
PSYCHOMETRIC PROPERTIES AND FACTOR STRUCTURE OF THE DISGUST SCALE-REVISED (DS-R) FOR THE ROMANIAN POPULATION

*Simona A. Pascal**

Laboratory of Cognitive Clinical Sciences, University of Bucharest, Bucharest, Romania

Abstract

Research on measuring the intensity of disgust has required the development of instruments to measure this construct. Given that, a more culturally appropriate scale is needed to ensure a valid and reliable measurement of disgust. The concept of “disgust” does not have an appropriate literature in Romanian pathology, and Disgust Scale-Revised (DS-R) is quite rarely used in the public health context. Therefore, this study focuses on the psychometric properties of the Romanian adaptation of the DS-R, one of the preferred instruments for measuring disgust. More specifically, the research investigated different forms of reliability and validity of the DS-R, using both Classical Test Theory (CTT) and Item Response Theory (IRT) analysis approaches. In general, the results showed good fidelity, fit of the single-factor model of the DS-R, good convergent and divergent validity with respect to the relationships of this scale with other variables. The study also highlights the important role of disgust and anxiety in predicting obsessive-compulsive symptoms. In conclusion, further refinement of the scale could be useful for a more comprehensive development of this instrument in the clinical setting.

Keywords: disgust, scale adaptation, item response theory, confirmatory factor analysis, incremental validity.

One of the least studied emotions, disgust, gets an increasing interest in the literature. Empirical studies published on this topic have shown that this emotion is involved in various anxiety psychopathologies, such as animal and spider phobias (Bianchi & Carter, 2012; Olatunji & Deacon, 2008), blood-injection-injury phobia (Gilchrist et al., 2016; Olatunji et al., 2006), health anxiety (Brand et al., 2013; Fan

* Correspondence concerning this article should be addressed to Simona A. Pascal, Laboratory of Cognitive Clinical Sciences, University of Bucharest, Bucharest, Romania.
E-mail: alexandra-simona.pascal@fpse.unibuc.ro

& Olatunji, 2013), obsessive-compulsive disorder (Armstrong & Olatunji, 2017; Cervin & Perrin, 2019; Olatunji, Berg, et al., 2017), posttraumatic stress disorder (Badour & Feldner, 2016; Brake et al., 2017), and eating disorders (Anderson et al., 2018; Khairallah et al., 2019; Olatunji, 2019). From a pathological point of view, disgust may therefore contribute to the development and maintenance of both anxiety and related clinical manifestations from the earliest years of life (Muris, 2006). In relation to anxiety disorders, the available empirical research suggested that disgust mediates the relationship between negative affect and specific symptoms of spider phobia and blood-injection-injury phobia, but only partially in the case of fear of contamination. Disgust may also contribute to the development of anxiety concerns through performance and attention biases or fear of contagion (Olatunji et al., 2010).

In the case of obsessive-compulsive disorder (OCD), the common concern of people diagnosed with this disorder was fear of contamination (Knowles, Tomarken, et al., 2018). On the one hand, these people evaluated themselves negatively in terms of personal hygiene as part of their obsessions and believed that they were spreading germs; on the other hand, their compulsions related to personal hygiene and the cleaning of objects made the sufferers extremely stressed. In addition, people with OCD often tend to avoid situations in which they might contaminate themselves (Rachman, 2004). Thus, empirical research highlighted that while concern about contamination is traditionally guided by fear, disgust may be a more relevant emotion in this clinical disorder (Knowles, Cox, et al., 2018). Both self-reported data and neurobiological studies have proven a connection between disgust and fear of contamination (Deacon & Olatunji, 2007; Olatunji et al., 2004). Specifically, viewing disgusting images increased insula activity in people with OCD, as this region is involved in disgust (Shapira et al., 2003). Theoretical models have suggested that this emotion is an active variable in the development of OCD and reinforces the causes of avoidance of the disorder (Olatunji, Ebesutani, et al., 2011; Olatunji, Tart, et al., 2011). Similarly, research has shown that the experience of disgust contributes to the development of fear-related beliefs and subsequent avoidance behaviour as early as adolescence (Muris et al., 2009).

Research on the intensity of disgust required the development of instruments to measure this construct. The scales were developed according to the two-factor model, which describes two types of disgust, core and animal. While core disgust is based on unpleasantness and the risk of contamination, animal-reminder disgust reflects aversion to stimuli that are reminiscent of the animal origins of humans. The bifactorial model of disgust was found to be more appropriate than a unitary model of disgust (Olatunji et al., 2005). Other studies have also helped to support the usefulness of the two-factor model. For example, fear of animals and contamination-based obsessive-compulsive disorder appear to be specifically related to core disgust, while fear of blood-injection-injury has been linked to animal-reminder disgust (De Jong & Merckelbach, 1998; Olatunji et al., 2005).

The first instrument to measure this concept is the Disgust and Contamination Sensitivity Questionnaire (DQ; Rozin et al., 1984). Originally, the DQ was developed to identify similarities and differences between children and parents in their attitudes towards certain foods. It was later used to measure disgust sensitivity. The original form of the questionnaire included the following three sections: food area, disgust sensitivity and other aspects (e.g., culinary knowledge). The validity of this instrument was limited to the relationship between disgust and specific phobias (Merckelbach et al., 1999; Mulkens et al., 1996). In addition, Arrindell et al. (1999) considered that the DQ was limited to aspects of food consumption. However, the stimuli that trigger disgust include more than food and its rejection (Olatunji & Sawchuk, 2005). This diversity of stimuli has led to the argument that disgust is not a unitary construct (Olatunji et al., 2004). So, a multidimensional approach to this concept can thus lead to the development of more comprehensive and heterogeneous self-assessment tools (Olatunji & Sawchuk, 2005).

More recently, the Disgust Emotion Scale (DES; Kleinknecht et al., 1997) has been introduced as an alternative measure of disgust intensity in several domains: animals, injections and blood draws, mutilation and death, rotting foods and odours. Kleinknecht et al. (1997) used a structural equation model to show that fear of blood-injection-injury was positively related to fainting that occurred during the last exposure to injections and blood. Thus, disgust showed a positive relationship with fear of these elements. In addition, the researchers felt that the instrument would allow for more accurate identification of individual differences related to this emotion (Olatunji & McKay, 2009).

The Three Domains of Disgust Scale (TDDS; Tybur et al., 2009) is another instrument that measures three types of disgust reported in the literature, namely pathogenic, moral, and sexual disgust. The pathogenic dimension has been associated with self-reported obsessive-compulsive symptoms (Olatunji et al., 2015). In addition, an increased predisposition to sexual disgust in mothers has been associated with a high risk of developing post-traumatic stress disorder in individuals with sexually abused children (Van Delft et al., 2016). This scale includes 21 items measured on a Likert scale with response options ranging from *not at all disgusting* (0) to *extremely disgusting* (6). The literature suggests that the instrument has the following two important limitations: (1) there is a conceptual overlap with anxiety in that it contains items similar to those used to measure animal phobias or obsessive-compulsive disorder (e.g., the item "*Seeing a cockroach walk across the floor*"), and (2) it does not distinguish between different types of relevant pathogens (De Jong & Borg, 2020).

Another instrument used to measure disgust is the Disgust Propensity and Sensitivity Scale (DPSS; Cavanagh & Davey, 2000). More specifically, this measures individual differences in the propensity to experience disgust, regardless of the agents involved (De Jong & Borg, 2020). The scale includes 32 items

measured on a Likert scale with five response options ranging from *never* (1) to *always* (5). The instrument is also available in two revised versions, one containing 16 items (DPSS-R; Van Overveld et al., 2006), and the second containing 12 items (DPSS-R; Fergus & Valentiner, 2009), based on the psychometric properties of the scale. The current version has predictive value for avoidance behaviour and psychopathology (Engelhard, et al., 2011; Van Overveld et al., 2010). In addition, the DPSS-R is useful for assessing disgust sensitivity in various mental disorders. However, Olatunji & McKay (2009) pointed out that the items of this instrument need to be restructured, especially regarding their cultural stability.

The most commonly used measure of disgust in the contemporary empirical literature is the Disgust Scale (DS; Haidt et al., 1994). It assesses the intensity of disgust responses in the following domains: animals, body products, death, food, hygiene, and sex. DS contains 32 statements divided into two main sections: (1) an assessment of avoidance behaviours and emotional responses to potentially disgusting stimuli and (2) the severity of disgust when exposed to specific scenarios. For this instrument, Haidt et al. (1997) described a latent structure with eight factors (food, animals, body products, sex, body envelope violations, death, hygiene, and sympathetic magic). In this case, inadequate estimates of internal consistency were found (Olatunji & McKay, 2009). Therefore, DS was not psychometrically assessed. Furthermore, Olatunji, Sawchuk et al. (2007) conducted four research studies that identified the psychometric limitations of the instrument and revised it by removing seven items. The final product of these studies was the revised version of the instrument.

The Disgust Scale-Revised (DS-R; Olatunji, Williams, et al., 2007) is the most widely used instrument to assess the experience of disgust (De Jong & Borg, 2020). It was developed to measure individual differences in the extent of disgust experienced in everyday life (Olatunji & Sawchuk, 2005). The assessment instrument includes the following three dimensions of disgust, which have been transformed into subscales: core disgust (based on an offensive nature and threat of disease consisting of stimuli such as spoiled food, garbage, and small animals), animal-reminder disgust (reflecting aversion to stimuli that serve as reminders of human animal origins), and contamination-based disgust (includes specific responses based on the perceived threat of contagion). This version contains 25 items, of which the first 13 statements have dichotomous response options of *false* (0) and *true* (1), and the following 12 items provide response options on a Likert scale, ranging from *not disgusting* (0), *slightly disgusting* (0.50) to *very disgusting* (1). DS-R has been used in subclinical (Olatunji et al., 2004), clinical (Woody & Tolin, 2002), and cultural settings (Olatunji et al., 2006). Both DS and DS-R have been used in studies investigating the association between an increased predisposition to disgust and certain clinical anxiety symptoms. More specifically, they indicated that while core and contamination-related disgust were related to obsessive-compulsive symptoms (Olatunji, Williams, et al., 2007), blood-injection-

injury phobia was associated with disgust reminiscent of animal nature (De Jong & Merckelbach, 1998). Although this scale has been widely used and has important features, it is necessary to mention its two main limitations. The first one pointed out that half of the items in the instrument contain statements about avoidance of certain stimuli or behaviours that do not explicitly refer to disgust (e.g., the statement “*I might be willing to try eating monkey meat, under some circumstances.*”). The second important limitation concerns conceptual overlap with anxiety (e.g. the statement “*I never let any part of my body touch the toilet seat in a public washroom.*”; De Jong & Borg, 2020).

