Journal of Anxiety Disorders 65 (2019) 34–40

Contents lists available at ScienceDirect

Journal of Anxiety Disorders

journal homepage: www.elsevier.com/locate/janxdis

Prospective associations between disgust proneness and OCD symptoms: Specificity to excessive washing compulsions

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ARTICLE INFO

Keywords:
Disgust Proneness
OCD
Washing
Contamination

ABSTRACT

Although considerable evidence has linked disgust proneness (DP) to obsessive-compulsive disorder (OCD), few studies have examined the extent to which DP predicts OCD symptoms over time. Further, it remains unclear if DP is a risk factor for the contamination subtype of OCD specifically or if it is prospectively associated with other OCD symptom subtypes. The present study sought to address these gaps in the literature with a large sample of unselected community participants (n = 497) that completed measures of DP and OCD symptoms monthly over a 6-month period. Latent growth analysis revealed that initial levels of DP were associated with higher initial level of total OCD symptoms when controlling for depression, but not the slope of change in total OCD symptoms over time. Initial levels of total OCD symptoms were also associated with higher initial levels of DP when controlling depression, but not the slope of change in DP over time. Examination of symptom specificity revealed that initial levels of DP were associated with initial levels of washing, neutralizing, obsessing, ordering, and hoarding symptoms. However, initial levels of DP were associated only with the slope of change in the washing subtype when controlling for depression such that high initial levels of DP were associated with steeper increases in washing symptoms of OCD over the 6-month period. These findings suggest that although DP may have concurrent associations with symptoms of OCD more broadly, prospective associations are specific to the contamination/washing subtype of OCD. The implications of these findings for the etiology and treatment of contamination-based OCD are discussed.

1. Introduction

Disgust proneness (DP) is a personality trait that is characterized by the tendency to experience disgust as well as the tendency to find the experience of disgust aversive (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006). Psychometric research suggests that DP is relatively stable over time (Olatunji et al., 2012), and taxometric analysis has shown that it is present to a greater or lesser extent in all individuals (Olatunji & Broman-Fulks, 2007). Although it is clear that individuals vary in the degree to which they experience disgust, the mechanism(s) that may account for such differences remains unclear. There is research suggesting that DP may be the product of a combination of genetic factors (Kang et al., 2012; Sherlock, Zietsch, Tybur, & Jern, 2016) and environmental factors (Rozin & Millman, 1987; Stevenson, Oaten, Case, Repacholi, & Wagland, 2010) including childhood socializing experiences where disgust responses are modeled excessively. The interaction of genetic vulnerabilities and various environmental factors, including social transmission during formative stages of development (Kim, Ebesutani, Young, & Olatunji, 2013; Rozin, Haidt, & McCauley, 2008) and acquired information shared by a particular culture through social learning and group hygiene behavior (Curtis, de Barra, & Aunger, 2011), may also partially explain individual differences in DP.

High levels of DP have been more recently identified as a risk factor for the development of obsessive-compulsive disorder (OCD; Olatunji, Armstrong, & Elwood, 2017; Olatunji, Cisler, McKay, & Phillips, 2010). There is convincing evidence that disgust evolved as an adaptive response to protect against disease risk (Curtis, Aunger, & Rabie, 2004; Tybur, Lieberman, Kurzban, & DeScioli, 2013). Accordingly, excessive DP may be a risk factor for only the contamination subtype of OCD. Contamination-based OCD is characterized by intrusive, repetitive thoughts, images, or impulses about contagion. Compulsions associated with contamination-based OCD consist of purposeful, repetitive overt and covert behaviors such as excessive washing and cleaning that are

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https://doi.org/10.1016/j.janxdis.2019.05.003
Received 24 February 2019; Received in revised form 12 April 2019; Accepted 19 May 2019
Available online 25 May 2019
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performed in an effort to relieve obsessional distress. Given that disgust is thought to serve a disease-avoidance function (Matchett & Davey, 1991), it has been posited that the contamination-based OCD subtype represents a dysfunction in DP (Husted, Shapira, & Goodman, 2006). Consistent with this view, research has shown that individual differences in DP predict beliefs about the likelihood of catching a disease when confronted with potentially contaminated stimuli, even after controlling for anxiety symptoms (Mitte, 2008). Research examining the link between DP and symptoms of OCD more directly also supports a specific link with the contamination subtype. For example, Mancini, Gragnani, and D'Olimpio (2001), found that the washing symptom variant of OCD is best predicted by DP, whereas other OCD symptoms (e.g., obsessions and impulses) are best predicted by anxiety and/or depression. Similarly, Tolin, Woods, and Abramowitz (2006) found that although DP was associated with several OCD symptom subtypes, analysis of residuals controlling for paired comparisons indicated that the clearest relationship was with the washing symptoms of OCD.

