

RELATIONSHIP BETWEEN SENSITIVITY TO DISGUST AND IRRITABLE BOWEL SYNDROME: A STUDY ON HEALTHY INDIVIDUALS

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Abstract

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Objective: Irritable bowel syndrome (IBS) is a psychosomatic gastrointestinal disorder involving the dysfunctional activation of specific brain regions crucial for interoception and disgust processing. Yet, no study has ever investigated the link between this socio-affective/visceral experience and IBS.

Method: The present study investigated whether disgust sensitivity and disgust propensity, which can be socially relevant, relate with IBS symptoms in a non-clinical population.

105 healthy participants were asked to complete the Disgust Propensity and Sensitivity Scale-Revised (DPSS-R), the Irritable Bowel Syndrome-Quality of Life Measure (IBS-QOL), and the Chronic Urticaria Quality of Life Measure (CU-Q2OL), as control condition.

Results: Results showed higher disgust sensitivity scores in individuals with high IBS-QOL score, compared to individuals with low IBS-QOL score. The correlation analysis corroborates this result by showing a positive relationship between disgust sensitivity and respective IBS-QOL scores.

Conclusions: This research provides new insights into understanding the etiopathogenesis of IBS, suggesting the relevance of a socially relevant personality trait such as disgust sensitivity as a potential trigger and / or predisposition factor for this chronic inflammatory disease.

Key words: chronic urticaria, disgust sensitivity, healthy individuals, irritable bowel syndrome, psychosomatics

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1. Introduction

Irritable bowel syndrome (IBS) is a gastrointestinal function disorder of psychosomatic origin that affects about 15-20% of the world's population (Yuan et al., 2003). It involves several symptoms, including diarrhea, constipation, abdominal pain (Ringel, & Drossman, 2000), which might have a psychological origin based on psychological distress and alexithymia (Tolmunen et al., 2010; Martino et al., 2020). Although the etiology of IBS is multifactorial (Fournier et al., 2020), unlike Inflammatory Bowel Disease (IBD), which includes Crohn's disease (McFarland, 2008), this syndrome does not cause severe inflammation, ulcers or other structural damage that aids the diagnosis of IBD (McFarland, 2008). Therefore, according to some author (McFarland, 2008), the varying nature of symptoms and lack of structural abnormalities represents a diagnostic challenge for IBS. Visceral hypersensitivity (Barbara et al., 2005) and interoceptive deficits (Fournier et al., 2020), such as difficulty in accurate detection of the

body internal signals, are considered hallmarks of this clinical condition. This is corroborated at the neural level by evidence documenting abnormal activity into neural regions associated with interoception, such as the insula and the cingulate cortex (Brewer et al., 2021) in individuals with IBS. Interestingly, this neural network is involved in disgust sensitivity (Vicario et al., 2017, Vicario et al., 2016), an individual trait of personality involved in socially relevant behavior such as moral decision making and prejudice (Zakrzewska et al., 2019; Terizzi et al., 2009; Vicario et al., 2022). Moreover, this emotion is related to mental disorders with a high rate of comorbidity with IBS (Tybur et al., 2009; Mascolo et al., 2017) such as obsessive-compulsive disorders (Vicario et al., 2017) and Anorexia Nervosa (Vicario, 2013). Finally, disgust sensitivity is linked with the digestive system, as it predicts eating habits (Houben & Havermans, 2012; Vicario & Rafal, 2017), and could be a protective response to inflammatory states such as those present in IBS and in numerous interoceptive responses to sickness (Harrison et al., 2009), which

accompanied psychopathology.

Based on these findings, and in agreement with the Engel's biopsychosocial model (Engel, 1977), which highlights the importance of considering the social, psychological, and behavioral dimensions of illness, in the current study we investigated the existence of a link between disgust sensitivity and IBS symptoms in non-clinical population. Given the relation between disgust sensitivity and difficulty in accurately detecting the internal body signals (Scarpazza et al., 2015), we hypothesized higher IBS symptoms in healthy individuals with higher disgust sensitivity.

To establish the specific relevance of disgust sensitivity for IBS, we extended our investigation to disgust propensity, which refers to the extent that one is likely to experience disgust (van Overveld et al., 2006), and to chronic stress urticaria (CU) as a control psychosomatic syndrome. We focused on CU as this syndrome seems to be associated with a different – i.e., not interoception related – neural network, which encompasses the reward system (e.g., Wang et al., 2018; Ishiui, 2019). We did not expect to detect a relationship between disgust propensity and IBS, as well as a relationship between disgust sensitivity/disgust propensity and CU.

