory function may relate to reduced disgust promoting sexual promiscuity; on the other hand, a sensory impairment may determine greater alertness, awareness, and vigilance toward pathogen cues and/or greater motivation to avoid containing situations, such as sexual promiscuity.

While recent studies reported links between olfaction and attachment security (Granqvist et al., 2019), sexual function and olfaction (Deng et al., 2020), reproduction and chemosignals (Lübke & Pause, 2015), we are not aware of studies investigating the mere relation between olfaction and fidelity. In their review of romantic relationships and body odors, Mahmut and Croy (2019) conclude that body odors are important for sexual satisfaction, familiarity, and comfort. Mahmut and Croy ended their review with a call for research to explore if and how "a partner's body odor may function to reduce the chances of infidelity by producing strong affectionate emotions toward one's partner, making

them feel physically closer to their absent partner, and/or reduce desire for comfort from others." Thus, as a first step, to expand the current literature regarding olfactory function, sexual function, and interpersonal relationships to questions more specifically about infidelity, we exploratively investigated their connection to disgust in this study. In other words, we aimed to examine the relations between self-reported olfactory function, pathogen disgust sensitivity, sexual well-being, and infidelity with exploratory analyses in an Italian sample.

Method

Participants

In total, 1127 people participated while ten participants were eliminated because they did not subsequently provide informed consent, and 16 participants were eliminated because they did not classify as male or female. Finally, four subjects did not comply with the methodological criteria of this research.

Among the remaining total sample of participants ($N=1107$), 646 identified themselves as female, and 461 identified themselves as males. The sample consisted of subjects between 18 and 70 years and originated mainly from south-central Italy (Calabria, Campania, and Lazio). Participants' sexual orientation was assessed through the Kinsey scale, and the results were divided into heterosexual ($n=941$; 85%) and non-heterosexual ($n=166$; 15%). The majority of our sample reported that they were in a relationship ($n=786$; 71%), and the maximum duration of the relationship was about 30 years (for further information, see Table 1).

Invitation to participate in the study was sent by a link to the authors' social media contacts (such as WhatsApp and Facebook) and advertisement of the research on the "Doctorium Medical Institute" website, a platform designed to find medical specialists on the Web. Participation was voluntary and without payment, and participants received information about the research procedure in an initial online phase. Before beginning the survey, the participants first gave their consent after reading information concerning the study. Both the information and online survey were in Italian. Then the participants completed the online survey in a self-paced manner.

Measures

A brief introduction of sociopersonal data and data of interest to this study, such as infidelity and olfactory function, was conducted before administering the other scales (see Table 1), which assessed sexual functioning, sociosexuality, and attitudes, and disgust sensitivity (for further information, see Appendix 1).

Self-Reported Olfactory Function

We included one question concerning olfactory function. The question was "How do you rate your olfactory capacities?" and the participants needed to answer by choosing one of the five alternatives ranging from "Absent" to "Excellent."

Sexual Functioning, Sexual Attitude Assessment, and Infidelity

We assessed general sexual pleasure, arousal, and desire (frequency/interest) using questions retrieved from the Changes in Sexual Functioning Questionnaire-short form (CSFQ-14; Keller et al., 2006). CSFQ-14 is a self-reported gender-specific questionnaire and valuable to assess global sexual functioning. This questionnaire has been previously described by Emerenziani et al. (2019). We selected and used questions from the female and male versions of the questionnaire and reformulated them to be used in both sexes. We used Items 1–4, 6–8, and 13 as these selected questions refer to sexual pleasure, arousal, and desire.

To assess participants' sexual function, we used only four items of the International Index for Erectile Function (IIEF-15; Rosen et al., 1997) questionnaire regarding intercourse frequency. We also used the pleasure and sexual desire items of the Female Sexual Functioning Index (FSFI; Rosen et al., 2000). Both the IIEF and the FSFI items were reformulated in order to easily be relatable for both sexes, respectively (see supplemental materials).

We used the revised Sociosexual Orientation Inventory (SOI-R; Penke & Asendorpf 2008) because it measures individual differences in the tendency to have casual sexual relationships. We used the SOI-R (nine-item self-report test) to assess three facets of sociosexual orientation: behavior, attitude, and desire (Izzo et al., 2020). According to the SOI-R manual, a high score indicates a less restricted mating strategy, several sex partners, more casual uncommitted sexual intercourse, less time in a relationship before having sex, more likely to have sex with people other than a partner.