The unique link between DP and contamination-based OCD has also been observed with regards to treatment outcome. For example, Athey et al. (2015) assessed DP and symptoms of OCD in patients receiving intensive residential treatment for OCD. Using linear regression with adjustment for age, sex, and depression severity, change in DP was found to be significantly associated with improvement in contamination/washing symptoms but not in other OCD symptom dimensions. It is important to note that research linking DP to only symptoms of contamination-based OCD has not been consistent. For example, some research has shown that DP predicts more global symptoms of OCD (Olatunji, Ebesutani, David, Fan, & McGrath, 2011) and OCD symptoms of neutralizing and ordering specifically (Berger & Anaki, 2014; Olatunji, Moretz et al., 2010). Similarly, Olatunji et al. (2007) found that DP predicted general OCD symptoms as well as OCD washing concerns when controlling for anxiety symptoms. Treatment outcome research has also not been fully consistent. For example, Olatunji, Tart, Ciesielski, McGrath, and Smits (2011) found that decreases in DP during exposure-based treatment mediated improvement in global OCD symptoms consisting of washing, checking, obsessing, neutralizing, ordering, and hoarding, even after controlling for improvements in negative affect. Thus, it remains unclear if DP is a specific risk factor for only the contamination-based OCD subtype.

Delineating the extent to which DP confers risk for various symptoms of OCD require the use of longitudinal research designs. Unfortunately, the majority of the available research has been cross-sectional and the paucity of longitudinal studies have produced inconsistent findings. In one study, Olatunji (2010) found that changes in DP over a 12-week period predicted changes in self-reported contamination-based OCD symptoms in a non-clinical sample. Only two longitudinal studies to date have examined the link between DP and other OCD symptoms. In the first such study, David et al. (2009) examined an undergraduate sample at baseline and then again after 12 weeks. They found that DP did not predict residual change in total symptoms of OCD over the 12-week period when controlling for various other anxiety disorder risk factors. Furthermore, examination of specific OCD symptoms revealed that DP predicted only residual change in hoarding. In a subsequent longitudinal study, Berle et al. (2012) examined one hundred and nine OCD participants who completed measures of DP and OCD symptoms at baseline and sixty of the participants underwent a six-month follow-up assessment. At the baseline assessment, DP was significantly associated with all OCD symptom dimensions except hoarding. Although changes in DP between baseline and the six-month follow-up assessment were significantly associated with changes in overall self-reported OCD symptoms, it was not associated with changes in contamination-based OCD symptoms.

Although the two longitudinal studies to date have failed to uniquely link DP to the contamination symptom subtype of OCD, the studies are not without limitations. In addition to relatively small sample sizes, the studies are also limited by the assessment of DP and OCD symptoms at only 2 time points. Symptom assessment at only 2 time points makes it difficult to detect distinct patterns of change over time. Another limitation of the two longitudinal studies is that they focus exclusively on DP as a predictor of OCD symptoms and not the inverse. Indeed, an alternative hypothesis may be that DP is not a risk factor for OCD but rather a consequence of OCD. To address these limitations in the available research, the present study examined the association between DP and OCD symptoms in a large sample of unselected community participants that completed measures of DP and OCD symptoms monthly over a 6-month period. Using latent growth analysis, it was predicted that DP at time 1 of the assessment would be associated with initial levels of a range of symptoms of OCD. However, it was predicted that DP at time 1 would be associated with only changes in symptoms of contamination-based OCD over time. Specifically, it was hypothesized that higher initial levels of DP will predict a steeper increase in washing symptoms of OCD over the 6-month period. Exploratory analyses were also conducted to examine the extent to which OCD symptoms at time 1 of the assessment predicted initial levels and change in DP.

2. Method

2.1. Participants

A total of 1613 participants enrolled in the study (83.3% female) at baseline. The mean age of the participants was 41.73 years (SD = 13.68), ranging from 18 to 71 years. The ethnicity composition was as follows: African American (n = 63; 3.9%), Asian (n = 42; 2.6%), Caucasian (n = 1367; 84.7%), Hispanic/Latino (n = 62; 3.8%), Other (n = 39; 2.4%), Not Reported (n = 40; 2.5%).