2. Method

2.1 Participants

A total of 105 healthy subjects participated in the present study, including 83 females and 22 males, ranging in age from 18 to 35 years ($M = 23.2$; $SD = 3.7$). Most participants were students recruited from the Department of Cognitive, Psychological, Pedagogical, and Cultural Studies at the University of Messina. Participants were recruited via social network (e.g., Facebook). Exclusion criteria were age over 35 years, and/or being affected by IBS or CU. The entire sample was asked to read and sign the informed consent form. Also, the study was approved by the department's Ethics Committee. Moreover, the experimental procedures were conducted according to the 1964 Declaration of Helsinki principles and subsequent updated versions.

2.2 Instruments

Participants were asked to complete the following questionnaires:

Disgust Propensity and Sensitivity Scale-Revised (DPSS-R) (Fergus & Valentiner, 2009) a scale consisting of 12 items including: Six items measure levels of **Disgust Sensitivity**, i.e., the emotional impact related to disgust experiences (i.e., how bothered one is by their disgust), such as: "When I feel disgusted, I am afraid of fainting" or "Feeling nauseous scares me". In particular, the items that refer to this scale are 2, 3, 7, 9, 11, and 12. Six items measure **Disgust Propensity**, that is, the frequency with which we can feel disgusted (i.e., how easily one is disgusted), such as, "I avoid disgusting things" or "I feel disgusted." Items: 1, 4, 5, 6, 8, and 10 refer to this scale.

The questionnaire consisted of a five-point Likert-type response scale (1=never; 5=always). It has been translated into Italian. According to the authors, the DPSS-R is reliable and valid. Specifically, the subscales show good internal consistency "DP: Cronbach's $\alpha = .78$; DS: $\alpha = .77$ ".

Irritable Bowel Syndrome-Quality of Life Measure (IBS-QOL) (Patrick et al., 1998) is a questionnaire

consisting of 34 items that explore 8 points concerning the quality of life of subjects with IBS. The questionnaire consists of a five-point Likert-type response scale (1=not at all; 5=extremely). The scale was translated into Italian.

Chronic Urticaria – Quality of Life Measure (CU-Q2OL) (Baiardini et al., 2005) is a questionnaire consisting of 23 items that explore 6 points related to the quality of life in subjects with CU. The questionnaire consists of a five-point Likert-type response scale (1=not at all; 5=very much).

2.3 Procedure

105 healthy subjects, mainly university students, were asked to fill out the three questionnaires after reading and signing the informed consent. The questionnaires were completed in about 15 minutes. The data collected were treated by the laws on privacy and in compliance with Legislative Decree No. 196 of June 30, 2003, "Code for the protection of personal data", ensuring the anonymity of the participants.

2.4 Data Analysis

Extreme outliers have been excluded with the interquartile range (IQR) formula ($Q1 - 1.5 \text{ IQR}$; $Q3 + 1.5 \text{ IQR}$). Next, the tertiles of the DPSS-R and its scales (disgust sensitivity and disgust propensity) were calculated to obtain three sub-samples. Comparisons were made between first (low Disgust Sensitivity) and third (high Disgust Sensitivity) tertiles (as shown in Haghghatdoost et al., 2021 and Ozawa et al., 2017). Next, we calculated the Shapiro-Wilk test of normality (see **table 1**), and nonparametric tests (Spearman's rho Correlation, Mann-Whitney U) were applied, as a no normal distribution verified. Firstly, a correlation analysis was performed via Spearman's rho. Subsequently, comparisons were made via Mann Whitney U after creating a categorical variable (Disgust Sensitivity Level) by tertile splitting. This procedure allowed to compare the scores of high and low disgust sensitivity obtained in the scales for studying psychosomatic syndromes examined (IBS and Urticaria). Jamovi 1.6 and IBM SPSS Statistics 26.0 were used for the analysis.

3. Results

A positive correlation emerged between disgust sensitivity and irritable bowel syndrome ($r = .251$; $p = .014$) (see **figure 1. a**), but not with stress urticaria ($r = .036$; $p = .726$). Furthermore, no correlation was found between irritable bowel syndrome and disgust propensity ($r = .012$; $p = .911$), nor with total disgust score ($r = .164$; $p = .115$). Likewise, no relationships between urticaria, disgust propensity ($r = .139$; $p = .173$) and total disgust ($r = .068$; $p = .506$).

Further analyses (see **table 2**) clarify that the correlation between disgust sensitivity and IBS is only significant for women.

The results of the Mann-Whitney U between the extreme tertiles revealed a significant difference between individuals with high ($Mdn = 48.0$; $IQR = 19.5$) and low ($Mdn = 40.0$; $IQR = 9.3$) DS scores with regard to IBS scores ($U = 249$; $p = .042$). On the other hand, no difference was found between low ($Mdn = 36.0$; $IQR = 11.3$) and high ($Mdn = 38.5$; $IQR = 13.5$) DS in urticaria score ($U = 327$; $p = .349$) (see **figure 1.b**).