We included one question for infidelity. The answering alternatives for the infidelity question; "Are you having affairs/extramarital affairs?" were "Yes, I am having affairs/extramarital affairs," "No, I am not having affairs/extramarital affairs," or "I do not have any relationship." Important to note is that this question involves all relationships, not exclusively marriage and all types of affairs (see supplemental materials).

Disgust Assessment

We administered the Body Odor Disgust Scale (BODS) (Liuzza et al., 2017) to measure sensitivity to six body odors generated

Table 1 Sample demographic characteristics

	Value	Frequency	Proportion
Age	18–25	383	0.346
	26–30	226	0.204
	31–35	162	0.146
	36–40	111	0.100
	41–50	118	0.107
	51–60	77	0.070
	61–70	30	0.027
Education	0–5	2	0.002
	5–13	24	0.022
	13–17	468	0.423
	17	416	0.376
	17>	197	0.178
Gender	F	646	0.584
	M	461	0.416
Town	Village/rural areas	266	0.240
	Small town	409	0.369
	Medium–large city	432	0.390
Occupation	Unemployed	83	0.075
	Worker	561	0.507
	Retired	12	0.011
	Student	451	0.407
Marital status	Unmarried/maiden	706	0.638
	Married	229	0.207
	Cohabiting partners	122	0.110
	Divorced	20	0.018
With child	Yes	245	0.221
	No	862	0.779
Duration of the relationship	< 1 year	162	0.189
	1–2 years	171	0.200
	3–5 years	153	0.179
	6–10 years	175	0.204
	11–20 years	113	0.132
	> 20 years	53	0.062
Sociosexual orientation	Heterosexual	941	0.85
	Non-heterosexual	166	0.15
Sexual relationship	Not having sex with partner	550	0.497
	Having sex	365	0.330
	Not having partner	192	0.173
Extramarital relationships	Not having extramarital relationships	749	0.677
	I do not have any kind of relationship	238	0.215
	I have extramarital relationships	120	0.108
Virtual sex	Yes/sometimes yes	307	0.277
	No	729	0.659
	Almost always	71	0.064
Porn desire	No	535	0.483
	Yes	274	0.248
	Often	298	0.269
Porn material	No	537	0.485
	Sometimes yes	403	0.364
	Often	167	0.151
Sexual addiction	No	712	0.643

Table 1 (continued)

	Value	Frequency	Proportion
	Yes	68	0.061
	A little	327	0.295
Alcohol	Never	183	0.165
	Daily basis	88	0.079
	Occasionally	836	0.755
Smoker	No	677	0.612
	Occasionally	170	0.154
	Yes	260	0.235
Physical activity	Never	117	0.106
	Daily basis	352	0.318
	Occasionally	638	0.576
Drugs	Yes	262	0.237
	No	845	0.763
Positive for Covid-19	Yes	5	0.005
	No	1102	0.995
Covid positive family members	Yes	84	0.076
	No	1023	0.924
Anosmia	Yes	59	0.053
	No	1048	0.947
Anosmia a 4 weeks	Yes	52	0.047
	No	1055	0.953
Daily medicines	Yes	253	0.229
	No	657	0.593
	As needed	197	0.178

by different sources (internal or external): axillary sweat, feet, breath, feces, gas, and urine. In each of the 12 items, participants were asked to indicate to what degree they found the scenario disgusting with a scale ranging from 1 (not disgusting at all) to 5 (extremely disgusting).

Three domains of disgust (TDDS) (Tybur et al., 2009) were used to evaluate three domains of disgust: pathogen, sexual, and moral. The test consists of 21 items, and participants evaluated the extent to which the scenario arouses disgust using a scale ranging from 0 (not at all disgusting) to 6 (extremely disgusting). For both tests, higher scores denote higher levels of disgust sensitivity.

Data Analysis

Data analysis was conducted in R (R Core Team, 2019). We reduced the dimensionality of our data through exploratory factor analysis. To decide the number of factors to extract, we conducted a parallel test (principal axis method, maximum likelihood estimation method) on the polychoric correlation matrix since we were dealing with items measured on an ordinal scale. However, we also assessed the number of factors that had an eigenvalue > 1,

and we evaluated the scree plot. Also, we decided to rotate the factor solution using oblimin rotation, as we assumed that the constructs were unlikely orthogonal.