2.2. Measures

The *Obsessive-Compulsive Inventory-Revised* (OCIR; Foa et al., 2002) is an 18-item self-report measure of OCD symptoms experienced in the past month. The OCIR consists of 6 subscales measuring specific categories of OCD symptoms (washing, checking, ordering, neutralizing, hoarding, obsessing). Items on the OCIR are rated on a Likert scale from 0 (*not at all*) to 4 (*extremely*), and higher scores indicate increased OCD symptom severity. A score of 21 or higher suggests clinically significant OCD symptoms. The OCIR demonstrated good internal consistency (α = .90) at time 1.

The *Disgust Propensity and Sensitivity Scale-Revised* (DPSS-R; van Overveld et al., 2006) is a 16-item self-report measure of the tendency to experience disgust and the degree to which experiencing disgust is aversive. Items on the DPSS-R are rated on a Likert scale from 1 (*never*) to 5 (*always*), and higher scores indicate increased disgust propensity and sensitivity. The DPSS-R demonstrated good internal consistency (α = .90) at time 1.

The *Depression Anxiety Stress Scale-21* (DASS; Lovibond & Lovibond, 1995) is a self-report measure of depression, anxiety and stress. It consists of three subscales with 4-point Likert scale from 0 (did not apply to me at all) to 3 (applied to me very much), and higher scores indicate severe depression, anxiety, and stress. The DASS depression subscale was examined and used as a covariate in the present study. The alpha coefficient for the DASS depression was .93 in the present study.

2.3. Procedure

Participants were recruited through ResearchMatch as part of a larger longitudinal study, a national health volunteer registry that was created by several academic institutions and supported by the U.S. National Institutes of Health as part of the Clinical Translational Science Award (CTSA) program. ResearchMatch has a large population of volunteers who have consented to be contacted by researchers about health studies for which they may be eligible. Adults between the ages

of 18–65 were recruited. Participants received a total of six identical survey batteries that included the measures described above as well as other measures over a five-month period. Participants who completed the first survey (time 1) received each subsequent survey at one-month intervals (e.g., the sixth survey (time 6) was received five months after the completion of survey 1 at time 1). The 6-month duration was selected in an attempt to capitalize on allowing sufficient duration for symptom change to occur while also maximizing participant retention. Compensation took the form of a drawing for 1 of 6 $25 gift cards. Participants were informed that their number of entries into the drawing would be equal to the number of surveys completed (e.g., a participant who completed 4 of the 6 surveys would receive 4 drawing entries). Study data were collected and managed using REDCap (Research Electronic Data Capture) hosted at Vanderbilt University (Harris et al., 2009). REDCap is a secure, web-based application designed to support data capture for research studies and is supported by UL1 TR000445 from NCATS/NIH. Review and approval for this study and all procedures was obtained from the University Institutional Review Board, and informed consent was obtained from all individual participants included in the study.

2.4. Data analytic plan

A latent growth analysis was employed using Mplus 7.4 (Muthén & Muthén, 1998–2007Muthén and Muthén, -, 2007Muthén & Muthén, 1998–2007) to examine the stability and change in symptoms of OCD and DP. This analysis was conducted using full information maximum likelihood estimation (Enders & Bandalos, 2001). Thus, parameters were estimated using all available data from the 1613 participants including those with some missing data. In order to examine growth of symptoms, a 2-factor Latent Growth Model (LGM) was used (Fig. 1). The first factor (the intercept factor) describes the initial level of symptoms (intercept mean) and individual differences in the initial level (intercept variance). The intercept is a constant for any given individual across time; therefore, the factor loadings for symptom measures were set at 1 for each wave. The second factor in the LGM (the slope factor) describes the rate of change (slope mean) and individual differences in growth patterns (slope variance). In the model (linear growth model) these factor loadings are fixed at the specific values that correspond to a linear time scale (0, 1, 2, 3, 4, and 5). The parameters of growth (intercept mean, slope mean, intercept variance, slope variance, and error terms) were estimated.