DS-R has been adapted for use in several cultures, including Australia, Brazil, Germany, Italy, Japan, the Netherlands, Sweden, and the United States with non-clinical populations (Olatunji et al., 2009; Van Overveld et al., 2011), Iran with obsessive-compulsive disorder populations (Shams et al., 2015), Korea with non-clinical populations (In Kang et al., 2012), and Ghana (Skolnick & Dzokoto, 2013), respectively. This disgust assessment instrument had good internal consistency across adjustments, with Cronbach's Alpha coefficients ranging from .68 to .87. The English (Van Overveld et al., 2011) and Korean (In Kang et al., 2012) versions had the highest internal consistency coefficient values, while the cross-cultural studies had the lowest values (Olatunji et al., 2009; Skolnick & Dzokoto, 2013). In addition, these studies conducted confirmatory factor analyses for this instrument. The following models were tested: one-factor model, three-factor model (Olatunji et al., 2009; Olatunji, Williams, et al., 2007), and five-factor model (In Kang et al., 2012). The results obtained by these authors at the level of incremental indicators, residuals, and approximation error, highlighted the fit of the models to the population covariance matrix.

With the tools available to assess disgust, research directions have focused on determining the role of this emotion in various mental disorders. For example, previous studies have used structural equation models of disgust in anxiety and obsessive-compulsive psychopathology. The number of these studies is limited, but the main results are presented below. Regarding anxiety symptoms, clinical manifestations of blood-injection-injury phobia were positively associated with fainting symptoms, whereas experiences of disgust were negatively associated with them (Kleinknecht et al., 1997).

In relation to obsessive-compulsive symptoms, negative affect (anxiety, neuro-vegetative symptoms, mood) and disgust predicted their severity (Olatunji, Ebesutani, et al., 2017). Moreover, pathogenic disgust was the only predictor of contamination after the contact with an object, while sexual disgust was a predictor of fear of psychological contamination after controlling for anxiety and depression (Poli et al., 2019). Disgust proneness was associated with avoidance behaviours. Furthermore, emotion as a condition mediated the effects of disgust proneness on avoidance behaviour. These data have implications for the aetiology of contamination-related OCD.

Experiences perceived as unfair and obsessive beliefs have been associated with psychological symptom severity. While these experiences were associated with core dimensions of OCD (checking, washing, compulsivity, ordering, and psychological neutralisation), predisposition to disgust was associated with obsessive manifestations and, negatively, with psychological neutralisation. Moreover, unfair experiences and levels of dissatisfaction partially mediated the overall effect of disgust in the case of fear of contamination. Thus, sensitivity to sensory phenomena was the mechanism that partially explained why disgust may lead to contamination and washing behaviours (Olafsson et al., 2020). From a longitudinal perspective, baseline levels of disgust susceptibility were found to be associated with higher levels of obsessive-compulsive symptoms when levels of depression were controlled. Thus, although disgust proneness may be concurrently associated with obsessive-compulsive symptoms, the possible associations are specific to the subtype of contamination or washout (Olatunji, Kim, et al., 2019). This information underscores the importance of analysing vulnerability factors to better understand OCD, as well as the strong association between OCD symptoms (especially cleaning symptoms) and disgust proneness (Melli et al., 2019).

Thus, there is a need for a valid and accurate instrument to measure disgust with the main goal of identifying individuals with elevated levels who may be at risk when clinical symptoms are also present. Such an instrument is necessary to assist and intervene in cases to achieve adaptive management of situations. Identifying individuals with high disgust scores as part of anxiety and obsessive-compulsive symptoms also allows clinical psychologists to adapt and personalize the psychological strategies and approaches used in these cases.

Purpose of the present study

If disgust contributes to the development of contamination fears, it may also be influenced by avoidance of phobic stimuli (Olatunji et al., 2008). Therefore, incorporating psychological interventions that assess both fear/anxiety and disgust in the context of anxiety disorders may result in more consistent treatment effects (Cisler et al., 2009). In addition, measuring disgust levels is critical to managing the various psychological symptoms elicited, as early detection can lead to the development of an effective psychological intervention strategy to reduce clinical manifestations. Therefore, the study was designed to evaluate the psychometric properties of the DS -R by applying a series of approaches typical of both Classical Test Theory and Item Response Theory on a data set from the Romanian population.

As a first study conducted with the revised version of this scale (Olatunji et al., 2007), as well as other validation studies (In Kang et al., 2012; Olatunji et al., 2009; Shams et al., 2015; Skolnick & Dzokoto, 2013; Van Overveld et al., 2011), the main objective of this research was to analyse the factor structure of the DS-R, its fidelity and validity (convergent and discriminant) for a Romanian non-clinical

sample. This objective was formulated because disgust is studied less in Romanian pathology and DS-R is quite rarely used in this context, although the emotion may represent a public health problem (Curtis et al., 2011). One of the reasons why French researchers and clinical practitioners have paid little attention to disgust is the lack of an official instrument to measure individual tendencies regarding specific disgust responses. Such a scale would allow analysing the role of disgust in specific relevant psychopathological conditions, thus verifying the applicability of scientific findings as proven in different cultural settings (Novara et al., 2019). Moreover, the validation of the Romanian version of DS-R may lead to the identification of new information about the analysed constructs, their applicability and the possibility of generalisation to the Romanian population.

In addition, this research aimed to identify specific predictors of obsessive-compulsive symptoms, a topic that may be useful in the field of clinical psychology and psychotherapy as therapists become more likely to be interested in new directions in treating people with fears of contamination (Poli et al., 2019). This goal was set because previous studies have focused solely on the internal structure of the instrument and neglected predictors of clinical symptoms when it came to disgust. Therefore, adapting an instrument to assess this emotion to the Romanian population is necessary because it allows both the study of the specific characteristics of disgust in Romania and the provision of information about the common cross-cultural components of the emotion. Furthermore, all analyses were applied to data derived from a less studied Eastern European culture.

Method

Sample

The convenience sample consisted of 480 people, of whom 371 were female (77.30%). The age of the participants ranged from 18 to 88 years ($M = 25.63$, $SD = 8.99$). Of the total number of persons, 222 people (46.30%) were employed. Regarding the place of residence, 399 participants (83.10%) lived in urban areas. In terms of last completed education level, 274 people (57.10%) had a high school degree, 117 participants (24.40%) attended a university at the bachelor's level, and 64 people (13.30%) held a university degree at the master's level. Further details can be found in Table 1.

The inclusion criteria for participants in this study consisted of the following three key aspects: (1) a minimum age of 18 years; (2) they spoke Romanian; and (3) they participated in all phases of the study and filled in all

responses to the items on the measurement instruments. There were no other restrictions related to demographic characteristics.

Table 1. Demographic data of the sample

Demographic feature	Results (N = 480)
Residence	
rural	81 (16.90%)
urban	399 (83.10%)
Ethnicity	
Romanian	472 (98.30%)
Tatar	2 (0.40%)
Polish	1 (0.20%)
Others	5 (1.00%)
Civil status	
single	242 (50.40%)
cohabitation	115 (24.00%)
married	72 (15.00%)
divorced	12 (2.50%)
widowed	2 (0.40%)
in a stable relationship	37 (7.70%)
Education level (last completed)	
gymnasium	1 (0.20%)
high school	274 (57.10%)
technical education	21 (4.40%)
faculty-bachelor	117 (24.40%)
faculty-master	64 (13.30%)
doctoral school	3 (0.60%)
Current academic status	
faculty-bachelor	364 (75.80%)
faculty-master	57 (11.90%)
doctoral school	7 (1.50%)
another academic status	52 (10.80%)
Current professional status	
employed	222 (46.30%)
unemployed	256 (53.30%)
retired	2 (0.40%)

Variables measured and instruments used

The variables included in this study were disgust, anxiety, depression, perceived stress, and obsessive-compulsive symptoms. These were measured with self-report instruments. In order to study the two main objectives, the variables chosen by the authors of the other previously published studies that adapted the same scales were carefully analysed (In Kang et al., 2012; Olatunji et al., 2007, Shams et al., 2015; Skoknick & Dzokoto, 2013) and finally, instruments measuring similar variables were selected. In addition, they had to be adapted according to the objectives set. The variables and assessment instruments are explained in more detail below.

Disgust was measured using the Disgust Scale-Revised (DS-R; Olatunji et al., 2007). The instrument measures the degree of this emotion in various everyday situations. This scale contains 25 items, of which the first 13 statements have dichotomous response options of *false* (0) and *true* (1), and the following 12 items represent response options on a Likert scale, ranging from *not disgusting* (0), *slightly disgusting* (0.50) to *very disgusting* (1). For example, one of the statements is „*It would bother me tremendously to touch a dead body.*” Items 1, 3, and 7 were reversed and the scores obtained for the items were then summed. For this sample, the internal consistency for DS-R was $\alpha = .83$.

The disgust variable was also measured with the Disgust Emotion Scale (DES; Olatunji, Sawchuk, et al., 2007). This instrument assesses the degree of disgust in specific situations that evoke levels of disgust, revulsion, or repugnance in some people based on five domains of disgust triggers (animals, injections and blood draws, mutilation and death, rotting food, and smells). DES includes 30 items; an example of the affirmations is “*Photos of wounded soldiers.*” The instrument uses Likert scale responses with options ranging from *no disgust or repugnance at all* (0) to *extreme disgust or repugnance* (4). The total score was determined by summing all 30 items. DES yielded an internal consistency of $\alpha = .93$ for the present sample.