Zero-order correlations were estimated through Spearman's rho rank correlation coefficient accordingly, as some of the variables were measured at an ordinal scale level. To test the effects of the independent variables on the dependent variables, we ran linear models adding age class, gender, town size, and education as covariates. To test the effects of our independent variables of infidelity, we ran a generalized linear model (family = binomial, link function = logit).

Results

Demographic Characteristics

Participants' demographic characteristics are shown further in Table 1. Our sample mainly consisted of participants who were unmarried ($n = 706$; 64%) and without children ($n = 862$; 78%); however, many reported to be in a relationship ($n = 786$, 71%). Most of the participants in a relationship did not/nor had sex

with partner ($n=550$; 50%), were not cheating ($n=684$; 90% among the respondents), nor virtual sex ($n=541$; 69%) at the time of the survey. Concerning porn consumption, almost half of the participants ($n=535$; 48%) declared to have no porn desire, and similarly, almost half ($n=537$; 48.5%) did not watch pornographic material, a smaller proportion of the sample ($n=403$; 36%) watched pornographic material habitually, and a smaller proportion ($n=167$; 15%) watched occasionally. Concerning addictions, approximately a third of the sample ($n=327$; 29%) felt addicted to sex. Most of the participants did not take drugs ($n=845$; 73%) and did not take daily medicines ($n=657$; 59%); furthermore, only a few subjects stated to have hypo/anosmia and to be positive/ to have relatives positive to Covid-19.

Self-Reported Olfactory Function

In general, participants reported to have an average good sense of smell ($M=3.89$, $SD=0.97$, $Min=0$, $Max=5$). There was a significant difference in self-reported olfactory function between the individuals in a committed relationship ($M=3.93$, $SD=0.97$) and singles ($M=3.76$, $SD=0.95$), $t(606)=-2.67$, $p=.008$, $d=-.18$). This effect remained significant even when controlling for all the sociodemographic factors that could have an effect on smell ($p=.001$). There was no significant difference in olfactory function between women ($M=3.91$, $SD=0.96$) and men ($M=3.83$, $SD=0.99$), $t(971)=1.7$, $p=.09$, $d=-.01$.

Exploratory Factor Analysis

The parallel test results suggested an 11-factor solution, while the eigenvalues-based criterion suggested a seven-factor solution. The analysis indicated a four-factor solution (see scree plot as Fig. 1 in Appendix 2), which produces a more parsimonious solution whose results align with theoretical expectations. For this purpose, we conducted a factorial analysis (principal axis method with oblimin rotation, maximum likelihood estimation method) since it appears likely that some of the factors may be related to each other. This solution explained 38% of the variance. The saturation matrix (see pattern matrix as Table 1 in Appendix 2) illustrates the result that the variables are grouped substantially into the following factors:

1. *Pathogen disgust sensitivity*, saturated by the items of the BODS (e.g., "You are close to a stranger and you notice that the shirt that he/she is wearing it smells strongly of his own sweat") and of the pathogenic subscale of the TDDS (e.g., "Seeing mold on old leftovers in one's refrigerator").
2. *Sociosexuality*, positively saturated by SOI items (e.g., "Sex without love is OK.") and negatively from the items in the sexual subscale of the TDDS (e.g., "practicing oral sex").
3. *Sexual well-being*, saturated with items related to sexual well-being in the last four weeks (e.g., "In the last 4 weeks,

when you tried to have sex, how many times have you been able to have a full relationship with your partner?").

4. *Moral disgust sensitivity*, saturated by the items of the moral subscale of the TDDS (e.g., "Intentionally lying during a commercial transaction.")

We then created factorial scores (regression method) and focused our analysis directly on those scores. Indeed, this scoring procedure does not rest on the often untenable assumption of a parallel form for the measurement model (McNeish & Wolf, 2020).

Sexual Well-Being

The effect of self-reported olfactory function on sexual well-being was significant even when controlling for other potentially confounding demographic factors ($B=0.07$, $SE=0.03$, $t(968)=2.22$, $p=.02$). Self-reported olfactory function was also significant when compared with pathogen disgust sensitivity ($B=0.10$, $SE=0.03$, $t(968)=3.112$, $p<.01$). We further tested whether pathogen disgust sensitivity mediated the relationship between self-reported olfactory function and sexual well-being. To this purpose, we conducted mediational analyses through the mediation R package (Imai et al., 2010) using a quasi-Bayesian Monte Carlo method based on normal approximation. The results indicated that the relationship between self-reported olfactory function and sexual well-being was fully mediated by pathogen disgust sensitivity (Fig. 1; 95% CI = [0.003, 0.02]).