The overall goodness of fit of each model is presented with the following indices: χ^2 value, corresponding p value, the Root Mean Square Error of Approximation (RMSEA), Non-Normed Fit Index (NNFI), and Comparative Fit Index (CFI). Good-fitting models yield

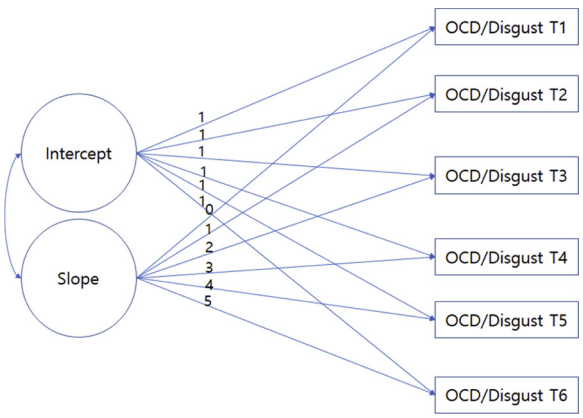

Fig. 1. A two-factor latent growth model for OCD symptoms and Disgust Proneness. T1 = Time 1, T2, = Time 2, T3 = Time 3, T4 = Time 4, T5 = Time 5, T6 = Time 6.

nonsignificant chi-square. Values of the RMSEA less than .05 are considered to indicate good fit, with values between .05 and .08 indicating fair fit (Browne & Cudeck, 1993). Values of CFI greater than .95 are generally taken as evidence of good fit (Bentler, 1990). The predictors were DP, OCD total and their subscales. We examined whether these predictors accounted for individual differences in the initial level of symptoms and for differences in the rate of change.

3. Results

3.1. Descriptive statistics

Tables 1 and 2 present mean, standard deviations, and correlations among measures of DPs and OCD symptoms across the 6 monthly assessments. Table 3 displays the sample size at each time point. Those who completed all time points did not significantly differ from those who did not complete all time points in baseline DP, depression, or OCD symptoms ($ps > .05$). Table 4 shows means, standard deviations, and range of the OCI-R subscale scores at each time point. In general, OCD symptoms and DP exhibited high stability across time points (correlations range from .79 to .95). Furthermore, DP at time 1 (T1) was significantly correlated with OCD symptoms from T1 to T6. Similarly, OCD symptoms at T1 was significantly correlated with DP from T1-T6.

3.2. Basic LGM for OCD symptoms and disgust proneness

The basic LGM of change in OCD was associated with adequate fit based on CFI (.997), but less so based on RMSEA (.122, C.I. ranges .112 to .133), χ^2 (16) = 401.273, $p < .001$. Significant slope means ($\beta = -.178$, $p < .001$) indicated that significant (linear) reduction in OCD symptoms occurred over the six measurement occasions. The estimated means of OCD symptoms were 11.4, 11.22, 11.04, 10.87, 10.69, and 10.51, for T1-T6, respectively. There were also significant variances, indicating substantial variation in individual differences in initial OCD symptom levels (significant intercept variance; $\beta = 75.56$, $p < .001$) and OCD symptom trajectories (significant slope variance; $\beta = .35$, $p < .001$). The R square statistic indicated the proportion of variance in the observed measure that is explained by the growth curve factors. Small R square indicates that most of the observed change is not related to time (Stoolmiller, 1994). In the current model, all obtained R squares are large; i.e., the growth curve factors explain 81.9%, 91.3%, 88%, 92.9%, 95.7% and 95% of the observed variance in OCD symptoms at T1, T2, T3, T4, T5 and T6, respectively.

The fit indices for the basic linear model for DP were: χ^2 (16) = 255.198, $p < .001$; RMSEA = .096 (C.I. ranges .086˜.107), CFI = .983. Significant slope means ($\beta = -.653$, $p < .001$) indicated that significant (linear) reduction in DP occurred over six measurement occasions. The estimated means for DP were 33.3, 32.64, 31.99, 31.34, 30.68, and 30.03, which show a slight decrease across the 6 measurements. There were also significant variances, indicating substantial variation in individual differences in initial DP levels (significant intercept variance; $\beta = 66.78$, $p < .001$) and DP trajectories (significant slope variance; $\beta = .34$, $p < .001$). In the current model, all obtained R squares were large; i.e., the growth curve factors explain 76.3%, 84.5%,89.7%, 90.9%, 92% and 90.9% of the observed variance in DP at T1, T2, T3, T4, T5 and T6, respectively.

3.3. LGM predicting change in OCD symptoms and disgust proneness

OCD symptoms and DP each with a single indicator, were incorporated simultaneously into the basic model as predictors with the DASS-D subscale as a covariate (see Fig. 2). The model predicting OCD was associated with the following fit indices: χ^2 (24) = 341.801, $p < .001$; RMSEA = .094 ($RMSEA_{C.I.}$ ranges .085 ˜ .103), CFI = .980. DP at T1 was associated with higher initial levels of OCD symptoms ($\beta = .447$, $p < .001$). DP at T1 accounted for 20% of the variance in

Table 1
Mean, Standard Deviation (SD) and Intercorrelations among Scores on the DPSS-R at T1, DASS-D at T1 and the OCI-R from T1-T6.