Anxiety was measured using the Beck Anxiety Inventory (BAI; Steer & Beck, 1997). This instrument measures the level of anxiety in the past month using 21 items. For example, one of the items is “*Fear of worst happening.*” The scale includes responses on a Likert scale ranging from *not at all* (0) to *severely-it bothered me a lot* (3). The total score is the sum of the responses given by each participant. BAI showed an internal consistency of $\alpha = .86$ for this sample.

Depression was measured with Beck Depression Inventory (BDI; Beck et al., 1996). This instrument measures the level of depression in the past month using 21 groups of statements with four situations each. For example, one of the items is “*I feel sad.*” The scale uses four response options, coded 0 to 3 points depending on the severity of each item. The total score was obtained by summing all responses. BDI achieved an internal consistency of $\alpha = .73$ in the present sample.

Perceived stress was measured using the Perceived Stress Scale (PSS; Cohen et al., 1983), which measures the amount of stress felt by the person in the past month. This scale includes 10 questions with response variations on a Likert scale from *never* (0) to *very often* (4). For example, one of the items is “*In the last month, how often have you been upset because of something that happened unexpectedly?*” Items 4, 5, 7, and 8 are reversed, and the scores obtained for the items were then summed. The PSS achieved an internal consistency of $\alpha = .86$ for this sample.

Obsessive-compulsive symptoms were measured with The Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). This instrument measures obsessive-compulsive symptoms using 18 statements. These relate to the experiences that people have in their daily lives. For example, one of the items is “*I get upset if others change the way I have arranged things.*” The instrument uses

responses on a Likert scale with response options ranging from *not at all* (0) to *extremely* (4). The total score was determined by summing all 18 items for each participant. The OCI-R had an internal consistency of $\alpha = .65$ in the present sample.

Procedure

Firstly, the DS-R and DES were translated from English using the traditional dyadic method to obtain the final form of the questionnaire. Secondly, the data for this research was collected through various social networks using Google Forms. Specifically, people were recruited both on university campus (advertising through various student networks) and online (through various social networks). All participants were part of this convenience sample. They provided information about their demographic data and filled out DS-R, DES, BAI, BDI, PSS, and OCI-R. As the assessment tools were administered online, it was not possible to fill in all the answers without providing all of them. Therefore, there was no missing information in the database.

All volunteers had to speak Romanian and be at least 18 years of old. These inclusion criteria were outlined at the beginning of the information material. In addition, best practices in research with human participants were followed. Each participant was given an informed consent form describing their rights and responsibilities, the use of data for research purposes and the right to refuse to participate or withdraw at any time. In this regard, participants could not access the actual survey without first agreeing to the conditions specified in the consent form.

Statistical approach

Firstly, before the actual data analysis, from the collected information, responses that did not meet the research objectives, and duplicate responses were reviewed. Also, OCI-R scale scores were checked to identify those exceeding the cutoff points set by Foa et al. (2002) as at least 21 (no such cases were identified). Secondly, internal consistency, convergent, discriminant, and incremental validity were examined in this study. For this purpose, the fidelity of the entire DS -R and for each subscale (core disgust, animal-reminder disgust, and contamination-related disgust subscale) was measured. Convergent validity was estimated using simple correlations between the two scales measuring disgust, namely DS-R and DES. Discriminant validity was examined using the relationship between disgust scores (measured with DS-R) and anxiety (measured with BAI), depression (measured with BDI) and perceived stress (measured with PSS). Predictive and incremental validity were tested using multiple regression analysis. In this context, the fit of the measured model was analysed. It included the criterion defined by the obsessive-compulsive symptoms (measured with OCI-R) and the following predictors: disgust (measured with DS-R), anxiety (measured with BAI), and perceived stress (measured with PSS).

The application of multiple linear regression required the fulfilment of conditions for both the dependent and independent variables (Popa, 2010). In this regard, the statistical analyses were performed using IBM SPSS Statistics version 23.

Thirdly, the aim of the study was to test the one-factor, three-factor, and five-factor models for the DS-R that exist in the literature. For this purpose, a confirmatory factor analysis was performed using JASP, version 0.14.1.0 (Goss-Sampson, 2020). The fit of the measured model was analysed using the following indicators: comparative fit index (CFI), Tucker-Lewis's index (TLI), parsimony index (AIC), standardized root mean squared residual (SRMR), and the root mean square error of approximation (RMSEA). For the incremental CFI, values above .95 indicate a good fit (Hu & Bentler, 1999), and for the RMSEA and SRMR indicators, values below .08 indicate a good model fit (Browne & Cudeck, 1993; Hu & Bentler, 1999).

Finally, Item Response Theory parameters for disgust (measured with DS-R) were analysed using the *mirt* package (Chalmers, 2012) of the R software (R Core Team, 2016). Estimates of disgust levels were obtained using the Graded Response Model (Samejima, 1997) for polytomous items. These models examined the following two important aspects: (1) the discrimination parameter (slope) which indicates the strength of the association between the item and the latent construct and (2) the boundary parameter, which refers to the position of the item on the latent variable continuum.

Results

Results of preliminary data

To test the normality of the distribution of the variables included in this study, indicators of the shape of the distribution were analysed, namely the skewness and kurtosis indices. Thus, all variables met the condition of normality. Details of the indicators of the shape of distribution for the variables disgust (DS-R and DES), anxiety (BAI), obsessive-compulsive symptoms (OCI-R), perceived stress (PSS), and depression (BDI) are shown in Table 2. To test the homogeneity of the distribution of the variables, Levene's test was used, and all variables met the homogeneity condition ($p > .05$). The descriptive statistics for each item of the DS-R instrument are shown in Table 3.

Table 2. Descriptive Statistics, Cronbach Alpha indices, and correlations between the variables included in the study ($N = 480$)

Instrument	1	2	3	4	5	6
1. DS-R	—	.75**	.02	-.10*	.14**	.20**
2. DES	.75**	—	.09*	-.08	.09*	.24**
3. BAI	.02	.09*	—	.54**	.26**	.28**

Instrument	1	2	3	4	5	6
4. BDI	-.10*	-.08	.54**	—	.53**	.19**
5. PSS	.14**	.09*	.26**	.53**	—	.25**
6. OCI-R	.20**	.24**	.28**	.19**	.25**	—
<i>M</i>	12.39	45.95	7.53	5.29	14.12	9.78
<i>SD</i>	4.52	20.94	6.48	4.60	6.21	5.25
Skewness	-0.16	0.19	0.91	0.84	0.04	.01
Kurtosis	-0.81	-0.52	0.16	0.10	-0.28	-1.07

Notes. BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; DES = Disgust Emotion Scale; DS-R = Disgust Scale-Revised; PSS = Perceived Stress Scale; OCI-R = The Obsessive-Compulsive Inventory-Revised; M = mean; AS = standard deviation.

* $p < .05$ and ** $p < .01$. Standard error for skewness values is 0.11 and for kurtosis it is 0.22.

Descriptive statistics for the DS-R items with a sample of 480 participants revealed a less symmetrical distribution of items. The majority ranged from -2 to +2 for the distributional shape indicators, although this was more pronounced for item 2 (kurtosis = -2.00), item 5 (kurtosis = -2.00), and item 9 (skewness = 2.09 and kurtosis = 2.36). The correlations between the study variables are shown in Table 2.

Table 3. Descriptive statistics for DS-R

Item	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Item-total correlations	Cronbach's Alpha if item deleted
DSR_1	0.65	0.48	-0.64	-1.60	0.25	0.83
DSR_2	0.51	0.50	-0.03	-2.00	0.39	0.83
DSR_3	0.60	0.49	-0.43	-1.82	0.33	0.83
DSR_4	0.17	0.38	1.73	1.01	0.27	0.83
DSR_5	0.49	0.50	0.02	-2.00	0.36	0.83
DSR_6	0.31	0.46	0.80	-1.36	0.34	0.83
DSR_7	0.66	0.47	-0.68	-1.54	0.41	0.83
DSR_8	0.60	0.49	-0.39	-1.85	0.48	0.82
DSR_9	0.14	0.35	2.09	2.36	0.33	0.83
DSR_10	0.70	0.46	-0.85	-1.28	0.26	0.83
DSR_11	0.22	0.42	1.32	-0.25	0.19	0.83
DSR_12	0.75	0.43	-1.15	-0.69	0.32	0.83
DSR_13	0.65	0.48	-0.64	-1.60	0.42	0.82
DSR_14	0.33	0.32	0.42	-0.69	0.37	0.83
DSR_15	0.60	0.33	-0.25	-0.76	0.34	0.83
DSR_16	0.73	0.35	-0.90	-0.47	0.51	0.82
DSR_17	0.60	0.36	-0.33	-1.05	0.45	0.82
DSR_18	0.60	0.30	-0.11	-0.43	0.51	0.82
DSR_19	0.77	0.33	-1.12	0.01	0.53	0.82
DSR_20	0.60	0.40	-0.36	-1.37	0.48	0.82
DSR_21	0.34	0.39	0.60	-1.11	0.58	0.82
DSR_22	0.13	0.24	1.57	1.54	0.35	0.83
DSR_23	0.72	0.34	-0.84	-0.46	0.41	0.83

Item	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Item-total correlations	Cronbach's Alpha if item deleted
DSR_24	0.17	0.28	1.37	0.92	0.31	0.83
DSR_25	0.33	0.38	0.64	-0.97	0.34	0.83