We also built and tested five different explanation models to evaluate how good sexual well-being was accounted for by the different factors. We tested five models (main effect of olfaction, main effect of moral disgust sensitivity, the effect of moral disgust sensitivity + olfaction, the effect of moral disgust sensitivity + pathogen disgust sensitivity, and lastly, the main effect of olfaction + moral disgust sensitivity + pathogen disgust sensitivity). All models included demographic variables (age, gender, education level, and living area). Using the Akaike Information Criterion (Akaike, 1974), we could evaluate how well the models' prediction accuracy. The best fit model was the last one, including all parameters; olfaction + moral disgust sensitivity + pathogen

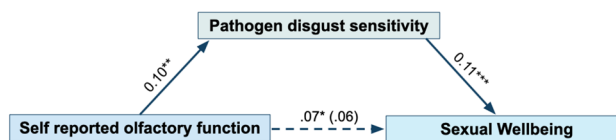


Fig. 1 Mediation analysis. Note $*p \leq .05$, $**p \leq .01$, $***p \leq .001$. Values represent standardized parameter estimates for each path. Numbers in parentheses represent the coefficients when Pathogen disgust sensitivity was entered into the analyses. The dashed line indicates that the direct path is significantly mediated by the indirect path, i.e., its estimated confidence intervals do not include zero; 95% CI = [0.008; 0.136]

disgust sensitivity, and the sociodemographic variables. Among the variables in the best fitted model, the ones that displayed a significant relationship with sexual well-being were pathogen disgust sensitivity ($b=0.11$, $SE=0.03$, $p<.001$), age ($b=0.05$, $SE=0.02$, $p=.016$), and gender ($b=0.23$, $SE=0.07$, $p<.001$).

Infidelity

In this analysis, only subjects reporting to be in a relationship ($n=786$, 71%) were included. Most of them reported to not cheat ($n=684$; 90%). Our results indicate that self-reported olfactory function significantly decreases the likelihood of having an extramarital affair ($OR: 0.78$, $z=-2.12$, $p=.03$). Unsurprisingly, the likelihood of having an extramarital relationship significantly increases as a function of sociosexuality ($OR: 2.71$, $z=5.26$, $p<.001$). However, sociosexuality was not significantly predicted by self-reported olfactory function, when controlling for sociodemographic variables ($B=-0.02$, $SE=0.03$, $p=.49$). Therefore, we cannot hypothesize that sociosexuality could mediate the relationship between self-reported olfactory function and infidelity (Table 2).

To explore the hypothesis that moral disgust sensitivity could also have a role in predicting cheating, we also tested moral disgust sensitivity and found a relation between them. Thus, a higher moral disgust sensitivity decreased the likelihood of cheating ($OR=0.61$, $z=-4.1$, $p<.001$).

Discussion

This exploratory study aimed to investigate the possible relations between self-reported olfactory function, pathogen disgust sensitivity, sexual well-being, and infidelity among an Italian population using an online survey. Our first finding that self-reported olfactory function predicts sexual well-being confirms that sex is more than just one sensory input. It is a combination of all senses: vision, auditory, tactile, taste, and olfaction. This multimodal idea of attractiveness is also established in a recent review by

Groyecka et al. (2017). Thus, the higher ability to include olfaction in the act of sex (measured in our study by a self-reported olfactory function score), the more well-being or rating of sexual wellness is likely to occur. To have this ability to include and be aware of olfactory sensory input (i.e., odor awareness) in intimacy and bonding behaviors between romantic partners has been indicated in earlier studies (for a review, see Mahmut & Croy, 2019) as a benefit. In addition, we extend previous studies concerning mother and child bonding (Cernoch & Porter, 1985) by showing that this type of odor awareness benefits seems essential in intimate relationships with romantic partners in adult life. Our finding also reflects earlier studies concerning romantic attachment. A romantic partner could work as a platform for safety and comfort and a companion in adventures. This suggests that your partner's scent is a scent of security and comfort at a moment of stress (Granqvist et al., 2019) or separation (McBurney et al., 2006; Shoup et al., 2008). The ability to recognize and be aware of this scent of security is fundamental for relational outcomes such as sexual well-being.