	1	2	3	4	5	6	7	8
1. DPSS-R T1	–							
2. DASS-D T1	.196***	–						
4. OCI-R T1	.414**	.433**	–					
5. OCI-R T2	.406**	.400**	.887**	–				
6. OCI-R T3	.426**	.307**	.842**	.880**	–			
7. OCI-R T4	.428**	.349**	.858**	.922**	.890**	–		
8. OCI-R T5	.448**	.291**	.856**	.908**	.927**	.937**	–	
9. OCI-R T6	.413**	.321**	.843**	.905**	.910**	.935**	.954**	–
Mean	33.936	4.943	12.155	10.985	11.154	10.667	10.483	10.809
SD	9.203	5.114	9.884	9.162	9.273	8.919	8.961	9.544

Note. DPSS-R = Disgust Propensity and Sensitivity Scale-Revised, DASS-D = Depression Anxiety Stress Scales – Depression Subscale, OCI-R = Obsessive-Compulsive Inventory-Revised, T1 = Time 1, T2, = Time 2, T3 = Time 3, T4 = Time 4, T5 = Time 5, T6 = Time 6, $^{**}p < .001$.

Table 2
Mean, Standard Deviation (SD) and Intercorrelations among Scores on the OCI-R at T1, DASS-D at T1 and the DPSS-R from T1-T6.

	1	2	3	4	5	6	7	8
1. OCI-R T1	–							
2. DASS-D T1	.433***	–						
3. DPSS-R T1	.414***	.196***	–					
4. DPSS-R T2	.443***	.181***	.818***	–				
5. DPSS-R T3	.436***	.156***	.805***	.885***	–			
6. DPSS-R T4	.411***	.135***	.815***	.859***	.901***	–		
7. DPSS-R T5	.411***	.142***	.800***	.864***	.903***	.912***	–	
8. DPSS-R T6	.446***	.130***	.789***	.857***	.891***	.910***	.915***	–
Mean	12.155	4.943	33.936	33.012	31.580	31.011	30.520	30.513
SD	9.884	5.114	9.203	9.175	8.804	8.685	8.879	9.339

Note. DPSS-R = Disgust Propensity and Sensitivity Scale-Revised, DASS-D = Depression Anxiety Stress Scales – Depression Subscale, OCI-R = Obsessive-Compulsive Inventory-Revised, T1 = Time 1, T2, = Time 2, T3 = Time 3, T4 = Time 4, T5 = Time 5, T6 = Time 6, $^{**}p < .001$.

Table 3
Sample Size at each Time Point.

Wave	Participants	% Completed Relative to T1	Clinical Cut off*	Missing (%)
T1	1379	–	262 (16.2%)	234 (14.5)
T2	886	64.25%	198 (12.3%)	727 (45.1)
T3	684	49.60%	211 (13.1%)	929 (57.6)
T4	618	44.82%	197 (12.2%)	995 (61.7)
T5	581	42.13%	199 (12.3%)	1032 (64)
T6	497	36.04%	211 (13.1%)	1116 (69.2)

Note. *Refers to participants above the obsessive-compulsive disorder diagnostic cut off score of 21 on the Obsessive-Compulsive Inventory-Revised. T1 = Time 1, T2, = Time 2, T3 = Time 3, T4 = Time 4, T5 = Time 5, T6 = Time 6.

initial levels of OCD symptoms. However, DP at T1 accounted for only 0.1% of the variance in the rate of change (slope factor) in OCD symptoms. The model predicting DP was good: χ^2 (24) = 296.747, $p < .001$; RMSEA= .083 ($RMSEA_{C.I.}$ ranges .074 ˜ .092), CFI = .982. OCD symptoms at T1 explained 22.3% of the variance in initial levels of DP. Higher initial levels of OCD symptoms at T1 was related to DP at T1 ($\beta = .472$, $p < .001$). However, the rate of change in DP was not associated with OCD symptoms at T1.