Table 4. Item parameters for DS-R items

Core disgust scale						
Item	<i>a</i> (ES)	<i>b1</i> (ES)	<i>b2</i> (ES)	$S\text{-}\chi^2$	$RMSEA_{S\text{-}\chi^2}$	<i>p</i>
DSR_1	0.56 (0.12)	-1.20 (0.30)	–	21.81	0.04	.058
DSR_2	1.19 (0.17)	-0.03 (0.10)	–	15.20	0.03	.174
DSR_3	1.15 (0.16)	-0.46 (0.11)	–	12.69	0.02	.314
DSR_4	0.89 (0.18)	2.02 (0.35)	–	10.05	0.01	.436
DSR_5	0.85 (0.14)	0.04 (0.12)	–	11.38	0.00	.497
DSR_12	0.72 (0.14)	-1.67 (0.31)	–	13.12	0.01	.361
DSR_14	1.19 (0.15)	-0.31 (0.10)	2.35 (0.26)	11.94	0.00	.850
DSR_15	0.96 (0.13)	-2.22 (0.28)	0.83 (0.15)	21.34	0.00	.497
DSR_16	1.82 (0.21)	-1.64 (0.15)	-0.25 (0.08)	16.86	0.00	.464
DSR_17	1.21 (0.15)	-1.56 (0.18)	0.52 (0.11)	16.64	0.00	.614
DSR_18	1.58 (0.19)	-1.90 (0.18)	0.80 (0.10)	23.86	0.03	.160
DSR_23	1.03 (0.14)	-2.44 (0.31)	-0.23 (0.11)	30.72	0.03	.102
Animal-reminder disgust scale						
Item	<i>a</i> (ES)	<i>b1</i> (ES)	<i>b2</i> (ES)	$S\text{-}\chi^2$	$RMSEA_{S\text{-}\chi^2}$	<i>p</i>
DSR_6	1.21 (0.18)	0.82 (0.13)	–	3.20	0.00	.867
DSR_7	1.44 (0.19)	-0.64 (0.10)	–	8.45	0.02	.294
DSR_8	2.14 (0.28)	-0.31 (0.08)	–	8.13	0.02	.229
DSR_9	1.38 (0.24)	1.74 (0.22)	–	12.12	0.05	.059
DSR_13	1.45 (0.19)	-0.60 (0.10)	–	7.73	0.01	.357
DSR_19	2.56 (0.34)	-1.57 (0.12)	-0.41 (0.07)	7.07	0.00	.529
DSR_20	1.30 (0.15)	-1.13 (0.14)	0.26 (0.10)	1.55	0.00	1.000
DSR_21	1.74 (0.20)	0.02 (0.08)	1.21 (0.12)	8.35	0.00	.681
Contamination-related disgust scale						
Item	<i>a</i> (ES)	<i>b1</i> (ES)	<i>b2</i> (ES)	$S\text{-}\chi^2$	$RMSEA_{S\text{-}\chi^2}$	<i>p</i>
DSR_10	0.47 (0.14)	-1.84 (0.54)	–	0.25	0.00	.969
DSR_11	0.70 (0.15)	1.94 (0.39)	–	4.85	0.00	.434
DSR_22	5.49 (2.74)	0.71 (0.07)	2.14 (0.18)	5.93	0.04	.115
DSR_24	2.30 (0.37)	0.66 (0.08)	2.20 (0.20)	4.23	0.00	.516
DSR_25	0.86 (0.14)	0.04 (0.12)	2.10 (0.32)	4.85	0.00	.563

Note. *a* = item discrimination; *b* = item boundary parameter.

Item Response Theory analysis

Item Response Theory analysis was performed using the Graded Response Model (GRM). The item parameters for DS-R are shown in Table 5. More

specifically, the results showed that the slope parameters (a) ranged from 0.56 to 1.82 for core disgust, from 1.21 to 2.56 for animal-reminder disgust, and from 0.47 to 5.49 for contamination-based disgust. All of these results represent moderate to very high discrimination coefficients. Thus, consistent with Hayes et al. (2000), the higher the values of this parameter, the better they are associated with items that are better able to discriminate between levels of contiguous features near the inflection point.

In general, the boundary parameters (b) started from a low level to a very high level. More specifically, they ranged from -2.44 to 2.35 for core disgust, from -0.64 to 1.74 for animal-reminder disgust, and from -1.84 to 2.20 for contamination-based disgust. In terms of item-to-scale fit level, after Bonferroni correction, none of the 25 statements were statistically significant at a Type I error rate of .05. This aspect revealed an item agreement for the respective scales.

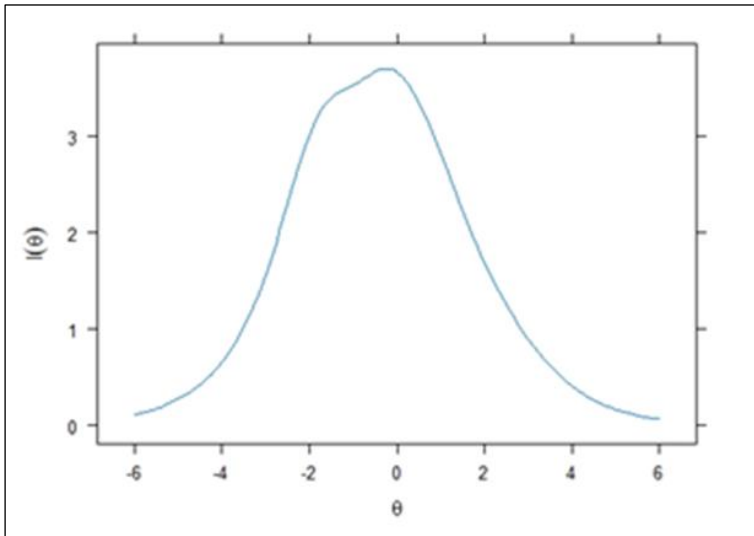


Figure 1. Information curve for core disgust scale

Given that the trait level must be $b1 > 0.00$ for the items to define the variable being measured, the results showed that the core disgust scale (12 affirmations) had only one item with a location parameter that was above 0 ($b1 > 0.00$) and two other items that approximated 0 (DSR_2 and DSR_5). For animal-reminder disgust (eight items), two items showed a value of $b1 > 0.00$ (DSR_6 and DSR_9) and item 21 was close to 0. For the last scale measuring contamination-based disgust (five affirmations), three items defined the measured variable (items 11, 22, and 24), while DSR_25 showed a value close to 0. In terms of item endorsement, we obtained the following results (θ): approximately between -3.00 and 2.00 for core disgust (Figure

1), between -2.00 and 2.00 for animal-reminder disgust (Figure 2), and between 0.00 and 3.00 for contamination-based disgust (Figure 3).

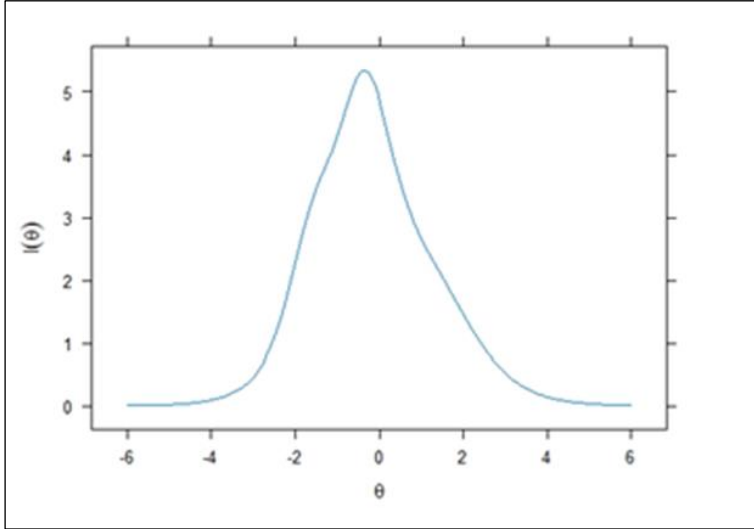


Figure 2. Information curve for animal-reminder disgust scale

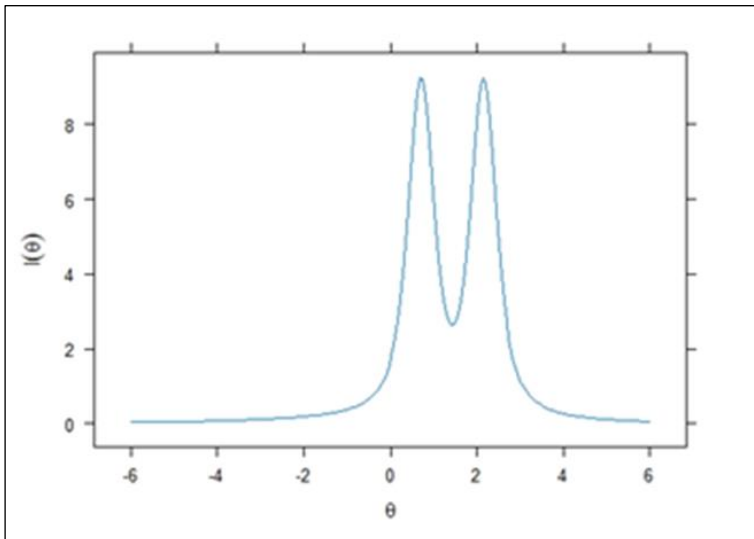


Figure 3. Information curve for contamination-based disgust

Analysis of the items for each scale revealed that the response categories for the following items were difficult to identify: item 19 and item 21 from the animal-

reminder disgust and item 22 from the contamination-based disgust. The item trace lines can be seen in Figures 4, 5, and 6.

