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ORIGINAL RESEARCH

Disgust and Anxiety Sensitivity as Vulnerability Factors in Misophonia

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Abstract

Objective: This study was aimed at exploring the association between disgust sensitivity and misophonia. We explored the mediating mechanisms underlying this relationship by specifically examining the mediating role of components of anxiety sensitivity in this association.
Methods: Two hundred and thirteen individuals completed the online measures of disgust sensitivity, anxiety sensitivity and misophonia.
Results: The results indicated that core disgust was significantly and positively associated with misophonic distress and aggressive behavioral reactions to triggers of misophonia but failed to correlate with nonaggressive reactions to the distress elicitors. Furthermore, the social concerns component of anxiety sensitivity partly mediated the association between core disgust and misophonic distress and the cognitive concerns component of anxiety sensitivity served as a mediator in the relationship of core disgust and aggressive behavioral reactions to misophonic distress elicitors. Direct effects of core disgust on misophonic distress were also found.
Conclusion: Results highlight the significance of identifying the mechanisms that underlie the mediated paths between core disgust and emotional-behavioral features of misophonia. Findings point to a distinction between misophonia and obsessive compulsive and related disorders. Theoretical implications involving 'not just right experiences', sociomoral disgust and mental contamination are discussed.
Keywords: Misophonia, Disgust, Anxiety Sensitivity, Not-Just-Right Experiences, Mental Contamination

INTRODUCTION

Misophonia involves an exaggerated emotional response to typically innocuous audiovisual stimuli such as the sound of chewing and breathing or the sight of a repetitive action performed by someone. The individual shows a disproportionally negative reaction such as anger, rage, disgust or even sadness, accompanied by increased physiological arousal and increased activity in brain areas associated with the salience network (1, 2), and may subsequently respond with confrontational or avoidance behaviours that may lead them to avoid the distressing situations, endure them with increased distress or experience impairment in functioning (2). The current prevalence in the population is approximately 20% with 6% reaching clinical states. In the DSM-5, misophonia does not exist as a distinct disorder.

Misophonia is not merely a problem of hypersensitivity to noise. Research has revealed dysfunctional connections and abnormal activity of brain networks involved in attention to detail, salience, cognitive flexibility and emotion (3). A unique structural abnormality characteristic of misophonia is higher myelination of tracts connecting the amygdala with the occipital cortex and the orbitofrontal cortex (OFC) with the dorsolateral prefrontal cortex (dlPFC), which implies difficulty disengaging attention away from aversive stimuli (4).

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Kumar et al. (5) found prefrontal areas to be hypoactive or displaying aberrant connectivity with limbic structures, which may be the cause for difficulties that people with misophonia experience with downregulating their exaggerated arousal response. These researchers also found that like PTSD patients during trauma exposure, in misohonia too, during exposure to trigger sounds, the anterior insular cortex in the left hemisphere had enhanced functional connectivity with the amygdala suggesting that the perception of trigger sounds is similar to exposure to trauma.

Research has associated misophonia with a wide range of psychopathology. Misophonia has been noted to be comorbid with OCD (6), depression (7) , attention deficit hyperactivity disorder (7), eating disorders (7, 8), affective disorders (9), posttraumatic stress disorder (PTSD; (10), social phobia (11), body dysmorphic disorder (12), panic disorder (11, 12), borderline personality disorder (13), specific phobia (14), agoraphobia (11), hypochondria (15), skin picking (7, 15), and bipolar disorder (7, 15). However, considering the similar pattern of obsession over trigger stimuli and the subsequent coping responses, it is suggested that misophonia be categorized within the OCD spectrum (15). From the cognitive behavioral perspective, misophonia may be similar to anxiety disorders as the responses to distress elicitors are negatively reinforced if they serve to alleviate the distress. This prompts the speculation that individuals with misophonia may share certain vulnerabilities with those with anxiety or obsessive-compulsive and related disorders.

According to the triple vulnerability model (16) emotional disorders arise from three vulnerabilities: a general biological vulnerability that refers to an inherited stable temperamental disposition to experience negative emotions, such as neuroticism; a general psychological vulnerability that develops from experiencing adversities in childhood such as negative parenting styles, stifling the development of efficient coping strategies and self-efficacy and resulting in a diminished sense of control; and a disorder specific psychological vulnerability such as intolerance of uncertainty in GAD. According to the model, the general biological and psychological vulnerabilities form the core of anxiety disorders. The biological vulnerability may be described as a disposition for elevated sympathetic nervous system arousal and the general psychological vulnerability as a general sense of unpredictability and uncontrollability over life events and emotions (17).

Anxiety Sensitivity and Misophonia.