3.3.1. Disgust proneness in the prediction of specific OCD symptoms

DP at T1 was associated with the intercept of the OCD washing ($\beta = .433$, $p < .001$), hoarding ($\beta = .242$, $p < .001$), neutralizing ($\beta = .270$, $p < .001$), obsessing ($\beta = .384$, $p < .001$), and ordering ($\beta = .348$, $p < .001$) symptoms when controlling for symptoms of depression. In terms of association with slope when controlling for depression, DP at T1 was only associated with the slope of OCD washing symptoms ($\beta = .155$, $p < .001$) such that those with higher levels of DP at T1 displayed steeper increases in OCD washing symptoms over time. Conversely, OCD washing symptoms predicted the intercept ($\beta = .472$, $p < .001$) and the slope of DP ($\beta = .087$, $p < .05$) such that those with higher levels of OCD washing symptoms at T1 displayed steeper increases in DP over time

4. Discussion

The present study employed a longitudinal approach to examine the association between DP and OCD symptoms. Latent growth analysis revealed a significant (linear) reduction in OCD symptoms over the six months. However, there was significant variability in initial OCD symptom levels as well as the trajectory of OCD symptoms. A slight decrease in DP was also observed over the six months. Furthermore, there was significant variation in initial DP levels as well as the trajectory of DP. The finding of decline in both symptoms of OCD and DP is consistent with previous research that has found that repeated administration of anxiety-related constructs (i.e., anxiety sensitivity) measures can often produce declining scores (i.e., Broman-Fulks, Berman, Martin, Marsic, & Harris, 2009). Importantly, findings of significant decreases in anxiety-related symptoms are often not accounted for by regression to the mean. It is possible that the mere completion of measures of OCD and DP has a systematic impact on self-reported distress associated with OCD symptoms and the propensity to experience disgust. It is also possible that exposure to questions regarding symptoms of OCD and DP leads to increased attention, monitoring, and/or cognitive processing of such symptoms, which, in turn, may cause a decline in the symptoms. Such findings do raise the question as to whether DP is best conceptualized as a psychological trait or state. However, it is important to note that most psychological constructs are neither completely trait-like nor completely state-like (Hertzog & Nesselroade, 1987). Furthermore, OCD symptoms and DP exhibited high stability across time points (correlation ranges from .79 to .95) in the present study. These findings likely suggest that DP may contain both state-like and trait-like components.

Latent growth analysis also indicated that initial levels of DP in the

Table 4
Means, Standard Deviations, and Range of the OCI-R subscale scores at each time point.

OCI-R Subscale	Min	Max	Mean	SD
OCIR. Checking.T1	0.00	12.00	1.72	2.157
OCIR. Checking.T2	0.00	12.00	1.39	2.033
OCIR. Checking.T3	0.00	12.00	1.31	2.063
OCIR. Checking.T4	0.00	12.00	1.18	1.874
OCIR. Checking.T5	0.00	12.00	1.05	1.826
OCIR. Checking.T6	0.00	11.00	1.15	1.959
OCIR.Hoarding.T1	0.00	12.00	2.82	2.745
OCIR. Hoarding.T2	0.00	12.00	2.50	2.630
OCIR. Hoarding.T3	0.00	12.00	2.52	2.637
OCIR. Hoarding.T4	0.00	12.00	2.52	2.661
OCIR. Hoarding.T5	0.00	12.00	2.41	2.690
OCIR. Hoarding.T6	0.00	12.00	2.52	2.878
OCIR.Neutralizing.T1	0.00	12.00	1.10	2.000
OCIR. Neutralizing.T2	0.00	12.00	0.98	1.859
OCIR. Neutralizing.T3	0.00	12.00	0.90	1.791
OCIR. Neutralizing.T4	0.00	12.00	0.82	1.674
OCIR. Neutralizing.T5	0.00	10.00	0.83	1.717
OCIR. Neutralizing.T6	0.00	11.00	0.91	1.881
OCIR.Obsessing.T1	0.00	12.00	2.57	2.880
OCIR. Obsessing.T2	0.00	12.00	2.22	2.612
OCIR. Obsessing.T3	0.00	12.00	2.07	2.578
OCIR. Obsessing.T4	0.00	12.00	1.92	2.447
OCIR. Obsessing.T5	0.00	12.00	1.77	2.380
OCIR. Obsessing.T6	0.00	12.00	1.92	2.585
OCIR.Ordering.T1	0.00	12.00	2.92	2.850
OCIR. Ordering.T2	0.00	12.00	2.63	2.759
OCIR. Ordering.T3	0.00	12.00	2.61	2.670
OCIR. Ordering.T4	0.00	12.00	2.52	2.651
OCIR. Ordering.T5	0.00	12.00	2.37	2.539
OCIR. Ordering.T6	0.00	12.00	2.45	2.672
OCIR. Washing.T1	0.00	12.00	1.02	1.967
OCIR. Washing.T2	0.00	12.00	0.94	1.967
OCIR. Washing.T3	0.00	12.00	0.92	1.981
OCIR. Washing.T4	0.00	12.00	0.89	1.925
OCIR. Washing.T5	0.00	12.00	0.78	1.743
OCIR. Washing.T6	0.00	12.00	0.93	1.994