Table 1. Descriptive statistics of the involved measures

	Total Disgust	Disgust Propensity	Disgust Sensitivity	Irritable Bowel	Urticaria
Number of participants	102	103	104	97	100
Missing data	3	2	1	8	5
Mean	33.0	19.5	13.8	44.9	36.9
Median	32.5	19.0	13.0	41.0	35.0
Standard deviation (SD)	6.31	3.36	4.27	10.8	8.34
Interquartile range (IQR)	9.00	5.00	6.00	12.0	11.3
Shapiro-Wilk, <i>W</i>	.981	.989	.971	.852	.961
Shapiro-Wilk, p-level	.147	.525	.024*	< .001*	.005*
I Tertile, mean	30.0	18.0	12.0	38.0	32.0
III Tertile, mean	36.0	21.0	16.0	47.0	41.0

* indicates significant results

Table 2. Correlation analyses stratified by gender. * indicates significant results

	N	R	p-level		N	R	p-level
<i>Women</i> DS & CU	83	.038	.730	<i>Men</i> DS & CU	22	.170	.447
DS & IBS	83	.251	.021*	DS & IBS	22	.150	.505
DP & CU	83	.183	.097	DP & CU	22	.058	.794
DP & IBS	83	.050	.648	DP & IBS	22	.100	.657

There was no significant difference between the first (*Mdn* = 41; *IQR* = 11) and third (*Mdn* = 39; *IQR* = 21) tertile in DP for IBS (*U* = 284; *p* = .748), and between the first (*Mdn* = 33; *IQR* = 11) and third (*Mdn* = 37; *IQR* = 14) tertile for Urticaria (*U* = 254; *p* = .255).

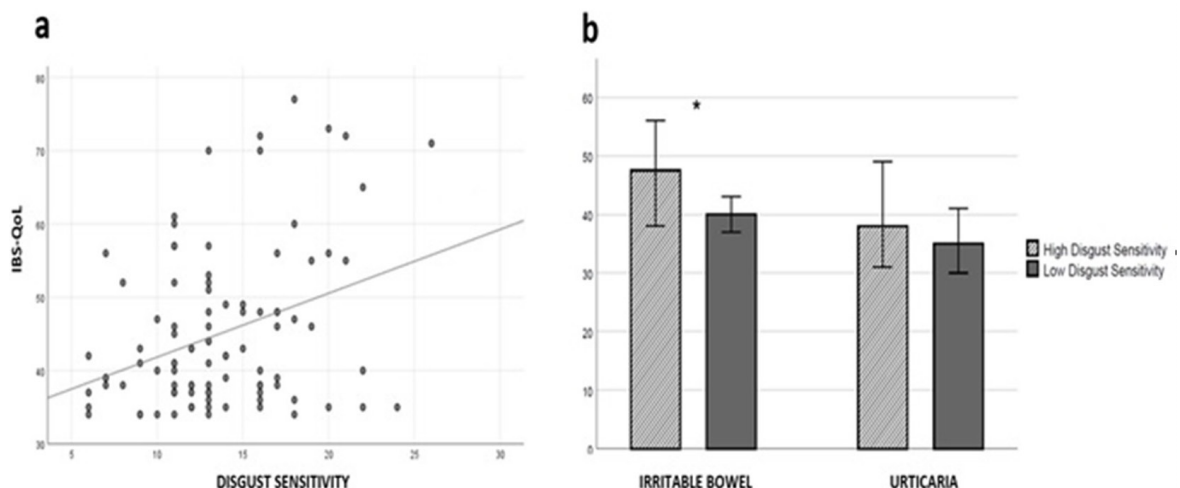
Discussion

Our study aimed to investigate a possible relation between disgust processing and IBS. The results indicate that IBS is specifically related with the emotional intensity dimension of the experience of disgust (van Overveld et al., 2006). In line with our hypothesis, we documented a more severe IBS-QoL score in individuals with high levels of disgust sensitivity (i.e., “how bothered one is by their disgust”, Ferguson, &

Valentiner, 2009), but not in disgust propensity. This result is also corroborated by the significant positive correlation between IBS and disgust sensitivity, but not with disgust propensity. However, the further correlation analysis stratified by gender shows that this pattern is only significant for women participants. This might be explained by the evidence that IBS is more common in women than in men (McFarland, 2008). However, the absence of significant results for male participants may be due to the low numerosity of this sub-sample.