One general construct considered to be a trait-like vulnerability for many anxiety disorders is anxiety sensitivity. Anxiety sensitivity refers to the tendency to perceive anxiety states as aversive and harmful (18). Although anxiety sensitivity was initially considered a specific vulnerability for panic disorder (19), there is evidence indicating it to be a transdiagnostic factor in the etiology and maintenance of several emotional disorders including social anxiety (20), obsessive-compulsive disorder (21), generalized anxiety disorder (GAD) (22), depression (23), and post-traumatic stress disorder (PTSD) (24).

A meta-analysis of anxiety sensitivity in anxiety and depressive disorders revealed that anxiety sensitivity was most strongly related to panic disorder, GAD and PTSD, moderately related to depression, social anxiety and OCD and weakly related to specific phobia (25). The study concluded that anxiety sensitivity was more strongly related to the disorders characterized by distress than to disorders characterized by fear. Although anxiety sensitivity may not differentiate well between specific disorders (26), the distinct dimensions to anxiety sensitivity; cognitive concerns, physical concerns and social concerns, each reflecting a different facet of dysfunctional perceptions (27) appear to show differential associations with specific symptoms (25). Cognitive concerns, mental structures and beliefs regarding the meaning of the physiological arousal, were most strongly related to symptoms of GAD, depression, panic, and PTSD. Physical concerns, centered around the possible negative health outcomes of physiological arousal, were strongly associated with symptoms of panic, agoraphobia, PTSD, and GAD, while social concerns, centered around public humiliation and rejection as a possible outcome of one's observable symptoms of physiological arousal, were correlated with symptoms of social anxiety and GAD. However, evidence on the association of obsessive-compulsive symptoms to the dimensions of anxiety sensitivity is far from clear. Naragon-Gainey (25) reported that symptoms of OCD and specific phobia showed weak correlations with all three components of anxiety sensitivity, while Wheaton et al. (26) and Raines et al. (28) found the dimension of cognitive concerns uniquely predictive of unacceptable obsessive thoughts.

Based on the understanding of anxiety sensitivity, the physiological arousal and emotional distress associated with misophonia, as well as the indicated comorbidities,

it is reasonable to assume an association between anxiety sensitivity and misophonia, and it may be even more useful to examine the relationship between the major symptoms of misophonia and the distinct components of anxiety sensitivity. Considering the similarity between misophonia and OCD, we anticipate an overall weak to moderate correlation between overall anxiety sensitivity and misophonia. Regarding the associations between misophonia and the specific dimensions of anxiety sensitivity, Cusack et al. (29) found that cognitive concerns directly and indirectly through obsessive thoughts explain misophonia severity, and McKay et al. (30) found elevations on the physical concerns dimension of anxiety sensitivity in individuals with misophonia. Furthermore, to the extent that misophonics realize that their emotions and thoughts about the sound and visual triggers are excessive, they are likely to be concerned about publicly observable anxiety symptoms (the social concern). That is, since misophonia involves aversive reactions to sounds and actions made by other individuals, significant associations between the social concerns component of anxiety sensitivity and misophonia can also be anticipated.

Disgust Sensitivity

Another emotional misophonic reaction to audiovisual cues is disgust. Disgust is an evolved psychological mechanism of the behavioral immune system (BIS) that detects stimuli threatening survival (31). When the BIS detects the presence of stimuli in the immediate environment that can be potentially harmful, physically or morally, it elicits emotional (e.g., fear, anxiety, disgust) cognitive (obsessions, difficulty concentrating, worry) and behavioral reactions (escape, avoidance, aggression). Disgust is a dispositional trait (32) that is a common vulnerability factor for specific anxiety-related conditions (33), obsessive-compulsive disorder (34, 35), and health anxiety (36, 37). The individual differences in the threshold or tendency for experiencing disgust is termed disgust propensity and differences in the tendency to find disgust aversive is named disgust sensitivity (38). Disgust proneness has been suggested to confer risk for anxiety-based psychopathologies like OCD by reinforcing disease-avoidance motives (39). A transdiagnostic framework in which disgust proneness interacts with cognitions to lead to trajectories of various kinds of psychopathology has been proposed (36, 40). Kupfer and Giner-Sorolla (41) believe that disgust is protective not only against disease-causing pathogens, but also against situations that may be in conflict with an individual's morals or values. Rachman (42) used the term mental contamination to refer to the distress individuals experience when they observe or think about something unclean, immoral, or undesirable. Mental contamination concerns originate as a result of disgust or anticipated exposure to stimuli that elicit disgust (43).