Note. OCI-R = Obsessive-Compulsive Inventory-Revised; T1 = Time 1, T2, = Time 2, T3 = Time 3, T4 = Time 4, T5 = Time 5, T6 = Time 6.

community sample were significantly associated with initial levels of total OCD symptoms even when covarying for depression. This finding is fully consistent with the existing literature that has observed a cross-sectional association between DP and OCD symptoms broadly defined (Olatunji, Ebesutani et al., 2011). However, the present findings also showed that initial DP levels were not significantly associated with the slope of change in total OCD symptoms over the 6-month time period when depression is considered a covariate. Thus, while DP appears to have concurrent associations with total OCD symptoms, it does not predict how such symptoms unfold over time. It is important to note that these findings are consistent with those of David et al. (2009) who found that DP did not predict residual change in total symptoms of OCD over a 12-week period. These findings cast doubt on the view of DP as a risk factor for OCD, broadly defined.

Although DP has traditionally been viewed as a risk factor for OCD (Olatunji et al., 2017), it may the case that elevated DP is a consequence rather than a cause of the disorder. Accordingly, it may be informative to also examine the extent to which OCD symptoms predict DP concurrently and over time. Latent growth analysis revealed that initial levels of total OCD symptoms were associated with initial levels of DP when depression is covaried. This finding raises the possibility that OCD symptoms and DP may be synergistic processes where one concurrently reinforces the other. However, the findings also showed that initial levels of total OCD symptoms did not significantly predict the slope of change in DP over the 6-month period when depression is entered as a covariate. Although DP is commonly viewed as a stable personality trait, research has shown that certain learning contingencies can produce variability in the trait over time (i.e., Olatunji, 2015). However, the present findings suggest that OCD symptoms, broadly defined, are not a reliable predictor of any variability that may be observed in DP over time.

An important aim of the present study was to examine the longitudinal association between DP and specific OCD symptoms. Given that the adaptive function of the experience of disgust is to protect against the acquisition of disease (Curtis et al., 2004; Tybur et al., 2013), it was predicted that DP would be a significant prospective predictor of only the contamination subtype of OCD. As predicted, examination of symptom specificity revealed that initial levels of DP were associated with initial levels of OCD-related washing symptoms even with depression as a covariate. However, initial levels of DP were also significantly associated with initial levels of neutralizing, obsessing, ordering, and hoarding subscale scores on the OCI-R. This finding is consistent with previous research that has linked DP to various OCD-related symptom subtypes (Olatunji, Cisler et al., 2010: Thorpe, Patel, & Simonds, 2003), including hoarding (David et al., 2009). Although it remains unclear why DP would confer risk for these OCD symptom subtypes, it has been proposed that the tendency towards behavioral inhibition to avoid punishment and non-reward may be one mechanism that explains the association between DP and such symptoms (Olatunji, Unkoka, Beran, David, & Armstrong, 2009). Examination of similar processes in future research may help clarify the nature of the association between DP and noncontamination-based OCD. The significant association between DP and the wide range of OCD symptoms may also be an artifact of broader deficits in emotion regulation. For example, in

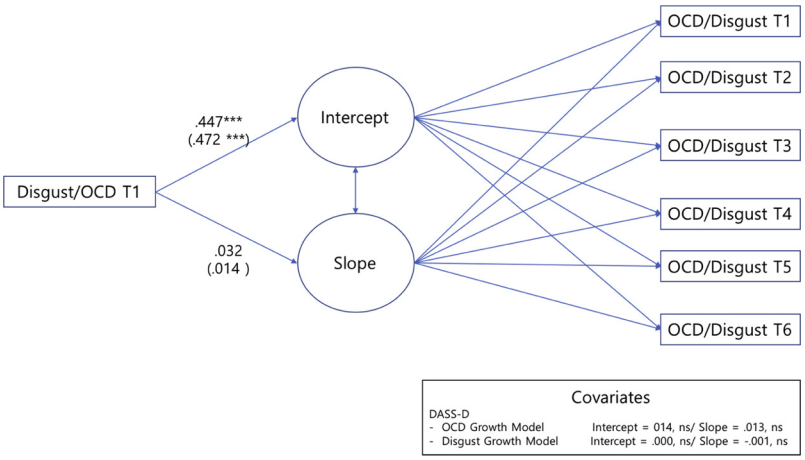

Fig. 2. Predicting the initial level and the rate of change in symptoms of OCD/Disgust Proneness. T1 = Time 1, T2, = Time 2, T3 = Time 3, T4 = Time 4, T5 = Time 5, T6 = Time 6.

the case of hoarding, it has been suggested that avoidance of discarding allows hoarders to avoid, or escape, anxiety and a range of other emotions (e.g., disgust), thereby negatively reinforcing maladaptive saving behaviors (Coles, Frost, Heimberg, & Steketee, 2003).

