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Examining associations among sensitivity to punishment and reward, shame, and eating pathology through tests of mediation

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ABSTRACT

This study investigated associations between sensitivity to punishment and reward, shame, and eating pathology by testing alternative mediation models in which shame mediated associations between temperament and eating pathology or eating pathology mediated associations between temperament and shame. Participants were 96 female undergraduate students who completed questionnaires. Results indicated shame fully mediated the relationship between sensitivity to punishment and eating pathology. Further, eating pathology did not mediate the association between sensitivity to punishment and shame. In contrast, for sensitivity to reward, shame fully mediated the relationship between sensitivity to reward and eating pathology, and eating pathology fully mediated the relationship between sensitivity to reward and shame. If associations are supported by longitudinal research, results suggest that it may be valuable to develop prevention approaches targeting shame to reduce risk for the development of eating pathology for those who are high in sensitivity to punishment. For those higher in sensitivity to reward, interventions targeting shame may reduce risk for eating pathology and those targeting eating pathology may reduce shame.

Gray's Reinforcement Sensitivity Theory posits that human behavior is influenced both by two dimensions of temperament – a behavioral approach system, reflected by sensitivity to reward, and a behavioral inhibition system, reflected by sensitivity to punishment (Gray, 1970). These pathways have been implicated in the etiology and maintenance of eating pathology (Harrison, O'Brien, Lopez, & Treasure, 2010; Loxton & Dawe, 2001). Specifically, researchers have hypothesized that the sensitivity to reward (SR) pathway may motivate the occurrence of binge episodes, while the sensitivity to punishment (SP) pathway may influence negative affect associated with binge episodes and motivate symptoms, such as purging, to undo the punishing effects of food on weight (Beck, Smits, Claes, Vandereycken, & Bijttebier, 2009; Carels et al., 2009; Loxton & Dawe, 2007; Webb, Fiery, & Jafari, 2016). Supporting these hypotheses, previous studies have

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found that both sensitivity to punishment and reward are elevated in individuals with eating disorders (ED) compared to healthy controls and reductions in sensitivity to punishment have been noted in individuals recovered from ED (Harrison et al., 2010).

Furthermore, eating pathology has been widely associated with shame (Burney & Irwin, 2000; Keith, Gillanders, & Simpson, 2009) and shame has been associated with sensitivity to punishment (Guimón, Las Hayas, Guillén, Boyra, & González-Pinto, 2007). This raises questions about the specific role shame may play in the connection between temperament and EDs.

Shame is a complex emotion involving affective, social, cognitive, behavioral, and physiological processes (Goss & Allan, 2009). In shame, there is a central belief that the self is flawed. Because the body is an inherent aspect of the self, displeasure with it often carries over to the entire being. In non-clinical female samples, shame has been positively correlated with bulimia symptomatology, body dissatisfaction, and drive for thinness (Ferreira, Pinto-Gouveia, & Duarte, 2013; Hayaki, Friedman, & Brownell, 2002). Women with EDs reported experiencing higher levels of shame than non-clinical participants (Doran & Lewis, 2012). Patients with eating pathology experienced more shame around eating than controls, suggesting that the negative feelings elicited by eating pathology may be leading to increased shame (Swan & Andrews, 2003).

Importantly, shame is not restricted to experiences of body size and eating behaviors. Shame has been delineated into three domains: bodily (shame associated with physical appearance and the body), characterological (shame associated with stable personal character flaws and the self), and behavioral (shame associated with negative evaluations being placed on a specific behavior or action) (Andrews, Qian, & Valentine, 2002; Doran & Lewis, 2012; Swan & Andrews, 2003). Bodily and characterological shame were associated with disordered eating in a nonclinical female sample (Doran & Lewis, 2012). In other studies, women with eating pathology have endorsed high levels of shame across all domains (Keith et al., 2009). Lastly, shame appears to be uniquely associated with eating pathology above and beyond other potential confounding variables, such as depression and negative affect (Gupta, Rosenthal, Mancini, Cheavens, & Lynch, 2008; Keith et al., 2009). These findings suggest that eating pathology may lead directly to shame. If true, this would suggest a linear pathway between sensitivity to punishment/reward, to the development of eating pathology, to the development of shame.

As noted above, prior work supports a positive association between elevated SP and shame (Guimón et al., 2007). Someone who is higher in SP may be more likely to feel ashamed when faced with criticism or negative feedback. Likewise, people who are predisposed to be higher in SR may be more vulnerable to experiencing shame if their predilection for rewarding experiences is viewed as overindulgence. In both cases, shame may contribute to

eating pathology. In line with this, binge eating has been theorized to promote an escape from self-awareness (Blackburn, Johnston, Blampied, Popp, & Kallen, 2006) and ecological momentary assessment studies suggest that increases in shame increase the likelihood of both binge eating and compensatory behaviors (Sanftner & Crowther, 1998; Troop, 2016). If true, this would suggest a linear pathway between sensitivity to punishment/reward to the development of shame, to the development of eating pathology.

