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Hyposmia and Disgust: Gender-Specific Effects

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Abstract

Reduced olfactory function is associated with altered trait disgust in men. This study sought to determine whether hyposmic women show similar changes in disgust responsiveness. We compared patients with hyposmia (25 men, 23 women) and 50 normosmic individuals (25 men, 25 women) with regard to their tendency to experience disgust across different disgust domains (disgust proneness), their self-disgust and their tendency to perceive their own disgust feelings as difficult to control and embarrassing (disgust sensitivity). We replicated the finding that male patients reported elevated self-disgust and disgust proneness toward a specific disgust domain (poor hygiene), whereas female patients obtained comparable disgust scores as the female control group. Both men and women of the patient group indicated disgust regulation difficulties in social contexts. In conclusion, we found greater changes in trait disgust in men with hyposmia. This gender-specific effect, which might be a result of more efficient compensatory behaviors in women, needs further investigation.

Key words: gender differences, hyposmia, trait disgust

Introduction

Olfaction is involved in basic behavioral systems, such as food intake, mate choice/sexuality, and health protection (e.g., warning of environmental hazards such as fire or microbial threats). Moreover, affective perception and experience is modulated by olfactory input (for a review see Stevenson 2010; Soudry et al. 2011).

Approximately 20% of the general population exhibit a reduced sense of smell (Murphy et al. 2002), which can take the form of a complete loss (anosmia) or a decreased sensitivity to some or all odorants (hyposmia). Several studies have begun to shed light on the consequences of such olfactory dysfunctions for the above mentioned functions (for a review see Croy et al. 2014). There is evidence that quality of life is impaired in patients with acquired hyposmia, who have an elevated risk to develop depressive symptoms (e.g., Deems et al. 1991; Faulcon et al. 1999). In a questionnaire study by Frasnelli and Hummel (2005), hyposmic and anosmic patients reported more daily life complaints compared to normosmic individuals. Croy et al. (2012, 2013) investigated patients, who were born without a sense of smell (congenital anosmia). These patients showed enhanced social insecurity and increased risk for depressive symptoms.

Beyond these general affective changes, systematic investigations of specific emotional dysfunctions due to a complete or partial loss of olfactory sensitivity are still rare. In a questionnaire study by Ille et al. (2016) anosmic and hyposmic men answered a self-report measure on disgust proneness (Schienle et al. 2002), which assesses the tendency of an individual to experience disgust to 5 different domains (death/deformation, spoilage/decay, unusual food, poor hygiene, and body secretions). The patients obtained lower scores on the questionnaire subscale "spoilage/decay" and higher scores on the subscale "poor hygiene" relative to normosmic men. The an/hyposmic men felt less disgusted by spoiled food (e.g., sour milk), but were more sensitive to signs of poor personal hygiene of other people (e.g., greasy hair, dirty fingernails). Another trait facet of disgust, self-disgust, was also enhanced in the patient group. Self-disgust is a personality trait which is characterized by a strong dislike of yourself, including bodily features (Schienle et al. 2014).

Since data of an exclusively male sample were analyzed, it remains open whether women with hyposmia show similar changes in their disgust responsiveness. Therefore, in the present investigation male and female hyposmic patients answered various self-report measures on disgust responsiveness: 1) disgust proneness: temporally stable tendency to experience disgust across different situations (Schienle et al. 2002), 2) disgust sensitivity: tendency to perceive one's own disgust feelings as uncontrollable (Schienle et al. 2010), and 3) self-disgust: tendency to feel revulsion and abhorrence at the self (Schienle et al. 2014). In healthy populations, women generally report greater disgust proneness than men, although the effect is small (e.g., Schienle et al. 2002; Olatunji et al. 2009). Gender differences in self-disgust and disgust sensitivity have not been identified consistently (e.g., Schienle et al. 2010, 2014). Based on these findings, we expected comparable changes in trait disgust in hyposmic men and women.