Although initial levels of DP significantly predicted initial levels of washing, neutralizing, obsessing, ordering, and hoarding scores on the OCI-R, initial levels of DP significantly predicted only the slope of change in excessive washing over the 6-month period when covarying for depression. That is, the prospective association between DP and symptoms of OCD was specific to only the contamination subtype. This finding is in line with a dimensional view of OCD where different subtypes may be the product of distinct risk factors (Mataix-Cols, Rosario-Campos, & Leckman, 2005; McKay et al., 2004). This finding is also consistent with previous research showing that changes in DP over a 12-week period predicted changes in contamination-based OCD symptoms (Olatunji, 2010). Importantly, the inverse was also true in the present study. That is, OCD washing symptoms were also significantly associated with the slope of DP when controlling for depression.

A risk factor is defined as a variable that can be shown to prospectively predict some subsequent pathological outcome (Stice, 2002). Accordingly, one interpretation of the present findings is that DP may be a risk factor for the subsequent development of the contamination subtype of OCD, but not other OCD subtypes. However, it is important to note that DP may still be causally related to washing symptoms of OCD without necessarily leading to an increase in such symptoms as observed in the present study. The present findings also suggest that the contamination subtype of OCD may also result in an increase in heightened DP which may then serve to maintain the disorder. This view suggests that DP and contamination concerns in OCD may be synergistic where one serves a mutually reinforcing function for the other. These findings appear to be in line with emerging treatment outcome research. For example, research has consistently shown that change in DP during exposure-based treatment predicts improvement in OCD symptoms, broadly defined (Knowles, Viar-Paxton, Riemann, Jacobi, & Olatunji, 2016; Olatunji, Ebesutani et al., 2011). However, examination of symptom specificity revealed that although change in DP was significantly associated with improvement in contamination/washing symptoms, no significant association was found between change in DP and change in other OCD symptom dimensions (Athey et al., 2015).

To our knowledge, this is the first study to assess the longitudinal association between DP and OCD symptoms using multiple repeated assessments. Although these findings suggest that DP predicts the pattern of change in only the contamination subtype of OCD symptoms, limitations of the study should be considered when making inferences based on these findings. For example, the exclusive reliance on a non-clinical sample does limit the generalizability of the findings. Similarly, the lower retention rate is another study limitation. Indeed, when studying risk for developing psychopathology those individuals at greatest risk are often the most likely to drop out and their absence can lead to bias in the study findings. Although those who completed all time points did not significantly differ from those who did not complete all time points in disgust proneness, depression, and OCD symptoms at baseline, their symptom trajectory may differ. Future longitudinal research along these lines will need to be more vigilant and effortful in retaining participants throughout the course of the study. Although 13–16% of the sample has scores that were at the established clinical cut off on the OCI-R suggesting the likelihood of a diagnosis of OCD, future research examining the pattern of change in DP and OCD symptoms over time in a clinical sample would bolster confidence in the present findings.

Another important study limitation is the exclusive reliance on a single self-report measure of each construct. For example, the OCI-R has been shown to be as strongly correlated with depressive symptoms as with OCD symptoms (Foa et al., 2002). Although the present study does covary for depressive symptoms, use of additional measures that may be more OCD-specific are warranted. As a consequence of exclusive use of self-report measures, relationships between DP and OCD may also be inflated as a result of questionnaire-specific method variance. Accordingly, examining how DP predicts OCD symptoms over time using indicators from other assessment modalities like behavioral markers of avoidance will allow for more definitive inferences to be made. Although the assessment window consisted of monthly assessments over a 6-month period, examination of the association between DP and OCD over a longer time period may also bolster confidence in the present findings. What remains unclear from the present findings is why and how DP predicts the pattern of change in symptoms of contamination-based OCD. Consistent with a diathesis–stress framework, future research is needed to examine potential interactions between DP (a predispositional vulnerability) and various stressors in the longitudinal prediction of contamination-based OCD. Research along these lines may clarify the mechanism(s) that account for the association between DP and contamination-based OCD. Such mechanism(s) may then be targeted in treatment and prevention efforts to reduce the prevalence of OCD over time.

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