Since many anxiety disorders share the same feature of avoidance of feared stimuli, researchers have studied and built models to explore the correlation between disgust and traits of anxiety (36). As defined, anxiety sensitivity is the disproportionate perception of danger provoked by one's physiological arousal as having physically, cognitively, and socially harmful implications. Furthermore, the additive effects and interaction between disgust sensitivity and anxiety sensitivity is observed in various cases and scales in predicting contamination fear (44).

Earlier research (32) of anxiety sensitivity suggested that disgust sensitivity is a dispositional trait that increases the likelihood of an individual developing avoidance reactions. Davey (45) reported evidence suggesting the role of disgust in the experience of anxiety and distress in various forms of psychopathology. Randler et al. (46)'s experiment involving a test of an individual's food acceptance after a disgust-evoking experience revealed greater avoidance of potentially contaminated food in participants with higher disgust sensitivity and anxiety. In a recent study of COVID-19 (47) the results showed that the strength of the association between physical concerns associated with anxiety sensitivity and fear of contracting the virus depended on the individual's disgust propensity and sensitivity. Similar results were reported by Winder et al. (48) who found significant associations between disgust sensitivity and aversive reactions to both fear-relevant and disgust-relevant stimuli.

Disgust and Misophonia

Haidt et al. (49) categorized disgust eliciting stimuli into seven overarching domains: food, animals, body products, sex, body envelope violations, death, and hygiene. Researchers have attempted to discover associations between these disgust elicitors and specific forms of psychopathology. For example, Tolin et al. (34) found a relationship between the OCD subcategory of washing and the disgust sensitivity subcategory of hygiene. Since disgust, along with anger and distress, is a common reaction to misophonic triggers (15, 50), there may be a component of disgust sensitivity in the development of misophonia. Schröder et al.

(15) proposed that misophonia may be linked to obsessionality in OCD, in particular obsessions centered around contamination. In accordance with Tolin et al. (34)'s suggestion that heightened disgust sensitivity facilitates fear of contamination and threat of disease, it is reasonable to assume that disgust sensitivity may be implicated in misophonia.

One study examining the relationship between sensory intolerance (including both auditory and tactile sensitivities) and disgust revealed that sensory intolerant individuals did report greater contamination-based disgust, but no differences were found within core and animal reminder based disgust (51). That study, however, was not particular to misophonia; rather, it included a two-item true/false scale to measure sensory intolerance. Further, the auditory sensitivity subscale only included mechanical and verbal auditory triggers, rendering the scale a relatively weak indicator of the presence of misophonia.

Present Study

Based on extant literature, there appears to be a possible and probable connection between misophonia, anxiety sensitivity and disgust sensitivity which has not been explored. In the present study, the relationship between the dimensions of anxiety sensitivity and misophonia was explored. We also anticipated that heightened disgust sensitivity or proneness would be associated with features of misophonia and that the combination of disgust sensitivity and anxiety sensitivity could potentially result in individuals responding with displeasure and anger to misophonia triggers.

METHODS

Participants

Participants were recruited based on certain inclusion and exclusion criteria. All participants were only included if they were between 18 and 65 years of age and had completed at least two years of education in English. Data collection began in November 2020 and continued through February 2021. A total of 213 participants provided data. They ranged in age from 18 to 62 with a mean age of 25.7 years (*SD* = 7.4). Participants were predominantly White (71.4%), with the rest being Asians, Black/African-Americans, Latinos, and individuals from other or multiple races. The demographic characteristics of the sample are provided in Table 1.

Table 1. Demographic Characteristics of the Sample

	Levels	Frequency	% of Total
Gender	Male	57	26.8
	Female	151	70.9
	Non-binary	5	2.3
Marital Status	Single, never married	126	59.2
	In a relationship	50	23.5
	Married	35	16.4
	Divorced/ Separated	2	.9
Educational	Less than high school degree	3	1.4
Status	High school degree or equivalent (e.g., GED)	38	17.8
	Some college but no degree	64	30.0
	Associate degree	18	8.5
	Bachelor degree	59	27.7
	Graduate degree	31	14.6
Employment	Disabled, not able to work	7	3.3
Status	Not employed, NOT looking for work	46	21.6
	Not employed, looking for work	47	22.1
	Employed, working 1-39 hours per week	67	31.5
	Employed, working 40 or more hours per week	44	20.7
	Retired	2	0.9
Ethnicity	White	152	71.4
	Asian	26	12.2
	Black or African American	4	1.9
	Latinos	13	6.1
	From multiple Races	13	6.1
	Other	5	2.3