Materials and methods

Subjects

Forty-eight patients with hyposmia (HYP) and 50 normosmic subjects (NORM) participated in the study. The HYP group consisted of 25 males (mean age: *M* = 37.32 years, SD = 10.40) and 23 women (*M* = 43.8 years, SD = 9.18). The NORM group was comprised of 25 men (*M* = 35.00 years, SD = 8.71) and 25 women (*M* = 35.72 years, SD = 8.87). Years of education were comparable in patients (*M* = 12.5 years, SD = 3.47) and controls (*M* = 13.6 years, SD = 3.72). Causes of olfactory dysfunction were categorized as follows: sinunasal (e.g., nasal polyps): 19 patients (39.6%), non-sinunasal post-traumatic (e.g., cranio-cerebral trauma): 15 patients (31.3%), non-sinunasal postviral (e.g., influenza infection): 1 patient (2.1%) and non-sinunasal idiopathic: 13 patients (27.1%). For the patients, the mean duration of olfactory impairment was 63 months (SD = 83). The duration and degree of olfactory dysfunction (olfactory threshold, odor discrimination/classification) did not differ between male and female patients (see Table 1).

Written informed consent was obtained from each individual. All patients had been recruited and diagnosed by specialists of the Department of Otorhinolaryngology at the University Hospital of Graz (Austria). The control subjects had been recruited via advertisements at the psychology department of the University of Graz or were patients at the University Hospital who were screened for olfactory dysfunction, but were diagnosed as normosmic.

The study was carried out in accordance with the Declaration of Helsinki and had been approved by the ethics committee of the Medical University of Graz (approval number 26–517 ex 13/14). Exclusion criteria for both groups were neurological and mental disorders, alcohol/ drug abuse (as assured by a standardized clinical interview, Margraf 1994, duration: approximately 15 min), smoking and pregnancy.

Questionnaires

All participants answered 3 disgust questionnaires (duration: approximately 20 min):

(1) The Questionnaire for the Assessment of Disgust Proneness (QADP, Schienle et al. 2002) describes 37 situations, which have to be judged on 5-point scales with regard to the experienced disgust (0, "not disgusting"; 4, "very disgusting"). The 5 subscales are 1) death/deformation (e.g., "Accidentally, you touched the stump of an arm-amputated man"), 2) body secretions (e.g., "Someone intensively smelling of sweat takes seat next to you in the bus"), 3) spoilage/decay (e.g., "During a walk through the forest you see a carcass"), 4) poor hygiene (e.g., "You touch the toilet seat with part of your body in a public restroom"), and 5) unusual food (e.g., "You bite into a grilled grasshopper"). The Cronbach's alpha of the total scale was 0.90 in the present sample (and 0.90 in the construction sample).

(2) The scale for the Assessment of Disgust Sensitivity (SADS, Schienle et al., 2010) consists of 7 items addressing the appraisal of one's own disgust feelings (e.g., "I am afraid that I will not be able to suppress my disgust feelings and get negative attention"). The Cronbach's alpha of the scale was 0.85/0.83 (construction/present sample).

(3) The subscale "personal disgust" (9 items) of the Questionnaire for the Assessment of Self-Disgust (QASD, Schienle et al. 2014) assesses experienced disgust because of one's own physical appearance and personality (e.g., "I find myself repulsive"). The items have to be judged on 5-point scales (0 = "not true at all"; 4 = "absolutely true"). Measurement accuracy (Guttman's $\lambda 4$) was 0.86 in the construction sample and 0.87 in the present sample.

Olfactory measurement

Olfactory function was assessed by means of the extended sniffin' sticks test battery (Burghart Ltd. Instruments, Wedel, Germany), which is a clinically approved test of olfactory function including threshold, discrimination and identification (Hummel et al. 2007). The odorants were presented to the blind-folded participants with pen-like odor dispensing devices. The olfactory detection threshold was assessed with *n*-butanol, which was presented in 16 dilutions in a staircase, 3-alternative, forced-choice procedure. Odor discrimination ability was obtained by presenting 16 triplets of odorant pens (2 pens contain the same odorant; the third pen contains a different odorant). The participants' task was to detect the different odor. Odor identification was assessed by means of 16 common odors (e.g., coffee). Subjects identified the odors by selecting the best label from a list of 4 descriptors. Possible scores for the detection threshold range between 1 and 16 (with higher scores indexing lower thresholds), and for the other 2 subtests between 0 and 16. The scores for all 3 subtests were summed to obtain the threshold detection identification (TDI) score with a maximum value of 48.