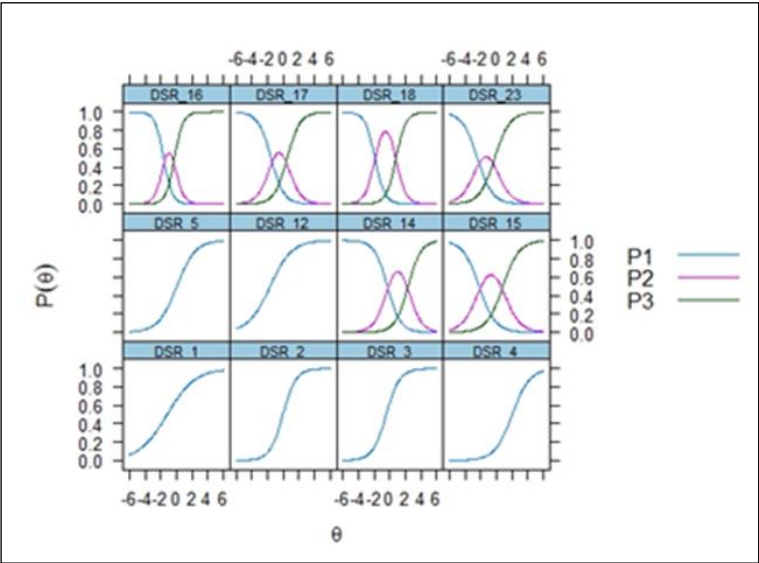


Figure 4. Item trace lines for core disgust scale

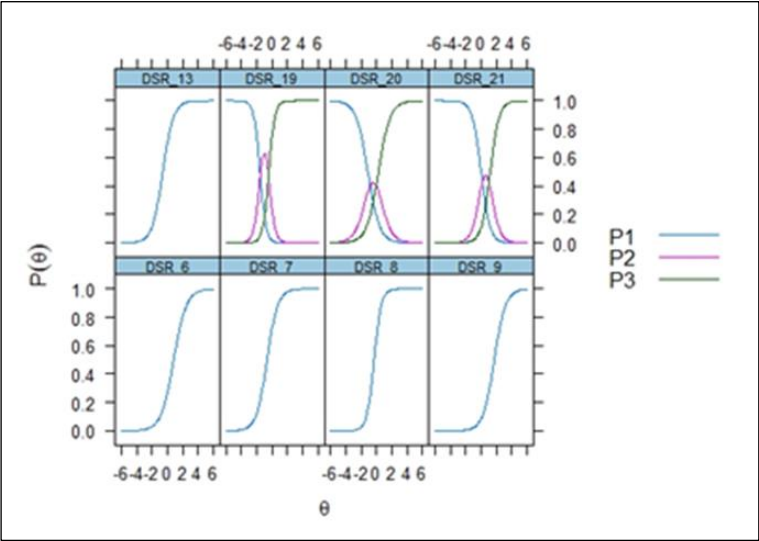


Figure 5. Item trace lines for animal-reminder disgust scale

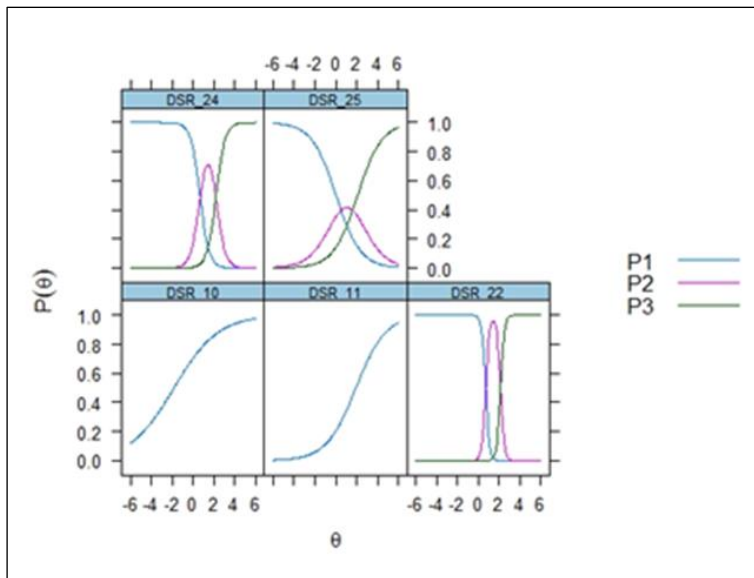


Figure 6. Item trace lines for contamination-based disgust

Local dependency statistics were analysed using the $LD-\chi^2$ index (Chen & Thissen, 1997) and with *Cramer V* values above 0.20 cut-off (Morizot et al., 2007) for all item pairs. For the core disgust scale, six item pairs had scores above 10 and 14 items had scores between 5 and 10. For the animal-reminder disgust scale, the pair of items 2 and 21 had scores above 10 and another pair had scores between 5 and 10. For the contamination-based disgust scale, one pair of items had scores above 10 and another pair had scores between 5 and 10. This problem made it clear that the assumption of local independence was violated. As for the *Cramer V* index, there were pairs of items that exceeded the value of 0.20, namely two pairs for the core disgust scale, 10 pairs in the case of animal-reminder disgust and four pairs in the contamination-based disgust subscale.

Factorial structure of DS-R (Romanian version)

The Keiser-Mayer-Olkin test for the 480 individuals and Bartlett's test were conducted to determine whether the characteristics of the data were appropriate for the factor analysis to be conducted. Thus, the Kaiser-Meyer-Olkin test yielded an index of 0.86 with Bartlett's test ($\chi^2 = 2368.58$, $df = 300$, $p < .001$), suggesting the presence of one or more common factors. Thus, the use of factor reduction procedures was warranted. In addition, confirmatory factor analysis provided freedom for factors to be correlated or independent (Costello & Osborne, 2005; Wood et al., 2015).

The models tested were those identified in the literature, namely the one-factor model (Model 1), models number 2 and 3 which represented three factors, proposed by Olatunji et al. (2009) and by Olatunji, Williams, et al. (2007), and the five-factor model (Model 4), tested by In Kang et al. (2012). The results of the standardized root mean squared residual (SRMR) and the root mean square error of approximation (RMSEA) indicators provided information about the fit of the models with the covariance matrix of the population (< 0.08), although this was true only for the first proposed model. The incremental indicators, on the other hand, did not support these data. Further details are provided in Table 5.

Table 5. Summary of the tested models

Indicators	Model 1	Model 2	Model 3	Model 4
χ^2	805.65	515.53	515.65	642.50
Df	275	249	249	263
CFI	0.75	0.87	0.87	0.82
TLI	0.73	0.86	0.85	0.80
Log-likelihood	-4912.89	-4533.81	-4703.88	-4831.31
AIC	9925.77	9169.61	9509.77	9786.61
BIC	10134.46	9382.48	9722.63	10045.39
RMSEA	0.06 ($p < .01$)	0.05 ($p = .781$)	0.05 ($p = .780$)	0.05 ($p = .069$)
90% CI	[.06, .07]	[.04, .05]	[.04, .05]	[.05, .06]
SRMR	0.05	0.06	0.06	0.05
GFI	0.87	0.92	0.92	0.90
ECVI	1.89	1.29	1.29	1.60

Internal consistency analysis

Cronbach's Alpha was used for internal consistency analysis. Specifically, the fidelity of the entire DS-R scale and for each subscale (core disgust subscale, animal-reminder disgust subscale, and contamination-based disgust subscale) was measured. Accordingly, the entire DS-R instrument showed good internal consistency ($\alpha = .83$, 95% CI [.82, .85]), and the subscales with good internal consistency were core disgust ($\alpha = .72$, 95% CI [.68, .75]) and animal-reminder disgust ($\alpha = .76$, 95% CI [.74, .79]). In contrast, the contamination-based disgust subscale showed low internal consistency ($\alpha = .51$, 95% CI [.49, .66]).

Convergent, discriminant, and incremental validity

To test convergent validity, we measured the disgust variable using two scales, namely DS-R and DES. The results showed a very good association ($r = .75$, $p < .001$). To test discriminant validity, we used the disgust variable (DS-R) together with depression ($r = -.10$, $p = .022$), anxiety ($r = .02$, $p = .676$), and perceived stress

($r = .14$, $p = .002$). The results showed very weak relationships between disgust and depression, and disgust and perceived stress.

Statistical analyses examined the incremental validity of disgust and other emotions in predicting obsessive-compulsive symptoms. In this direction, regression models were proposed in which the criterion chosen was obsessive-compulsive symptoms, and the predictors included in this analysis were (1) disgust; (2) disgust and anxiety; and (3) disgust, anxiety, and perceived stress. For the application of multiple linear regression, the necessary conditions were checked for both dependent and independent variables. The results showed that there were statistically significant relationships between the predictor variables (disgust, anxiety, and perceived stress) and the criterion variable (obsessive-compulsive symptoms). There was also a statistically significant relationship between the predictors. However, the correlation coefficients were low, below 0.30, so there were no collinearity problems. In addition, variables stored in the database that contained data on possible outliers were examined. For the Mahalanobis, Cook, and Standardized DfFit indices, the results did not exceed the values discussed.

For data collected from a sample of 480 participants, a hierarchical regression model was chosen. Thus, for the model with one predictor, we obtained significant results with a weak prediction ($R = .20$, $p < .001$). When the second predictor was added, the results continued to be significant with a higher prediction ($R = .36$, $p < .001$). The model with three predictors was no longer statistically significant ($R = .37$, $p > .05$). The result for the Durbin-Watson statistic of error independence is equal to 2.05, which is not a problem from this point of view. The results obtained for each proposed model are shown in Table 6.

Table 6. Results obtained for each prediction model analysed

Model	R	R^2	ΔR^2	ΔF	$df1, df2$	$p_{\Delta F}$	B	β	p
Model 1									
Disgust	.20	.04	.04	19.94	1, 478	< .001	.23	.20	< .001
Model 2									
Disgust	.36	.13	.09	51.30	1, 477	< .001	.23	.19	< .001
Anxiety							.25	.30	< .001
Model 3									
Disgust	.37	.14	.004	2.15	1, 476	.143	.21	.18	< .001
Anxiety							.21	.04	< .001
Stress							.06	.04	.143

Looking at the results obtained for each proposed model, we found the following results: (1) for the first model, which included the disgust variable, the coefficients were statistically significant ($p < .001$); (2) for the second model, which included the disgust and anxiety predictors, the coefficients were statistically

significant ($p < .001$); (3) for the last proposed model, which included the disgust, anxiety and perceived stress predictors, the results were statistically insignificant for the last variable. With regard to collinearity, the VIF and Tolerance values were within the recommended limits, meaning that there were no collinearity problems among predictors. Consequently, the best prediction model for the data collected was the one based on the first two blocks of variables.

In conclusion, consistent with the proposed objectives, the results demonstrated a positive association between the disgust measured on both scales. A lack of relationship between disgust and anxiety, an increased association between depression, perceived stress and anxiety, and disgust and perceived stress were also highlighted. In addition, disgust and anxiety played an important role in the development of obsessive-compulsive symptoms and could be considered predictors. This observation should be used with caution, since the results obtained are of low intensity.

Discussion

The purpose of this paper was to examine the psychometric properties of the Disgust Scale-Revised, Romanian version, on a non-clinical sample, as well as the implications of an item response model. Overall, the results indicated a good fidelity (through internal consistency), the dominance of the tri-factor model of the DS-R instrument in the literature, the fit of the single-factor model of the scale, good convergent and divergent validity concerning the scale's relationships with other variables, and the important role of disgust and anxiety in predicting obsessive-compulsive symptoms.