Measures

Anxiety Sensitivity Index-3 (ASI-3) (27): The ASI-3 is an 18-item instrument that assesses how concerned an individual feels about symptoms associated with anxious arousal. The items are grouped into 3 subscales of 6 items each, covering physical (e.g. It scares me when my heart beats rapidly), cognitive (e.g., When my mind goes blank, I worry there is something terribly wrong with me), and social (e.g., When I tremble in the presence of others, I fear what people might think of me) domains. Respondents indicate the extent to which they agree with each item using a 5-point Likert scale ranging from 0 (very little) to 4 (very much). Each subscale score ranges from 0 to 24 and total scores range from 0 to 72. The ASI-3 possesses excellent reliability and validity (27). In the current study, internal consistency estimated by Cronbach's α were found to be 0.82 for the physical concerns subscale, 0.87 for the cognitive concerns subscale, 0.78 for the social concerns subscale and 0.89 for the total scale.

The Disgust Scale-Revised (DS-R) (52): The DS-R consists of a 25 item self-report measure aimed to gauge individual levels of disgust reactions toward disgust-eliciting stimuli across various domains. It is a multidimensional scale containing three factors: Core Disgust, Animal Reminder Disgust, and Contamination-based Disgust. The first 13 items include true/false response options scored as either 0 or 1 (e.g., "It bothers me to hear someone clear a throat full of mucus"). The other 12 items are rated on a three point scale scored 0, 0.5, or 1, and assess the extent to which participants find certain objects or experiences disgusting ("not disgusting at all," "slightly disgusting," or "very disgusting"). The total score of relative disgust sensitivity is determined by summing the responses to the 25 items (three of the true/false items are reverse scored). The internal consistency (as determined by Cronbach's α) for the present study was determined to be 0.80.

New York Misophonia Scale (NYMS) (53): The NYMS has been recently developed to assess (1) the severity of emotional distress to misophonic triggers and (2) the nature of behavioral reactions to misophonic triggers. The emotional distress subscale includes 27 triggers (e.g., someone chewing loudly) that may elicit negative emotions, and participants rank the extent to which they find each trigger aversive on a 5-point Likert scale ranging from 0=doesn't bother me to 4=disgusting. The behavioral reactions subscale lists 14 behavioral reactions to misophonic triggers (e.g., "I cover my ears"). Participants rank how often they engage in each of these behaviors on a 5-point Likert scale ranging from 0=never to 4=always. The items in each subscale can be added using a simple summation to yield a score that can range from 0 to 108 in the emotional distress subscale and 0 to 56 in the behavioral reactions subscale. The scores from each item in both subscales can be added to yield a total misophonia score which can range from 0 to 164. The NYMS has been found to maintain good internal consistency (Cronbach's α for the full scale = .94 , for the misophonic distress subscale = .94, and for the behavioral reactions subscale = .85; (53). In the present study, the reliability for the emotional distress subscale was found to be 0.90, for the behavioral reactions subscale 0.85, and for the total scale 0.92.

Procedure

Data were collected using a non-experimental design. Participants were recruited via several social media platforms including Facebook, Instagram, Reddit, and LinkedIn. The surveys were posted on these sites in the form of a link directing participants to the information sheet, consent form, and questionnaires. Data collection began in November 2020 and continued through February 2021.

Statistical Analysis

Preliminary analyses were conducted to ensure no violation of assumptions. Descriptive statistics of all variables and correlations among all study variables were examined by Pearson's correlations. Subsequently, a mediation model was tested: the disgust score was entered as the independent variable, the scores on measures of emotional distress and aggressive reactions and non-aggressive reactions to misophonic triggers were entered as the dependent variables, and the anxiety sensitivity component scores were entered as the parallel mediators. Models were tested through the PROCESS macro for SPSS and a bootstrapping approach was applied: mediation exists when a 95% CI of the indirect effect estimated from the bootstrap procedure excludes zero (54). Ten thousand bootstrap samples and 95% bias-corrected CIs were used to evaluate the significance of the indirect effect and, in case it was significant, its effect size was measured as the ratio of indirect to total effect.

RESULTS

Several components of the study variables were significantly associated. Anxiety sensitivity and its components correlated significantly with total misophonia scores and with the subscales of misophonia namely, emotional distress, aggressive reactions and nonaggressive reactions. The largest coefficient was found between the anxiety sensitivity total score and misophonia total score (r = 0.370, p < .001) whereas the lowest was between anxiety sensitivity total score and non-aggressive reactions to misophonic triggers (r = 0.238, p < .001). The physical concerns component and the cognitive concerns component of anxiety sensitivity correlated most strongly with aggressive reactions to misophonic triggers and least strongly with non-aggressive reactions to misophonic triggers. However, the social concerns component had the strongest association with the emotional distress component and the weakest association with aggressive reactions to misophonic triggers (See Table 2).