As such, there are different pathways that may capture the specific role shame plays in the connection between temperament and EDs (Hayaki et al., 2002; Sanftner, Barlow, Marschall, & Tangney, 1995). Both pathways build on the presence of temperaments characterized by high SP and SR. One pathway posits that women who are prone to experience shame are at risk for developing eating pathology. Another is that shame is a result of eating pathology, possibly relating to behaviors involved with the disorder itself or to failed dieting and attempts to control eating. In the current study, four models were tested investigating these pathways to evaluate whether shame or eating pathology may be emerging first in the context of these temperamentally-based behavioral systems. Our first model tested whether shame mediated the relationship between SP and eating pathology. We also tested a second model in which eating pathology mediated the relationship between SP and shame. Likewise, for SR, we tested whether shame mediated the relationship between SR and eating pathology. Finally, we then tested a model in which eating pathology mediated the relationship between SR and shame. Among the models for which we found support for, we conducted exploratory analyses examining subdomains of shame to understand the contributions of bodily, characterological, and behavioral shame in these associations.

Methods

Participants

Female undergraduate students [$N = 96$, mean age: 19.5 (SD = 1.7)] were recruited from a large, southeastern university. Participants' mean (SD) body mass index (BMI kg/m^2) was 23.1 (3.6) kg/m^2 . The study was approved by the IRB of the university, and participants completed written informed consent prior to their participation.

Procedure

The study was advertised as studying associations among learning styles, self-perceptions, and eating attitudes and was available to all female undergraduate students who were participating in the psychology subject pool. This description was chosen to minimize demand characteristics and self-selection

out of the study. Participants were given a questionnaire packet consisting of the measures described below. At the completion of the study, participants were debriefed and given course credits for extra credit in one of their psychology courses.

Measures

The Experience of Shame Scale (ESS) is a 25-item self-report measure developed to assess three domains of shame: characterological, behavioral, and bodily shame (Andrews et al., 2002). In our analyses of global shame, the characterological and behavioral scales were combined to create a composite shame score that did not include bodily shame. We did this to minimize possible overlap between independent and dependent variables in our models. The internal reliability of this composite score was high (Cronbach's $\alpha = 0.94$). In exploratory analyses of subdomains of shame, each subscale was tested in its original form. Internal reliability of the subscales was very good: characterological (12 items; $\alpha = 0.90$), behavioral (9 items; $\alpha = 0.87$), and bodily (4 items; $\alpha = 0.86$).

The Eating Attitudes Test (EAT-26) is a 26-item measure that assesses ED symptoms and characteristics (Garner, Olmsted, Bohr, & Garfinkel, 1982). The nonclinical scoring procedure was used in which items are scored across the full range of 1–6 points, given the use of an undergraduate sample. The internal reliability in this study was high (Cronbach's $\alpha = 0.89$).

The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) is a 48-item measure that was developed to assess behavioral inhibition and behavioral activation functioning separately (Torrubia, Avila, Molto, & Caseras, 2001). The Sensitivity to Punishment subscale was used to assess general responses to punishment (Cronbach's $\alpha = 0.82$) and the Sensitivity to Reward subscale was used to assess general responses to reward (Cronbach's $\alpha = 0.70$).

Analysis

We tested kurtosis and skewness to evaluate the normality of distributions. All distributions were found to be in the acceptable range.

Following Baron and Kenny's (1986) steps for mediation model, multiple linear regressions were performed in Statistical Package for the Social Sciences (SPSS 22) to test associations between variables.

Results

SR and SP were not significantly correlated, suggesting they are measuring disparate aspects of the behavioral motivation system, consistent with Gray's

theory (see Table 1). In line with previous findings, higher SP was found to be significantly correlated with higher shame and eating pathology. Higher SR also was significantly correlated with greater shame and eating pathology. Finally, shame and eating pathology were found to be significantly positively correlated. Because variables were significantly associated, it was possible to run all planned mediation models.

The first mediation model for SP, which hypothesized that shame would mediate the association between SP and eating pathology, was supported. Following Baron and Kenny's steps for mediation, the pre-conditions for mediation were tested. SP was found to predict eating pathology and shame (see Table 2). Shame was found to predict eating pathology. Thus, the first three steps of mediation were satisfied. Lastly, when shame was held constant, SP no longer significantly predicted eating pathology. This indicates that shame fully mediated the relationship between SP and eating pathology.

In contrast, the second mediation model for SP was not supported. Although the pre-conditions for mediation were met, when eating pathology was held constant, SP was still significantly associated with shame (see Table 2). These results indicate that eating pathology does not mediate the relationship between SP and ED. Further, the association between SP and shame was not reduced by the inclusion of eating pathology, suggesting the absence of partial mediation.