Next, the first finding with self-reported olfactory function and sexual well-being is mediated by pathogen disgust sensitivity. To our knowledge, this is the first study to report such mediation, and it theoretically corresponds with earlier findings. For example, previous studies found that individuals with higher disgust sensitivity tend to report less tendency toward sexual promiscuity, probably to minimize contact with pathogens (Tybur et al., 2009, 2015). By contrast, another study has found a relationship between olfactory discrimination and sexual disgust, but not pathogen or moral disgust (Prokosch et al., 2021). Regardless of the measures used, we extended these findings to show that it is especially disgust sensitivity to pathogens and body odors that connect with sexual promiscuity and self-reported olfactory function.

The following finding of our study was related to infidelity. We found herein that higher levels of self-reported olfactory function predicted a decrease in infidelity. These results are consistent with our previous findings where we investigated another variable, muscular performance, and found that it is positively

Table 2 Spearman's rank correlation coefficients for central variables

Variable	1	2	3	4	5	6	7	8
1. Pathogen disgust sensitivity	–	–0.15*	0.08*	0.2*	0.13*	n.s	–0.12*	–0.09*
2. Sociosexuality		–	n.s	–0.26*	–0.07*	0.07*	n.s	n.s
3. Sexual well-being			–	0.09*	0.08*	0.07*	0.16*	0.09*
4. Moral disgust sensitivity				–	0.11*	n.s	0.19*	0.07*
5. Self-reported olfactory function					–	n.s	n.s	n.s
6. TOWnum						–	0.17*	0.17*
7. AGEnum							–	0.37*
8. EDUnum								–

* $p>.05$. n.s means nonsignificant, thus that the p value $>.05$ (Bonferroni corrected). The acronym TOWNnum concerns which living area out of the three options (village/rural areas, small town, medium–large city) and EDUnum stands for level of education and lastly AGEnum stands for the age in years

associated with a greater tendency to have occasional relationships and many sexual partners across genders (Izzo et al., 2020).

A recent study has also shown that axillary sweats by anxious persons signal prime defensive behavior in prepubertal girls (Lübke et al., 2017). We also know that the scent of disease and human body odor contain chemosensory cues of sickness (Olsson et al., 2014). At the same time, studies have shown that evaluation of body odors can reveal personality traits (Sorokowska, 2013; Sorokowska et al., 2012) and perceive sick individuals as less likable (Sarolidou et al., 2020). Thus, based on our findings, we suggest that there may also be a monogamy scent, a scent of the one and only romantic partner. The attachment literature describes this idea about the one and only romantic partner well by attachment behavior system. The romantic pair-bonding formation can be conceptualized in three behavioral systems discussed by Bowlby (1982): attachment, caregiving, and reproduction (Mikulincer & Shaver, 2016). It is possible that the romantic partner (triggered by scent) may signal caregiving, safety, comfort, and, foremost, reproduction behavior, i.e., sexual behavior. Thus, the partner's scent should cue the entire relationship if in a secure and stable relationship. Previous findings have shown that compared with men, women are more sensitive to odors in the context of sexual responses (Alves-Oliveira et al., 2018). Thus, this suggests the existence of gender-specific effects, with women's perceived genital arousal being modulated by the presence of body odors, and different central pathways triggered in human sexual response (Alves-Oliveira et al., 2018). In other words, the partner's scent could be a part of the individual's internal working model. The attachment literature discusses this latter as a model of behaving and interacting with others (Mikulincer & Shaver, 2016). By accumulating schemas, individuals create a model of how to act with others, especially in close relationships. As internal working models often are implicit, subconscious, and involve memories and expectations, we suggest that the partner's scent could be a part of this internal working model to guide our behavior in several different ways, for example, in moral decisions.