Total disgust sensitivity scores correlated with total anxiety sensitivity scores (r = 0.320; p < .001) but failed to correlate significantly with total misophonia scores (r = 0.100, p > .05). An examination of subscale associations revealed significant associations only

between core disgust and the emotional distress (r = 0.236, p < .001) and aggressive reactions (r = 0.160; p < .05) subscales of misophonia, but not with the non-aggressive reactions to misophonic triggers (r = 0.027, p > .05). Also, while core disgust and animal reminder disgust correlated significantly with all subscales of anxiety sensitivity, contamination-based disgust correlated only with the physical concerns component of anxiety sensitivity. All correlation coefficients are displayed in Table 3.

Table 2. Means, Standard Deviations and Correlations for the Disgust Sensitivity, Anxiety Sensitivity and Misophonia

Variables	Mouth Sounds	Repetitive Actions	Ambient Object Sounds	Ambient People Sounds	Aggressive Reactions	Non – Aggressive Reactions	Emotional Distress	Behavioral Reactions	Misophonia
Core Disgust	.19**	.16**	.22**	.16*	.16*	.03	.24***	.14*	.22**
Animal Reminder Disgust	.04	.02	.01	.01	-.05	.05	.03	-.03	.01
Contamination-Based Disgust	.10	.00	.05	.05	.00	.04	-.02	-.02	-.03
Disgust Sensitivity	.08	.09	.12	.08	.04	.02	.12	.04	.10
Physical Concerns	.18**	.17*	.25***	.20**	.28***	.18*	.26***	.28***	.29***
Cognitive Concerns	.19**	.18**	.25***	.27***	.32***	.15*	.27***	.31***	.31***
Social Concerns	.15*	.19**	.24***	.33***	.24***	.26***	.27***	.28***	.30***
Anxiety Sensitivity	.21**	.22**	.31***	.33***	.34***	.24***	.33***	.36***	.37***
Mean	14.04	7.22	5.10	6.51	15.00	11.33	32.86	26.34	59.20
SD	8.53	6.49	3.95	3.95	7.36	3.14	17.55	9.12	24.38
Cronbach's α	.90	.92	.74	.71	.84	.70	.92	.84	.93

Table 3. Means, Standard Deviations and Correlations for Disgust Sensitivity and Anxiety Sensitivity

Variables	M	SD	Cronbach's α	Correlations			
				5	6	7	8
1. Core Disgust	8.02	2.03	.72	.31***	.30***	.24***	.35***
2. Animal Reminder Disgust	3.83	2.20	.78	.29***	.15*	.16*	.24***
3. Contamination-Based Disgust	1.86	1.24	.71	.16*	.11	.04	.13
4. Disgust Sensitivity	13.71	4.37	.80	.33***	.25***	.21**	.32***
5. Physical Concerns	6.71	5.3	.82				
6. Cognitive Concerns	7.45	5.93	.87				
7. Social Concerns	11.20	5.63	.78				
8. Anxiety Sensitivity	25.37	13.75	.89				