Table 1. Olfactory function (mean, SD)

	Hyposmic patients		Normosmic controls	
	Men	Women	Men	Women
Threshold	2.37 (2.08)	2.45 (1.85)	8.57 (2.07)	7.68 (3.02)
Discrimination	7.56 (3.43)	7.52 (3.32)	12.92 (1.47)	14.44 (1.16)
Identification	7.04 (4.15)	7.26 (3.47)	13.12 (1.39)	13.68 (1.55)
TDI score	16.97 (8.52)	17.18 (7.67)	34.60 (2.71)	35.80 (3.01)

TDI scores between 48 and 31 are classified as normosmia, values between 30 and 16 index hyposima.

Statistical analysis

All statistical analyses were carried out using SPSS 22.0 for Windows. We computed univariate ANOVAs with the factors Group (NORM, HYP), and Gender (male, female) for the comparison of the sniffin' sticks test and questionnaire scores. We report Cohen's d as effect size measure. Alpha level significance was set at 0.05 for all statistical tests. In addition, we computed exploratory correlation analyses to investigate associations between olfactory performance and trait disgust.

Results

Olfactory performance

The analyses of variance revealed positive main effects of Group for olfactory threshold ($F(1,94) = 150.11$, $P < .001$; Cohen's $d = 2.50$), discrimination ($F(1,94) = 142.59$, $P < .001$; $d = 2.44$), and identification F (1,94) = 114.95, $P < 0.001$; $d = 2.19$). Hyposmic patients had lower scores (see Table 1). This also referred to the total TDI score ($F(1,94) = 220.19$, $P < 0.001$; $d = 3.03$). All other effects were non-significant.

Disgust measures

Disgust proneness

We found a significant group × gender interaction for disgust proneness (QADP) toward poor hygiene ($F(1,94) = 6.31$, $P = 0.014$; Cohen's $d = 0.51$), and a marginally significant main effect for gender ($F(1,94) = 3.86$, $P = 0.052$; Cohen's $d = 0.40$). The Group effect was non-significant ($F(1,94) = 1.93$, $P = 0.168$). Male hyposmic patients reported higher disgust proneness towards poor hygiene ($t(48) = 2.94$, $P = .005$; $d = 0.83$) compared to male controls. Female hyposmic patients and female controls did not differ in hygiene-related disgust ($t(48) = 0.75$, $P = 0.459$). Furthermore, the Gender effect reached statistical significance for the subscales body secretions ($F(1,94) = 5.92$, $P = 0.017$; $d = 0.50$), oral rejection ($F(1,94) = 14.45$, $P < 0.001$; $d = 0.78$), and for the total QADP ($F(1,94) = 8.57$, $P = 0.004$; $d = 0.60$) with higher scores in women. Main effects for group and gender as well as interaction effects for the other subscales were not significant (all P's > 0.149). The results are displayed in Figure 1.

Self-disgust

The analysis of variance revealed a significant group effect ($F(1,94) = 5.08$, $P = .027$; $d = 0.46$), and a marginally significant interaction for group × gender ($F(1,94) = 3.06$, $P = 0.083$). Hyposmic male patients reported higher self-disgust than male controls ($t(27.8) = 3.42$, $P = 0.003$; $d = 0.97$), whereas the 2 female groups did not differ from each other ($P = 0.690$).

Disgust sensitivity

We found a significant group effect ($F(1,94) = 5.06$, $P = .027$; $d = 0.46$). Hyposmic patients reported more difficulties in disgust regulation (HYP: $M = 0.72$, SD = 0.64; NORM: $M = 0.47$, SD = 0.43; $t(95) = 2.31$, $P = 0.023$). All other effects were non-significant.