The first part of the study revealed, through the psychometric analysis of the DS-R instrument, that the entire scale showed good internal consistency, and the subscales with good internal consistency were related to basic and animal-reminder disgust, with the contamination-related disgust subscale showing poor internal consistency. Consistent with previous research (In Kang et al., 2012; Shams et al., 2015; Van Overveld et al., 2011), acceptable internal consistency was determined. Specifically, these researches obtained Cronbach's Alpha coefficients between .77 and .87; of this study, the internal consistency coefficient was equal to $\alpha = .83$, and for the subscales, we obtained increased indicators, except for the subscale measuring contamination-related disgust. These results confirmed a good internal consistency in the measurement, beyond the minimum acceptable thresholds for this indicator.

With regard to convergent validity, a very high correlation coefficient was reported between two scales measuring disgust, in particular the DS-R and DES measurement. In addition, in terms of discriminant validity, disgust (measured with the DS-R instrument) showed a lack of association with anxiety and very weak relationships with depression and perceived stress. These findings differed from

those reported by In Kang et al. (2012). In terms of incremental validity, disgust and anxiety, contributed to an increase of approximately 9.00% in predicting obsessive-compulsive symptoms. While this result is significant, it was also weak. Therefore, it is likely that other variables not included in this study may also help predict obsessive-compulsive symptoms.

Item Response Theory analysis revealed acceptable fit indices for the three subscales of the DS-R instrument. All items showed discrimination coefficients between 0.47 and 5.49, with the discrimination index ranging from low to very high. Moreover, Item Response Theory analysis showed an acceptable coverage of the subscales of the DS-R instrument, with minor issues with certain items. As there is currently no literature on this subject in the local literature, the results could not be compared with those obtained in this paper.

The confirmatory factor analysis revealed that the three-factor models tested for the DS-R instrument were the most widely used, but were not sufficiently consistent with the data tested in this study. Furthermore, research conducted by In Kang et al. (2012) revealed the following five-factor version of the DS-R instrument: core disgust-touch, animal-reminder disgust, core disgust-dirt, contamination-based disgust, and social intolerance disgust. Therefore, the study provided evidence for the psychometric properties of the DS-R instrument and its use in the clinical settings for the evaluation of disgust, especially symptoms of specific phobias and obsessive-compulsive disorder. The research data also confirmed that the one-factor scale structure fulfilled most of the requirements regarding statistical indices. However, the study did not examine the scale's stability over time or susceptibility to change for either a clinical sample or for psychologically treated diagnoses. In addition, the socio-cultural characteristics of the population may be an important element in the under-identified disgust structures. The Romanian population has a different socio-cultural context than countries like the Netherlands, Korea, and the United States, which may influence the different construction of disgust sensitivity, a feature also emphasized by In Kang et al. (2012) on the Korean version of the DS-R instrument.

Theoretical and practical implications

From a theoretical perspective, the results of this study are important because they raise questions about the original structure of the DS-R instrument (and the measured construct) between the original samples from the United States and other European countries and the selected sample from Eastern Europe. One possible explanation for the lack of equivalence could be cross-cultural differences in feelings of disgust, a theme that has been widely highlighted in the literature (Preti et al., 2009; Siegrist & Hartmann, 2020).

From an empirical point of view, the findings of this study show that the DS-R may be successfully used for the Romanian population, especially in the clinical domain. Overall, the findings add to the evidence on the cross-cultural validity of this measure, given that various adaptations of the scale in different languages and

across different populations have often retained the same number of items and good psychometric properties. As a result, the translation of the scale into Romanian was generally found to be as psychometrically valid and reliable as the rest of the adaptations found in the literature.

From psychological perspective, the results of the study can help practitioners in evaluation and clinical decision making. This can be done by including forms of disgust associated with fear of contamination in obsessive-compulsive symptoms. In addition, the development of obsessive-compulsive symptoms that include disgust and anxiety as predictors has suggested the possibility of integrating these findings into the prevention or psychological treatment of mental disorders. These arguments have been made in research highlighting that obsessive-compulsive disorder is a disorder with numerous heterogeneous symptoms (Olatunji, Christian, et al., 2019); in particular, obsessions and compulsions may be accompanied by high levels of anxiety (Hjemdal et al., 2010), similar to anxiety disorders (Stein et al., 2010). Understanding distress beyond general irrational belief measures may be improved by stressor specific irrational beliefs (David et al., 2019). Thus, the study may provide a starting point for investigating the underlying mechanisms of obsessive-compulsive symptoms, with a focus on disgust. This could be particularly useful when applied in clinical populations to develop new psychological treatment approaches.

Study limitations and future research directions

Several limitations that should be considered were noted. Firstly, the study was cross-sectional and variables were measured only once. Therefore, longitudinal studies are essential to infer changes that may occur intra-individually over time. Secondly, data were collected only on the basis of self-report, which tends to exaggerate associations between variables. Thirdly, there was no rigorous selection of participants, as participants were self-selected. Most likely a representative sample would have accurately reflected the characteristics of the population of interest. Instead, the lack of rigorous sampling may limit the generalizability of the study's findings. Fourthly, the study did not include a control group, and participants were part of a nonclinical sample. Therefore, it is difficult to highlight the possibility that the reported associations are relevant to individuals diagnosed with specific phobias or obsessive-compulsive disorder. Finally, we used only a single instrument to measure the selected variables (with the exception of the measure of disgust). Future research could replicate these results using other instruments to measure the included variables.

Future studies may focus on efforts to validate the DS-R instrument in different populations, as it has been done to date in nonclinical samples from Australia, Brazil, Germany, Italy, Japan, Netherlands, Sweden, United States (Olatunji et al., 2009), Iranian clinical sample (Shams et al., 2015), Korean non-clinical sample (In Kang et al., 2012). This way, equivalence of measurements with

those in other countries around the world can be ensured. Other future directions could include creating and testing other models to determine the appropriate factor structure of the scale, as well as using diversity within the samples, i.e., testing on clinical samples diagnosed with specific phobias and obsessive-compulsive disorder. Future studies are also needed to outline the mechanisms of the disgust construct in relation to anxiety and perceived stress in the development of phobia-specific and obsessive-compulsive clinical manifestations. It is important that these future directions can be applied to clinical populations to develop new techniques for effective psychotherapeutic interventions. Given the importance of disgust in clinical disorders, the development of more complex methods that are independent of correlations, as well as further analyses of psychometric quality in the assessment of disgust, are essential to improve our understanding of the role of this emotion in the pathological setting.

Conclusions

In summary, although disgust is associated with the maintenance of anxiety and obsessive-compulsive symptoms, the relationship of this emotion to negative affect and symptoms of mental disorders is not clear enough. Therefore, the study provided evidence to support the psychometric properties of the revised version of the Disgust Scale for a large Romanian sample. Overall, the study demonstrated that this version of the instrument is reliable, valid, and acceptable for use in the field of psychology, especially when the one-factor model is considered. Further refinement of the scale could be beneficial for a more comprehensive development of this assessment instrument in the clinical setting. However, further studies are needed to apply these results in the clinical context and to develop new directions for effective psychological interventions.

Author's Note

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References

- Anderson, L. M., Reilly, E. E., Thomas, J. J., Eddy, K. T., Franko, D. L., Hormes, J. M., & Anderson, D. A. (2018). Associations among fear, disgust, and eating pathology in undergraduate men and women. *Appetite*, 125, 445–453. <https://doi.org/10.1016/j.appet.2018.02.017>

- Armstrong, T., & Olatunji, B. O. (2017). Pavlovian disgust conditioning as a model for contamination-based OCD: Evidence from an analogue study. *Behaviour Research and Therapy*, 93, 78–87. <https://doi.org/10.1016/j.brat.2017.03.009>
- Arrindell, W. A., Mulkens, S., Kok, J., & Vollenbroek, J. (1999). Disgust sensitivity and the sex difference in fears to common indigenous animals. *Behaviour Research and Therapy*, 37(3), 273–280. [https://doi.org/10.1016/S0005-7967\(98\)00129-6](https://doi.org/10.1016/S0005-7967(98)00129-6)
- Badour, C. L., & Feldner, M. T. (2016). Disgust and imaginal exposure to memories of sexual trauma: Implications for the treatment of posttraumatic stress. *Psychological Trauma*, 8(3), 267–275. <https://doi.org/10.1037/tra0000079>
- Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. F. (1996). Comparison of Beck Depression Inventories-IA and-II in psychiatric outpatients. *Journal of Personality Assessment*, 67(3), 588–597. https://doi.org/10.1207/s15327752jpa6703_13
- Bianchi, K. N., & Carter, M. M. (2012). An experimental analysis of disgust sensitivity and fear of contagion in Spider and Blood Injection Injury Phobia. *Journal of Anxiety Disorders*, 26(7), 753–761. <http://dx.doi.org/10.1016/j.janxdis.2012.06.004>
- Brake, C. A., Rojas, S. M., Badour, C. L., Dutton, C. E., & Feldner, M. T. (2017). Self-disgust as a potential mechanism underlying the association between PTSD and suicide risk. *Journal of Anxiety Disorders*, 47, 1–9. <https://doi.org/dx.doi.org/10.1016/j.janxdis.2017.01.003>
- Brand, J., McKay, D., Wheaton, M. G., & Abramowitz, J. S. (2013). The relationship between obsessive compulsive beliefs and symptoms, anxiety and disgust sensitivity, and Swine Flu fears. *Journal of Obsessive-Compulsive and Related Disorders*, 2, 200–206. <http://dx.doi.org/10.1016/j.jocrd.2013.01.007>
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Sage.
- Cavanagh, K., & Davey, G. C. L. (2000). *The development of a measure of individual differences in disgust*. British Psychological Society.
- Cervin, M., & Perrin, S. (2019). Measuring harm avoidance, incompleteness, and disgust in youth with obsessive-compulsive disorder and anxiety disorder. *Journal of Obsessive-Compulsive and Related Disorders*, 22, 100442. <https://doi.org/10.1016/j.jocrd.2019.100442>
- Chalmers, R. P. (2012). mirt: A multidimensional Item Response Theory package for the R environment. *Journal of Statistical Software*, 48(6), 1–29.
- Chen, W.-H., & Thissen, D. (1997). Local dependence indexes for item pairs using Item Response Theory. *Journal of Educational and Behavioral Statistics*, 22(3), 265–289. <https://doi.org/10.3102/10769986022003265>
- Cisler, J. M., Olatunji, B. O., & Lohr, J. M. (2009). Disgust, fear, and the anxiety disorders: A critical review. *Clinical Psychology Review*, 29(1), 34–46. <https://doi.org/10.1016/j.cpr.2008.09.007>

- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396. <https://doi.org/10.2307/2136404>
- Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation*, 10(7), 1–9. <https://doi.org/10.7275/jyj1-4868>
- Curtis, V., De Barra, M., & Aunger, R. (2011). Disgust as an adaptive system for disease avoidance behaviour. *Transactions of the Royal Society B: Biological Sciences*, 366(1563), 389–401. <https://doi.org/10.1098/rstb.2010.0117>
- David, D., Schnur, J. B., & Montgomery, G. H. (2019). Preliminary validation of a stressor-specific rational and irrational beliefs scales: The Beliefs Scale (SBS). *Journal of Evidence-Based Psychotherapies*, 19(2), 15–28. <https://doi.org/10.24193/jebp.2019.2.11>
- de Jong, P. J., & Borg, C. (2020). Disgust sensitivity. In J. S. Abramowitz & S. M. Blakey (Eds.), *Clinical handbook of fear and anxiety: Maintenance processes and treatment mechanisms* (pp. 81–98). American Psychological Association.
- de Jong, P. J., & Merckelbach, H. (1998). Blood-injection-injury phobia and fear of spiders: Domain specific individual differences in disgust sensitivity. *Personality and Individual Differences*, 24(2), 153–158. [https://doi.org/10.1016/S0191-8869\(97\)00178-5](https://doi.org/10.1016/S0191-8869(97)00178-5)
- Deacon, B., & Olatunji, B. O. (2007). Specificity of disgust sensitivity in the prediction of behavioral avoidance in contamination fear. *Behaviour Research and Therapy*, 45, 2110–2120. <https://doi.org/10.1016/j.brat.2007.03.008>
- Engelhard, Iris M., Olatunji, B. O., & de Jong, P. J. (2011). Disgust and the development of posttraumatic stress among soldiers deployed to Afghanistan. *Journal of Anxiety Disorders*, 25(1), 58–63. <https://doi.org/10.1016/j.janxdis.2010.08.003>
- Fan, Q., & Olatunji, B. O. (2013). Individual differences in disgust sensitivity and health-related avoidance: Examination of specific associations. *Personality and Individual Differences*, 55(5), 454–458. <https://doi.org/10.1016/j.paid.2013.04.007>
- Fergus, T. A., & Valentiner, D. P. (2009). The Disgust Propensity and Sensitivity Scale–Revised: An examination of a reduced-item version. *Journal of Anxiety Disorders*, 23(5), 703–710. <https://doi.org/10.1016/j.janxdis.2009.02.009>
- Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive–Compulsive Inventory: Development and validation of a short version. *Psychological Assessment*, 14(4), 485–496. <https://doi.org/10.1037//1040-3590.14.4.485>
- Gilchrist, P. T., Vrinceanu, T., Beland, S., Bacon, S. L., & Ditto, B. (2016). Disgust stimuli reduce heart rate but do not contribute to vasovagal symptoms. *Journal of Behavior Therapy and Experimental Psychiatry*, 51, 116–122. <http://dx.doi.org/10.1016/j.jbtep.2016.01.005>

- Goss-Sampson, M. (2020). *Statistical analysis in JASP: A guide for students* (4th ed.). <https://doi.org/10.6084/m9.figshare.9980744>
- Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences*, 16(5), 701–713. [https://doi.org/10.1016/0191-8869\(94\)90212-7](https://doi.org/10.1016/0191-8869(94)90212-7)
- Haidt, J., Rozin, P., McCauley, C., & Imada, S. (1997). Body, psyche, and culture: Their relationship between disgust and morality. *Psychology and Developing Societies*, 9(1), 107–131. <https://doi.org/10.1177/097133369700900105>
- Hays, R. D., Morales, L. S., & Reise, S. P. (2000). Item Response Theory and health outcomes measurement in the 21st century. *Medical Care*, 38(9 Suppl), II28. <https://doi.org/10.1097/00005650-200009002-00007>
- Hjemdal, O., Vogel, P. A., Solem, S., Hagen, K., & Stiles, T. C. (2010). The relationship between resilience and levels of anxiety, depression, and obsessive-compulsive symptoms in adolescents. *Clinical Psychology and Psychotherapy*, 18(4), 314–321. <https://doi.org/10.1002/cpp.719>
- Hu, L., & Bentler, P., M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1–55. <http://dx.doi.org/10.1080/10705519909540118>
- In Kang, J., Kim, S. J., Cho, H. J., Jhung, K., Lee, S. Y., Lee, E., & An, S. K. (2012). Psychometric analysis of the Korean version of the Disgust Scale—Revised. *Comprehensive Psychiatry*, 53(5), 648–655. <https://doi.org/10.1016/j.comppsy.2011.06.005>
- Khairallah, C., Zoghbi, M., Richa, S., & Bou Khalil, R. (2019). Disgust, impulsivity and depressive dimensions in subjects at risk for bulimia nervosa and/or binge eating disorder. *Asian Journal of Psychiatry*, 39, 32–34. <https://doi.org/10.1016/j.ajp.2018.11.019>
- Kleinknecht, R. A., Kleinknecht, E. E., & Thorndike, R. M. (1997). The role of disgust and fear in blood and injection—Related fainting symptoms: A structural equation model. *Behaviour Research and Therapy*, 35(12), 1075–1087. [https://doi.org/10.1016/S0005-7967\(97\)80002-2](https://doi.org/10.1016/S0005-7967(97)80002-2)
- Knowles, K. A., Cox, R. C., Armstrong, T., & Olatunji, B. O. (2018). Cognitive mechanisms of disgust in the development and maintenance of psychopathology: A qualitative review and synthesis. *Clinical Psychology Review*, 69, 30–50. <https://doi.org/10.1016/j.cpr.2018.06.002>
- Knowles, K. A., Tomarken, A., J., & Olatunji, B. O. (2018). Effects of exposure to erotica on disgust: A preliminary test among contamination-fearful individuals. *Journal of Obsessive-Compulsive and Related Disorders*, 18, 54–60. <https://doi.org/10.1016/j.jocrd.2018.06.006>
- Melli, G., Poli, A., Chiorri, C., & Olatunji, B. O. (2019). Is heightened disgust propensity truly a risk factor for contamination-related obsessive-compulsive disorder? *Behavior Therapy*, 50(3), 621–629. <https://doi.org/10.1016/j.beth.2018.10.002>

- Merckelbach, H., Muris, P., de Jong, P. J., & de Jongh, A. (1999). Disgust sensitivity, blood-injection-injury fear, and dental anxiety. *Clinical Psychology and Psychotherapy*, 6, 279–285. [https://doi.org/10.1002/\(SICI\)1099-0879\(199910\)6:4<279::AID-CPP210>3.0.CO;2-R](https://doi.org/10.1002/(SICI)1099-0879(199910)6:4<279::AID-CPP210>3.0.CO;2-R)
- Morizot, J., Ainsworth, A. T., & Reise, S. P. (2007). Toward modern psychometrics: Application of Item Response Theory models in personality research. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in personality* (pp. 407–423). Guilford Press.
- Mulkens, S. A. N., de Jong, P. J., & Merckelbach, H. (1996). Disgust and spider phobia. *Journal of Abnormal Psychology*, 105, 464–468. <http://dx.doi.org/10.1037/0021-843X.105.3.464>
- Muris, P. (2006). The pathogenesis of childhood anxiety disorders: Considerations from a developmental psychopathology perspective. *International Journal of Behavioral Development*, 30(1), 5–11. <https://doi.org/10.1177/0165025406059967>
- Muris, P., Huijding, J., Mayer, B., Leemreis, W., Passchier, S., & Bouwmeester, S. (2009). The effects of verbal disgust-and threat-related information about novel animals on disgust and fear beliefs and avoidance in children. *Journal of Clinical Child & Adolescent Psychology*, 38(4), 551–563. <https://doi.org/10.1080/15374410902976379>
- Novara, C., Boiche, J., Lebrun, C., Macgregor, A., Mateo, Y., & Raffard, S. (2019). Disgust assessment: Factorial structure and psychometric properties of the French version of the Disgust Propensity and Sensibility Scale Revised-12. *PLoS ONE*, 14(1), e0210639. <https://doi.org/10.1371/journal.pone.0210639>
- Olafsson, R. P., Emmelkamp, P. M. G., Ólason, D. Þ., & Kristjánsson, Á. (2020). Disgust and contamination concerns: The mediating role of harm avoidance and incompleteness. *International Journal of Cognitive Therapy*, 13, 251–270. <https://doi.org/10.1007/s41811-020-00076-5>
- Olatunji, B. O. (2020). Linking Pavlovian disgust conditioning and eating disorder symptoms: An analogue study. *Behavior Therapy*, 51(1), 178–189. <https://doi.org/10.1016/j.beth.2019.06.002>
- Olatunji, B. O., Berg, H., Cox, R. C., & Billingsley, A. (2017). The effects of cognitive reappraisal on conditioned disgust in contamination-based OCD: An analogue study. *Journal of Anxiety Disorders*, 51, 86–93. <http://dx.doi.org/10.1016/j.janxdis.2017.06.005>
- Olatunji, B. O., Christian, C., Brosnoff, L., Tolin, D. F., & Levinson, C. A. (2019). What is at the core of OCD? A network analysis of selected obsessive-compulsive symptoms and beliefs. *Journal of Affective Disorders*, 257, 45–54. <https://doi.org/10.1016/j.jad.2019.06.064>
- Olatunji, B. O., Cisler, J. M., Meunier, S., Connolly, K., & Lohr, J. M. (2008). Expectancy bias for fear and disgust and behavioral avoidance in spider fearful individuals. *Cognitive Therapy and Research*, 32(3), 460–469. <https://doi.org/10.1007/s10608-007-9164-8>