Note. M = Mean; *SD* = Standard Deviation

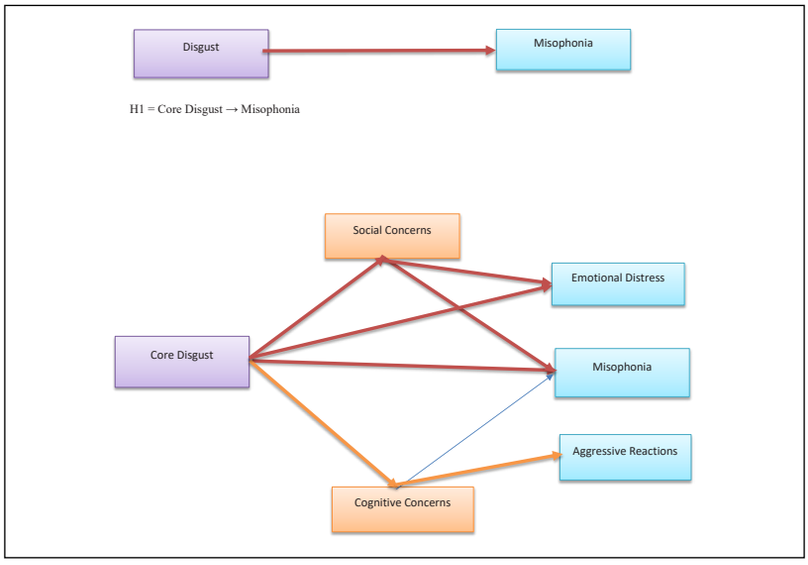

Figure 1. The Obtained Mediation Model

Mediation Findings

As total and subscale disgust scores failed to correlate with the non-aggressive behavioral reactions to misophonic distress, mediation analysis with non-aggressive reactions as the outcome variable was not tested. The obtained mediation model is shown in Fig. 1, which also reports the respective unstandardized regression coefficients. Regarding the direct effect, the scores on core disgust positively predicted the scores on the emotional distress, (b = 1.21; SE = 0.60 95% CIs 0.025, 2.386), but had no significant direct effects on aggressive (b = 0.16; SE = 0.25 95% CIs – 0.334, 0.658) behavioral reactions to the distress elicitors. The core disgust scores were predictive of all three components of anxiety sensitivity, physical concerns (b = 0.80; SE = 0.17 95% CIs 0.466, 1.140), cognitive concerns, (b = 0.88; SE = 0.19 95% CIs 0.502, 1.259), and social concerns (b = 0.68; SE = 0.18 95% CIs 0.316, 1.046). However, while the physical concerns component of anxiety sensitivity failed to predict both emotional distress and behavioral reactions to misophonic triggers, the social concerns component of anxiety sensitivity significantly mediated the association of core disgust to emotional distress (indirect effect = 0.3228; Boot SE = 0.1824 95% Boot CIs 0.0271, 0.7299) and the cognitive concerns component of anxiety sensitivity (indirect effect = 0.2139; Boot SE = 0.1015 95% Boot CIs 0.0309, 0.4316) functioned as a significant mediator in the relationship between core disgust and aggressive behavioral reactions to misophonia. The unstandardized and standardized coefficients are presented in Table 4. The overall models for emotional distress ($F_{(1,\ 211)}$ = 12.39, p < .001)and aggressive behavioral reactions ($F_{(1,\ 211)}$ = 5.52, p < .05) were significant and explained 5.55% and 2.55% of the variance in the total score of emotional distress and aggressive reactions to misophonic triggers, respectively.

The ratio of indirect to total effect of core disgust on emotional distress through the social concerns subscale was 0.0373 (SE = 0.0211, 95% CIs = 0.0030, 0.0841), which indicates that the social concerns component of anxiety sensitivity mediated 3.73% of the path. Similarly, Finally, completely standardized indirect effects of core disgust on aggressive behavioral reactions to misophonic triggers through the cognitive concerns subscale was 0.0590 (SE = 0.0276, 95% CIs = 0.0087, 0.1166), which indicates that the cognitive concerns component of anxiety sensitivity mediated 5.90% of the path.

Table 4. Conditional Direct and Indirect Effects of Attitudes toward Affective Touch on Social Anxiety Via Fear of Negative Evaluation and Self-Critical Rumination

Conditional Direct Effects	*Estimate*	*SE*	Conditional Indirect Effects	Estimate	Bootstrap 95% Confidence Interval	
CD→ED	**1.20**	**0.60**	CD→PC→ED	0.24	-0.22,	0.78
			CD→SC→ED	**0.32**	**0.02,**	**0.72**
			CD→CC→ED	0.27	-0.20,	0.77
CD→AR	0.16	0.25	CD→PC→AR	0.12	-0.07,	0.34
			CD→SC→AR	0.08	-0.04,	0.34
			CD→CC→AR	**0.21**	**0.03,**	**0.43**
CD→NAR	-0.09	0.11	CD→PC→AR	0.05	-0.02,	0.13
			CD→SC→AR	0.09	0.02,	0.18
			CD→CC→AR	-0.00	-0.07,	0.06
CD→M	**1.27**	**0.82**	CD→PC→M	0.02	-0.01,	0.05
			CD→SC→M	**0.02**	**0.00**	**0.04**
			CD→CC→M	0.02	– 0.00	0.05

Note. CD = Core Disgust; ED = Emotional Distress; AR = Aggressive Reactions; NAR = Non-Aggressive Reactions; M = Misophonia; PC = Physical Concerns; SC = Social Concerns; CC = Cognitive ConcernsItems in bold are significant.

DISCUSSION

The main aim of this study was to test the association between disgust and features of misophonia through anxiety sensitivity. Results from the mediational analysis provided support to the role of core disgust as a putative motivator of emotional distress in misophonia, since core disgust directly predicted the severity of emotional distress elicited by misophonic triggers (i.e., emotional distress total score). Furthermore, results showed that social concerns (a component of anxiety sensitivity) mediate the path between core disgust and emotional arousal in

misophonia. Our findings may suggest that individuals with a sensitivity to core disgust are likely to interpret certain actions and sounds made by other individuals or objects as aversive and respond with emotional arousal. Furthermore, it appears that the emotional distress they experience may be impacted by their concerns about how others around them would perceive their emotional response (anxiety sensitivity). This is in accordance with another study (29) that examined the relationship between anxiety sensitivity and misophonia in non-clinical individuals. Using an online survey with 451 undergraduate students and 377 community participants, these researchers found a significant moderate association between anxiety sensitivity and misophonia severity, with OCD symptoms, mainly obsessive thoughts, partially mediating the association.