Lastly, we also found that moral disgust sensitivity was related to infidelity and sexual well-being. We can argue that higher morality, in general, would lead to a decrease in cheating. An example of a moral decision in the sexual behavior domain is a study where both women and men who had lower acceptance for pornography experienced lower relationship satisfaction when exposed to more pornography use (Maas et al., 2018). Another example of how sexual behavior and moral decisions are related to perception of others and ourselves is the study by McAllister et al. (2020). They showed that higher levels of self-reported relationship sanctification (i.e., the concept that the relationship itself is sacred) were associated with a lower likelihood of emotional and physical cheating (McAllister et al., 2020). Altogether, these studies suggest that the way of living, how to behave and treat others, is connected to personal constructs and cognition (internal working models). According to us, this includes morals of faithfulness and infidelity behaviors. As previously stated, the

internal working model is a model of accumulating schemas of behavior, presumably including scent cues. Accordingly, self-reported olfactory function (the ability to detect the scent of one's partner/ odor awareness) negatively predicts infidelity (the way one behaves and treats one's partner) and leads us to hypothesize that a "scent of monogamy" could explain this model.

Limitations, Strengths, and Future Directions

We are aware that our study has limitations. One such limitation is the cross-sectional design with self-reported data. Although widely used in studies concerning sensitive topics such as intimate romantic relationships and infidelity, it brings a potential lack of control and bias of social desirability. In comparison, Prokosch et al. (2021) use the Sniffin' Sticks Test (SST; Hummel et al., 1997) to investigate olfactory acuity and disgust. As self-reported olfactory function measures and objective olfaction measures are poorly correlated (Landis et al., 2003), we suggest that future work should use a mixed method to reveal all possible subtle effects of olfactory function that may or may not be aware to participants. Perhaps our results point to a higher-order cognitive process to account for variance in our self-reported variables more so than actual abilities. However, speculative at this point, we leave these exciting research questions to future studies.

Gender differences in perceived body odors and their relationship to bonding and sexual intimacy may be accounted for by some of our results and need to be better explored and confirmed by targeted studies. Previous studies reported gender differences in dispositions toward experiencing disgust, mainly in the domain of sexual disgust (Liuzza et al., 2017, 2019). In particular, women typically outperform men in olfactory function tests (especially sensitivity) and, consequently, show higher disgust levels (Sorokowski et al., 2019). We did not split our analysis by gender. Thus, it could be of great value for future studies to include gender analysis to disentangle potential differences concerning sexual behavior driven by gender-dependent hormones and their connection to olfactory function. A similar topic is how sexual disgust sensitivity and moral disgust sensitivity could be related to sexual morality measures and behaviors beyond infidelity. We suggest future studies to investigate these pertinent questions, perhaps with gender-centered research questions.

Another limitation was our time for data collection during the pandemic of Covid-19. First, knowledge from earlier studies states that seeking safety cues occurs when an individual is stressed, such as smelling partners' clothing to facilitate closeness feelings (McBurney et al., 2006). By collecting data from a time when stress levels among the Italian population might have increased due to the pandemic, attention to safety cues such as sniffing clothing and staying near loved ones might also have been increased. The second, established as a part of the early signs of being infected by Covid-19, is to experience a loss of sense of smell (Giacomelli et al., 2020). By collecting data during such a particular time, perhaps individuals are more aware

of their olfactory function. Thus, this might be at the same time a limitation and a strength of our study; our participants might be more alerted about their olfactory function and report a more honest and accurate rating about their olfactory function. Third, since we measured disgust and particular pathogens, we also considered it a concern to collect data in the Covid-19 pandemic timeframe since the message from both authorities and media was to be cautious of pathogens and contamination. Finally, infidelity might have decreased during Covid-19 as a reaction to the restrictions. This question of infidelity is indeed something that we suggest in future studies to investigate in depth.

Conclusions

The integrity of the olfactory system provides lower stress levels and alerts us about pathogens, but can also carry out important information about sexuality, mate choices, avoidance, and anxiety (for an overview, see Lübke & Pause, 2015). In this study, we highlighted the importance of olfactory function and discussed how scents can guide interpersonal behaviors. We found that infidelity and sexual well-being are both related to self-reported olfactory function and moral disgust sensitivity. In addition, we found that pathogen disgust sensitivity mediated the relationship between self-reported olfactory function and sexual well-being. Lastly, we encourage future studies to include even larger samples when investigating the relationship between olfactory function, pathogen disgust sensitivity, infidelity, and sexual well-being. Although our results are statistically significant it is worth emphasizing that the effect sizes are small, and therefore the practical impact of our findings might be quite limited.

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Declarations

Ethical Approval The procedure followed was approved by the Ethics Committee in accordance with the Declaration of Helsinki of the World Medical Association.

Conflict of interest The authors has nothing to declare.

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