- Olatunji, B. O., Cisler, J., McKay, D., & Phillips, M. L. (2010). Is disgust associated with psychopathology? Emerging research in the anxiety disorders. *Psychiatry Research*, 175(1–2), 1–10. <https://doi.org/10.1016/j.psychres.2009.04.007>
- Olatunji, B. O., & Deacon, B. (2008). Specificity of disgust sensitivity in the prediction of fear and disgust responding to a brief spider exposure. *Journal of Anxiety Disorders*, 22(2), 328–336. <https://doi.org/10.1016/j.janxdis.2007.03.007>
- Olatunji, B. O., Ebesutani, C., David, B., Fan, Q., & McGrath, P. B. (2011). Disgust proneness and obsessive-compulsive symptoms in a clinical sample: Structural differentiation. *Journal of Anxiety Disorders*, 25, 932–938. <https://doi.org/10.1016/j.janxdis.2011.05.006>
- Olatunji, B. O., Ebesutani, C., & Kim, E. H. (2015). Examination of a bifactor model of the Three Domains of Disgust Scale: Specificity in relation to obsessive-compulsive symptoms. *Psychological Assessment*, 27(1), 102–113. <https://doi.org/10.1037/pas0000039>
- Olatunji, B. O., Ebesutani, C., Kim, J., Riemann, B. C., & Jacobi, D. M. (2017). Disgust proneness predicts obsessive compulsive disorder symptom severity in a clinical sample of youth: Distinctions from negative affect. *Journal of Affective Disorders*, 213, 118–125. <http://dx.doi.org/10.1016/j.jad.2017.02.017>
- Olatunji, B. O., Kim, J., Cox, R. C., & Ebesutani, C. (2019). Prospective associations between disgust proneness and OCD symptoms: Specificity to excessive washing compulsions. *Journal of Anxiety Disorders*, 65, 34–40. <https://doi.org/10.1016/j.janxdis.2019.05.003>
- Olatunji, B. O., & McKay, D. (2009). *Disgust and its disorders: Theory, assessment, and treatment implications*. American Psychological Association.
- Olatunji, B. O., Moretz, M. W., McKay, D., Bjorklund, F., de Jong, P. J., Haidt, J., Hursti, T. J., Imada, S., Koller, S., Mancini, F., Page, A. C., & Schienle, A. (2009). Confirming the three-factor structure of the Disgust Scale—Revised in eight countries. *Journal of Cross-Cultural Psychology*, 40(2), 234–255. <https://doi.org/10.1177/0022022108328918>
- Olatunji, B. O., & Sawchuk, C. N. (2005). Disgust: Characteristic features, social manifestations, and clinical implications. *Journal of Social and Clinical Psychology*, 24(7), 932–962. <http://dx.doi.org/10.1521/jscp.2005.24.7.932>
- Olatunji, B. O., Sawchuk, C. N., de Jong, P. J., & Lohr, J. M. (2006). The structural relation between disgust sensitivity and blood-injection-injury fears: A cross-cultural comparison of US and Dutch data. *Journal of Behavior Therapy and Experimental Psychiatry*, 37, 16–29. <https://doi.org/10.1016/j.jbtep.2005.09.002>
- Olatunji, B. O., Sawchuk, C. N., de Jong, P. J., & Lohr, J. M. (2007). Disgust sensitivity and anxiety disorder symptoms: Psychometric properties of the Disgust Emotion Scale. *Journal of Psychopathology and Behavioral Assessment*, 29, 115–124. <https://doi.org/10.1007/s10862-006-9027-8>

- Olatunji, B. O., Sawchuk, C. N., Lohr, J. M., & de Jong, P. J. (2004). Disgust domains in the prediction of contamination fear. *Behaviour Research and Therapy*, 42(1), 93–104. [https://doi.org/10.1016/S0005-7967\(03\)00102-5](https://doi.org/10.1016/S0005-7967(03)00102-5)
- Olatunji, B. O., Tart, C. D., Ciesielski, B. G., McGrath, P. B., & Smits, J. A. J. (2011). Specificity of disgust vulnerability in the distinction and treatment of OCD. *Journal of Psychiatric Research*, 45(9), 1236–1242. <https://doi.org/10.1016/j.jpsychires.2011.01.018>
- Olatunji, B. O., Williams, N. L., Lohr, J. M., & Sawchuk, C. N. (2005). The structure of disgust: Domain specificity in relation to contamination ideation and excessive washing. *Behaviour Research and Therapy*, 43(8), 1069–1086. <https://doi.org/10.1016/j.brat.2004.08.002>
- Olatunji, B. O., Williams, N. L., Tolin, D. F., Abramowitz, J. S., Sawchuk, C. N., Lohr, J. M., & Elwood, L. S. (2007). The Disgust Scale: Item analysis, factor structure, and suggestions for refinement. *Psychological Assessment*, 19(3), 281–297. <https://doi.org/10.1037/1040-3590.19.3.281>
- Poli, A., Melli, G., & Radomsky, A. S. (2019). Different disgust domains specifically relate to mental and contact contamination fear in obsessive-compulsive disorder: Evidence from a path analytic model in an Italian clinical sample. *Behavior Therapy*, 50(2), 380–394. <https://doi.org/10.1016/j.beth.2018.07.006>
- Popa, M. (2010). *Statistici multivariate aplicate în psihologie*. Polirom.
- Preti, A., De Girolamo, G., Vilagut, G., Alonso, J., De Graaf, R., Bruffaerts, R., Demyttenaere, K., Pinto-Meza, A., Haro, J. M., Morosini, P., & The ESEMeD-WMH Investigators. (2009). The epidemiology of eating disorders in six European countries: Results of the ESEMeD-WMH project. *Journal of Psychiatric Research*, 43(14), 1125–1132. <https://doi.org/10.1016/j.jpsychires.2009.04.003>
- R Core Team. (2016). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. <https://www.R-project.org/>
- Rachman, S. (2004). Fear of contamination. *Behaviour Research and Therapy*, 42(11), 1227–1255. <https://doi.org/10.1016/j.brat.2003.10.009>
- Rozin, P., Fallon, A. E., & Mandell, R. (1984). Family resemblance in attitudes to foods. *Developmental Psychology*, 20(2), 309–314. <http://dx.doi.org/10.1037/0012-1649.20.2.309>
- Samejima, F. (1997). Graded Response Model. In W.J. Linden & R. K. Hambleton (Eds.), *Handbook of Modern Item Response Theory* (pp. 85–100). Springer.
- Shams, G., Janani, L., Milosevic, I., & Foroughi, E. (2015). Disgust emotion and obsessive compulsive symptoms in an Iranian clinical sample. *Psychology*, 6(13), 1721–1731. <https://doi.org/10.4236/psych.2015.613168>
- Shapira, N. A., Liu, Y., He, A. G., Bradley, M. M., Lessig, M. C., James, G. A., Stein, D. J., Lang, P. J., & Goodman, W. K. (2003). Brain activation by disgust-inducing pictures in obsessive-compulsive disorder. *Biological Psychiatry*, 54(7), 751–756. [https://doi.org/10.1016/S0006-3223\(03\)00003-9](https://doi.org/10.1016/S0006-3223(03)00003-9)

- Siegrist, M., & Hartmann, C. (2020). Perceived naturalness, disgust, trust and food neophobia as predictors of cultured meat acceptance in ten countries. *Appetite*, 155, 104814. <https://doi.org/10.1016/j.appet.2020.104814>
- Skolnick, A. J., & Dzokoto, V. A. (2013). Disgust and contamination: A cross national comparison of Ghana and the United States. *Frontiers in Psychology*, 4(91), 1–11. <https://doi.org/10.3389/fpsyg.2013.00091>
- Steer, R. A., & Beck, A. T. (1997). Beck Anxiety Inventory. In C. P. Zalaquett & R. J. Wood (Eds.), *Evaluating stress: A book of resources* (pp. 23–40). Scarecrow Education.
- Stein, D. J., Fineberg, N. A., Bienvenu, O. J., Denys, D., Lochner, C., Nestadt, G., Leckman, J. F., Rauch, S. L., & Phillips, K. A. (2010). Should OCD be classified as an anxiety disorder in DSM-V? *Depression & Anxiety*, 27(6), 495–506. <https://doi.org/10.1002/da.20699>
- Tybur, J. M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: Individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology*, 97(1), 103–122. <https://doi.org/10.1037/a0015474>
- Van Delft, I., Finkenauer, C., Tybur, J. M., & Lamers-Winkelmann, F. (2016). Disgusted by sexual abuse: Exploring the association between disgust sensitivity and posttraumatic stress symptoms among mothers of sexually abused children. *Journal of Traumatic Stress*, 29(3), 237–244. <https://doi.org/10.1002/jts.22099>
- Van Overveld, M., de Jong, P. J., & Peters, M. L. (2010). The Disgust Propensity and Sensitivity Scale – Revised: Its predictive value for avoidance behavior. *Personality and Individual Differences*, 49(7), 706–711. <https://doi.org/10.1016/j.paid.2010.06.008>
- Van Overveld, M., de Jong, P. J., Peters, M. L., & Schouten, E. (2011). The Disgust Scale-R: A valid and reliable index to investigate separate disgust domains? *Personality and Individual Differences*, 51(3), 325–330. <https://doi.org/10.1016/j.paid.2011.03.023>
- Van Overveld, W. J. M., de Jong, P. J., Peters, M. L., Cavanach, K., & Davey, G. C. L. (2006). Disgust propensity and disgust sensitivity: Separate constructs that are differentially related to specific fears. *Personality and Individual Differences*, 41, 1241–1252. <https://doi.org/doi:10.1016/j.paid.2006.04.021>
- Wood, N. D., Akloubou Gnonhosou, D. C., & Bowling, J. (2015). Combining parallel and exploratory factor analysis in identifying relationship scales in secondary data. *Marriage & Family Review*, 51(5), 385–395. <https://doi.org/10.1080/01494929.2015.1059785>
- Woody, S. R., & Tolin, D. F. (2002). The relationship between disgust sensitivity and avoidant behavior: Studies of clinical and nonclinical samples. *Journal of Anxiety Disorders*, 16, 543–559. [https://doi.org/10.1016/S0887-6185\(02\)00173-1](https://doi.org/10.1016/S0887-6185(02)00173-1)