As regards aggressive behavioral reactions to misophonic triggers, findings indicate the mediational effect of cognitive concerns, a component of anxiety sensitivity, in the path from core disgust. This finding is in keeping with the assertion of (55) that anxiety sensitivity augments the likelihood of individuals with misophonia responding with anger, hostility or verbal aggression to aversive sounds.

Partial support was obtained for the anticipated association between disgust proneness and misophonia. Only participants' feelings of core disgust positively predicted their misophonic distress and their aggressive reactions to the distress elicitors, while failing to predict their non-aggressive reactions. This finding is partly consistent with a previous study (53) in which core disgust was reported to have both direct and indirect effects on misophonic distress and behavioral reactions to the misophonic triggers. The authors suggested dispositional disgust sensitivity to be a proximal risk factor for misophonia, providing support for the transdiagnostic model of disgust proneness proposed by Olatunji et al. (36). Furthermore, contrary to the suggestion of Schröder et al. (7) and in line with findings of Barahmand et al. (53), distress elicited by mouth sounds and all the other triggers correlated only with core disgust. Previous research (56-58) has confirmed the function of contamination-based disgust in various types of obsessive-compulsive disorders. However, our findings imply that contamination-based disgust is not relevant to misophonia and may serve to distinguish misophonia from obsessive-compulsive and related disorders. The finding that the physical concerns component of anxiety sensitivity failed to display any association with features of misophonia further confirms the distinction between misophonia and obsessive-compulsive and related disorders.

Mediation analysis revealed that core disgust directly influences misophonic distress but does not directly impact the behavioral reactions to the disgust. Core disgust affects aggressive reactions to disgust elicitors through cognitive concerns while also affecting the intensity of emotional arousal experienced through social concerns. These findings imply that misophonics recognize that their sensitivity to disgust and distress associated with the audio/visual triggers is "excessive or unreasonable." Whether this insight exists on a continuum, with some individuals completely acknowledging that their distress is unreasonable, while others strongly endorse the validity of their reactions, requires further research. The mediating role of social concerns in the association between core disgust and misophonic distress implies difficulties with regulating emotions. In the study by Barahmand et al. (53), the roles of emotion regulation difficulties and the absence of adaptive regulatory strategies in misophonia were highlighted. Present findings corroborate the assertion that problems with emotional reactivity and distress tolerance coupled with the lack of adequate strategies to regulate emotions or a lack of regulatory emotional self-efficacy may be characteristic of misophonia. Further research into the role of distress tolerance and emotional reactivity in misophonia is needed.

Theoretical Implications

There is no firm theoretical ground to explain the obtained results. However, the findings point to certain important implications. One theoretical implication of the obtained findings is that the aversion in misophonia may involve not just right experiences. Not just right experiences (NJRE) are defined as the subjective feeling that "something is not just right,"(59) a sensory-perceptual disturbance marked by a sensation that something in the individual's internal or external environment is not as it should be (60), or a discomfort experienced when there is a discrepancy experienced between one's desired and current sensory state (61). NJREs can be expressed through any sensory modality, thoughts or even language (62). In misophonia, NJREs are likely to involve sound (this sound is not right), or sight (this action or movement shouldn't be done). NJREs have been studied mainly in the context of OCD and related disorders where they have been considered as motivators of compulsive behaviors (60, 63, 64) although they have been reported in anxiety disorders as well, suggesting that NJREs may

be a transdiagnostic risk factor for several psychiatric disorders (65). Previous research has related NJREs to maladaptive domains of perfectionism (66) and intolerance of uncertainty (67, 68) in OCD. That is, NJREs may refer to the appraisal of an event or experience as imperfect which then gives rise to feelings of discomfort and an inner drive to perform an action to have things perfect, absolutely certain, and under control (69). The reactions to NJREs, conceptualized as attempts to reduce the distress associated with NJREs (66) while increasing a sense of control and certainty may vary depending on the disorder. They are in the form of compulsive repetitive acts in obsessive compulsive (e.g., (62, 68) and related disorders (e.g., (60), while in the context of anxiety disorders such as generalized anxiety disorder the reaction to NJREs is worry (65). There is research indicating a strong association between misophonia and obsessive thoughts and compulsions about ordering and symmetry (29), and a link between ordering and symmetry and NJREs (61, 70). The link between socio-cognitive concerns and features of misophonia found in the current study also point to the likely role of NJREs as a cognitive mechanism in misophonia. We speculate that NJREs in misophonia may be an indicator of perfectionistic beliefs that an 'act can be and must be done perfectly'. Our speculation is consistent with a recent observation of a trend toward a positive association between misophonia and perfectionism by (71) and with the suggestion made by (72) that trait anxiety may mediate the relationship between perfectionism and NJRE obsessions.