Finally, we conducted exploratory correlation analyses separately for the hyposmic and the normosmic group in order to investigate associations between olfactory performance and the scores on the disgust scales. Whereas all coefficients were non-significant in the hyposmic group (all P's > 0.223), in the control group the TDI score positively correlated with the reported disgust proneness (QADP: total score, death/deformation, unusual food, spoilage/decay; see Table 2).

Discussion

This questionnaire study investigated gender-specific effects on trait disgust in patients with hyposmia. We were able to replicate our previous finding on elevated self-disgust in men with this type of quantitative olfactory dysfunction (Ille et al. 2016). The odor of one's own body is part of our identity and self-concept, because we all have our own unique smell. Individuals perceive their own body odor as more positive than the odor of others (e.g., Stevenson and Repacholi 2005). Thus, there is acceptance of one's own body odor, and due to a lack of such information self-acceptance might be reduced. In addition, we had suggested previously that not being able to smell oneself might lead to reduced self-confidence, enhanced social insecurity, and fear of social rejection (Ille et al. 2016). Self-disgust is strongly associated with feelings of rejection by others. Self-loathing

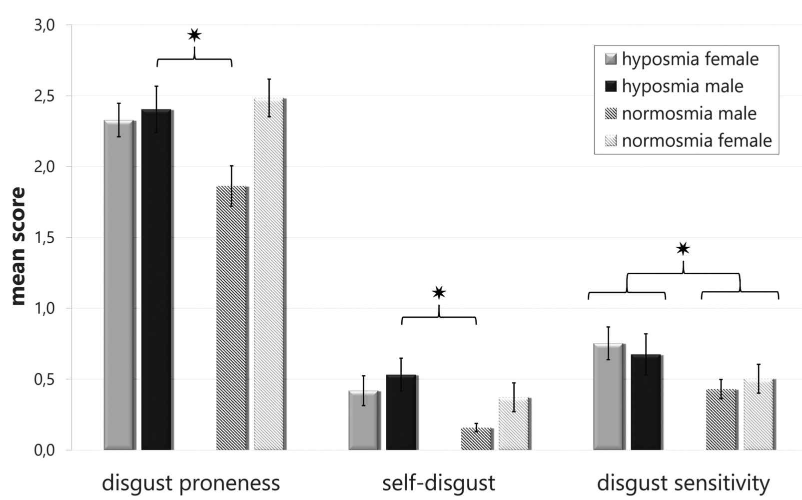

Figure 1. Differences in disgust proneness (toward poor hygiene), self-disgust, and disgust sensitivity (M, SD) between hyposmic patients and normosmic controls.

Table 2. Correlations between olfactory function and trait disgust in normosmic controls

r (*p*)	Threshold	Discrimination	Identification	TDI score
Disgust proneness total score	0.203 (0.158)	0.166 (0.248)	0.179 (0.214)	0.361 (0.010)
Death/deformation	0.184 (0.200)	0.167 (0.246)	0.202 (0.160)	0.356 (0.011)
Body secretions	0.041 (0.778)	0.117 (0.416)	−0.006 (0.970)	0.096 (0.509)
Unusual food	0.174 (0.226)	0.243 (0.089)	0.031 (0.832)	0.299 (0.035)
Poor hygiene	−0.034 (0.814)	0.109 (0.450)	0.290 (0.041)	0.176 (0.221)
Spoilage/decay	0.351 (0.012)	−0.009 (0.953)	0.125 (0.389)	0.374 (0.008)
Self-disgust	−0.120 (0.407)	0.269 (0.059)	0.091 (0.528)	0.080 (0.580)
Disgust sensitivity	0.020 (0.892)	0.147 (0.307)	0.117 (0.418)	0.156 (0.280)

n = 50.

has been observed in various clinical groups, which are characterized by a negative self-concept (e.g., Ille et al. 2014).