On the other hand, both disgust sensitivity and disgust propensity were not found to be related with CU-Q2OL score, which measures Urticaria. This suggests that disgust sensitivity can be selectively linked to IBS rather than being a general predictor of psychosomatic syndromes. However, investigations involving other

Figure 1. a) Positive correlation between Disgust Sensitivity and IBS-QoL. b) Difference between High and Low Disgust Sensitivity in IBS and Urticaria. (*) Indicates significant differences. Vertical bars denote ± standard error of means



psychosomatic syndromes (e.g., fibromyalgia, chronic fatigue) are needed to further verify to specificity of the link between disgust sensitivity and IBS.

At the neural level, both disgust sensitivity and IBS involve activation of the anterior insula and the anterior cingulate cortex (ACC) (Wicker et al., 2003; Borg et al., 2013; Rapps et al., 2008). Notably, the insula has been described by some authors as "the visceral brain" (see Uddin et al., 2017) because of its ability to encode interoceptive experiences that also include digestive system. The activity of this system is closely related to the experience of disgust, as shown by changes in gastric myoelectric activity related to increased arousal toward emotionally salient stimuli and emotional imagery (Vianna et al., 2009). Therefore, it would make sense to hypothesize a role of these regions to explain the reported results. However, this brain network is also involved in individuals who practice mindfulness, which promotes self-awareness, awareness of emotional and interoceptive states (e.g., Manuella, et al., 2016). These latter states suggest a diametrically opposite status to that reported in patients with a tendency to somatization. Therefore, the insula-ACC hypothesis remains to be directly addressed since we did not collect data on neural activation of our participants. Moreover, or in alternative, disgust sensitivity and IBS may be linked via autonomic nervous system, whose response involves both the sympathetic and parasympathetic branches (Ottaviani et al., 2013), and might modulate respective physiological correlates of digestive system such as salivation, which is also affected by the experience of disgust (Vicario et al., 2017).

A further explanation for the disgust-IBS linking might refer to the literature showing that disgust sensitivity became more severe in the context of an inflammatory body state, which is relevant in psychosomatic syndromes. Experimental manipulations have shown that disgust prompt oral pro-inflammatory response as revealed by salivary analysis (Stevenson et al., 2011). The recent study by Hansson et al. (2021) has shown that experimental endotoxemia, induced via intravenous injection of lipopolysaccharide, facilitates emotional down-regulation in response to disgusting stimuli. Finally, there is evidence of increased accuracy at detecting facial expressions of disgust following the assumption of inflammatory cytokine, interferon- α (Cooper et al., 2018). This literature makes plausible the hypothesis that inflammatory processes mediate the link between disgust sensitivity and IBS. However, the absence of relationship between disgust sensitivity and urticaria, another psychosomatics syndrome implying an inflammatory process, suggests that other factors, besides the inflammatory process per se, may be relevant.

In IBS, the inflammatory response can be linked to disgust sensitivity, for the involvement of the insula region (Rapps et al., 2008), which might increase subjective disgust sensitivity to reduce the exposure to contaminants that can worsen this psychosomatic condition (e.g., Marshall et al., 2007).

The inflammatory response of urticaria might be linked to an itchy reaction that triggers a positive feedback loop involving the reward circuit, to induce a feeling of relief. This is in line with the evidence of increased resting state activity of neural structures like the striatum and the nucleus accumbens in Urticaria (Wang et al., 2018).

Finally, a recent qualitative study offers a clinical-psychological perspective for the disgust-IBS linking based on the suggestion that this relation would come out in developmental age following specific parental

relationships related to stigmatization, for the strong cultural link between bowels and disgust (Dibley et al., 2020).

Our study has some limitations. It did not involve clinical populations, and the sample is not homogeneous and unbalanced towards female participants. This might explain why we did not report a significant correlation between DS and IBS scores in the sample of male participants. Therefore, future investigations are needed to clarify if the link between DS and IBS is limited to female participants. Nevertheless, in line with previous works (e.g., Costa et al., 2014; Robertson et al., 1989; La Barbera et al., 2017; Sajadinejad et al., 2012), this research provides new insights into understanding the etiopathogenesis of IBS, suggesting the importance of a socially relevant personality trait such as the individual sensitivity to disgust as a potential trigger and / or predisposition factor for this chronic inflammatory disease. Moreover, it expands an earlier work in the field (e.g., Smith et al., 2007), which proposes disgust sensitivity as a predictor of life satisfaction in colostomy patients, and a predictor of the potential physical contact with colostomy patients in healthy individuals.

Future investigations involving IBS patients are needed to corroborate the current findings in the clinical population. It would be worth investigating the relevance of disgust sensitivity as a predictor for IBS in longitudinal studies. Finally, it would be relevant to investigate whether the application of cognitive-behavioral therapy with an emphasis on exposure to disgust could be appropriate for improving the quality of life of these patients. This latter statement would imply that disgust sensitivity can also play a moderation role in IBS.

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