Pascual-Vera et al. (68) believe NJREs reflect the need to achieve a sense of certain, and Sica et al. (64) assert that NJREs may be reflective of a sensory-affective dysregulation indicating an intolerance of uncertainty and or perfectionism. It is not known whether misophonia is related to perfectionism or intolerance of uncertainty, but considering that misophonic annoyance and distress may be elicited by innocuous auditory or visual triggers (e.g. someone shaking their legs) and in the absence of repetitive compulsive acts, NJREs likely indicate perfectionistic beliefs, and reactions to the NJREs might be expressions of anger or avoidance of the distress elicitors. Further investigation into the likely role of NJREs in misophonia is warranted. This lack of compulsive acts differentiates misophonia and OCD; however, the misophonics' anger towards harmless triggers implies the presence of obsessive NJREs, and an examination of the mechanistic properties of NJREs in misophonia requires further investigation.

The finding that only core disgust is associated with misophonia indicates that contamination-based disgust and animal reminder disgust that have been found to be associated with obsessive compulsive and related disorders (36, 44, 45), may not be characteristic of misophonia. That is, while disgust may be a common experience in both misophonia and obsessive-compulsive disorders, there are subtle differences in the specific disgust categories. These findings are supported by the overlap and differences in neural dysfunction between obsessive-compulsive disorder and misophonia. Hyperactivity in the insula and amygdala as well as hyperconnectivity between the insula and frontal regions has been documented during symptom provocation in both misophonia and obsessive-compulsive disorder. But the specific dysfunctional connectivity is different: the aberrant connectivity in obsessive-compulsive disorder is seen between the dorsomedial prefrontal cortex and the insula while in misophonia it is between the ventromedial prefrontal cortex and the insula (3). Therefore, the disgust experienced is misophonia may be of a different category. Close examination of the description of (socio)moral disgust as an aversion towards individuals who transgress moral norms and threaten the integrity of social networks (73) or personal standards (74) implies that misophonia may arise from a sensitivity to moral disgust characterized by the attribution of agency to another person, judgment of the agentic behavior as value-laden, and the experience of anger (Lee & Ellsworth, in press). Furthermore, the association of core disgust with aggressive behavioral reactions may be evidence of the presence of action tendencies of approach and punishment conceptualized as a feature of moral disgust (75). Similarly, the absence of an association of core disgust with the non-aggressive behavioral avoidance reactions in misophonia may be indicative of the absence of the action tendencies of withdrawal and avoidance which, Lee and Ellsworth (74) assert, are descriptive of fear and physical disgust. Future research can shed light on this.

A final implication of current findings is that misophonia may be a case of mental contamination, defined as contamination that occurs in the absence of contact with an external object, by merely observing or thinking of something as unclean, immoral or just undesirable (42). This idea was suggested by (53) when they speculated that triggers of misophonia evoke mental contamination that interacts with disgust sensitivity in the trajectory to misophonia. However, mental contamination is also said to be caused by a misinterpretation of the personal

significance of a psychological or physical violation such as degradation, criticism, betrayal or sexual assault (76), none of which is true about misophonia. In misophonia, the individual experiences disgust and annoyance when exposed to sounds or sights, usually when made by other people, clearly implying that the action is considered unclean or undesirable as per the definition of mental contamination (42). However, even though thoughts, memories and images of the distress elicitor may also be felt as aversive and a violation of a sociomoral code or personal standard may be perceived, there is no feeling of shame or guilt or urge to wash that have been reported as features of mental contamination (76). Clearly, all the above-mentioned putative vulnerability factors need further examination before definitive inferences can be made.

Conclusions based on the findings of the current study are limited by the use of nonclinical individuals, predominantly female. Future research should be designed to replicate these findings both in a more demographically representative sample spanning different gender identities, ages, and educational and cultural backgrounds and in individuals diagnosed with misophonia. Furthermore, the use of a non-experimental design with data collected via self-report measures also limits inferences regarding the directionality of results. Despite these limitations, the current study does highlight the roles of disgust and anxiety sensitivity as potential vulnerability factors relevant to misophonia and reveals potential theoretical constructs that warrant further exploration.

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