Very interestingly, hyposmic and healthy men differed in self-disgust, while hyposmic women and the female control group were similar. Moreover, hyposmic men reported elevated sensitivity to poor hygiene, which was not found in the female patient sample. Male patients had expressed greater concerns with regard to personal cleanliness, which has also a strong association with possible negative judgment and rejection by others (Ille et al. 2016).

It can only be speculated whether men depend more on olfactory cues for their body image and social behavior than women. Previous research already demonstrated that the odor of one's own body is able to modulate self-perception and social interactions. Roberts et al. (2009) showed that the application of a scented deodorant resulted in a positive change of self-confidence and self-perceived attractiveness in men compared to a non-deodorant group. Moreover, the men who used the pleasant fragrance were judged as better looking by females, who had watched a video of them. The researchers concluded that it was the deodorant group's increase in self-confidence that caused the women (who had received no olfactory information) to see them as more attractive.

Gender-specific effects of congenital anosmia on a specific domain of social behavior, sexuality, were observed by Croy et al. (2013). The authors found that men (but not women) who were born without a sense of smell exhibited a strongly reduced number of sexual relationships. This effect might be associated with the development of a negative self-image due to the olfactory dysfunction.

Another explanation for the observed gender-specific effects of hyposmia is also possible. Perhaps female patients are able to show more effective compensatory behaviors and develop new routines for personal hygiene and cleaning. Further, it is known that women are better in utilizing social cues from different sensory channels (besides olfaction) than men (e.g., prosody of spoken language, gestures by others). For example, women were more efficient in recognizing affective facial expressions, especially for faces of the same gender (Levin and Herlitz 2002; Cellerino et al. 2004; Rahman et al. 2004; McBain et al. 2009). In contrast, men were more likely to make classification errors when they decoded negative emotions of females (e.g., Thayer and Johnsen 2000). In a study by Briton and Hall (1995) women used facial mimicry and hand gestures to express their thoughts more often than males, and were more skilled at sending and receiving nonverbal messages. These abilities might help female patients to better cope with their olfactory impairment.

We also observed differences in disgust sensitivity between hyposmic patients and healthy control participants. Disgust sensitivity describes the ability to control one's own disgust feelings, and is therefore connected with the concept of emotion regulation (Schienle et al. 2010). The ability to modulate one's own affective responses is crucial within social contexts when interacting with other people. Reported difficulties in disgust regulation by hyposmic individuals might be a further indicator of the social impairment associated with olfactory dysfunction.

It is of note, that an impaired sense of smell leads to disturbances in many important areas of life, such as food selection/enjoyment, detection of environmental hazards, and social/work behavior (Croy et al. 2014). On the other hand, a heightened sense of smell supports the above mentioned functions. Partial support for the latter could be found by our correlation analyses, which demonstrated a positive association between the overall TDI score and disgust proneness in normosmic participants. Individuals with a better olfactory function reported to experience more disgust to potential contaminants (e.g., smelling/looking at spoiled food, touching/seeing dead bodies). Thus, they indicated a more sensitive disease-avoidance system. No such correlations were found in the hyposmic group. It is possible that once the olfactory impairment has reached a certain level, no additional changes in disgust responsivity will occur.

We have to mention the following short-comings of our study. The participants answered various measures of trait disgust, but did not complete questionnaires on other affective traits and general emotion regulation capability. Therefore, we do not know whether our findings are emotion-specific or are part of a broader change in affective responsivity. This aspect should be considered in a future investigation. Moreover, forthcoming studies should additionally focus on qualitative olfactory disorders. Some patients perceive unpleasant (disgusting) odors in the absence of any olfactory stimulation (phantosmia) or they perceive atypical odors in response to a specific stimulus (parosmia). It seems promising to investigate possible changes in trait disgust for these dysfunctions as well.

In conclusion, we demonstrated gender-specific consequences of a reduced sense of smell for different domains of trait disgust. Our findings point to greater problems in men.

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