Exploratory analyses were conducted to examine if the association between SP and eating pathology was differentially mediated by type of shame (i.e.,

Table 1. Means (SD) and correlations among sensitivity to punishment, sensitivity to reward, shame, and eating pathology.

	1	2	3	4	5	6	7	Mean (SD)
1. Sensitivity to Punishment	-	-.035	.70***	.68***	.61***	.41***	.34**	13.2 (5.0)
2. Sensitivity to Reward		-	.20*	.18	.20*	.04	.21*	11.1 (3.6)
3. Shame - CBe			-	.94**	.90**	.65**	.50***	49.3 (13.2)
4. Shame - Character				-	.70***	.65***	.51***	26.3 (8.0)
5. Shame - Behavior					-	.52***	.39***	23.1 (6.3)
6. Shame - Bodily						-	.58***	10.3 (3.1)
7. Eating Pathology							-	65.2 (16.3)

** $p < 0.01$; *** $p < 0.001$

Table 2. Mediation analyses for sensitivity to punishment.

Model 1		Model 2	
Paths	β	Paths	β
1. Sensitivity to Punishment → Eating Pathology	.34**	1. Sensitivity to Punishment → Shame	.70***
2. Sensitivity to Punishment → Shame	.70***	2. Sensitivity to Punishment → Eating Pathology	.34**
3. Shame → Eating Pathology	.50***	3. Eating Pathology → Shame	.50***
4. Sensitivity to Punishment (Shame) → Eating Pathology	-.03	4. Sensitivity to Punishment (Eating Pathology) → Shame	.63***

** $p < 0.01$; *** $p < 0.001$

characterological, bodily, and behavioral). The preconditions for mediation were tested and met. Each domain of shame was associated with shame and sensitivity to punishment. Mediation results suggest that each of the domains of shame fully mediated the association between SP and eating pathology (see Table 4).

Our latter two mediation models focusing on SR were then tested. The first mediation model for SR, which hypothesized that shame would mediate the association between SR and eating pathology was supported. Results indicated that shame fully mediated the relationship between SR and eating pathology (see Table 3). The second model, proposing that eating pathology would mediate the relationship between SR and shame, was also supported. Results indicated that eating pathology fully mediated the relationship between SR and shame (see Table 3). Notably, this differs from our findings with SP as eating pathology did not mediate the relationship between SP and shame.

For the individual subscales, SR was only correlated with one of the subscales of shame, behavioral (see Table 1). As such, we were not able to test these mediations using characterological or bodily shame. Results indicated that behavioral shame fully mediated the relationship between SR and eating pathology (see Table 4). Furthermore, eating pathology fully mediated the relationship between SR and behavioral shame.

Discussion

SP and SR were significantly correlated with eating pathology, supporting the importance of temperament in risk for EDs found in prior research (Harrison et al., 2010; Loxton & Dawe, 2001). However, results suggest that the specific role of shame in the association between temperament and eating pathology may differ between SP and SR. Shame was found to mediate the relationship between SP and eating pathology and between SR and eating pathology. In contrast, eating pathology was found to mediate the relationship between SR and shame but not between SP and shame. This suggests that SR may lead concurrently to increased eating pathology and shame, which in turn reinforce each other. This has implications for treatment, as it suggests interventions to reduce eating pathology may effectively reduce shame among someone who has elevated reward sensitivity, but not

Table 3. Mediation analyses for sensitivity to reward.

Model 1		Model 2	
Paths	β	Paths	β
1. Sensitivity to Reward \rightarrow Eating Pathology	.21*	1. Sensitivity to Reward \rightarrow Shame	.20*
2. Sensitivity to Reward \rightarrow Shame	.20*	2. Sensitivity to Reward \rightarrow Eating Pathology	.21*
3. Shame \rightarrow Eating Pathology	.50***	3. Eating Pathology \rightarrow Shame	.50***
4. Sensitivity to Reward (Shame) \rightarrow Eating Pathology	.12	4. Sensitivity to Reward (Eating Pathology) \rightarrow Shame	.10

** $p < 0.01$; *** $p < 0.001$

Table 4. Mediation analyses for shame subscales.

Characterological Shame	β	Behavioral Shame	β	Bodily Shame	β	Behavioral Shame	β
1. Sensitivity to Punishment → Characterological	.69***	1. Sensitivity to Punishment → Behavioral	.61***	1. Sensitivity to Punishment → Bodily	.41***	1. Sensitivity to Reward → Behavioral	.20*
2. Sensitivity to Punishment → Eating Pathology	.34**	2. Sensitivity to Punishment → Eating Pathology	.34**	2. Sensitivity to Punishment → Eating Pathology	.34**	2. Sensitivity to Reward → Eating Pathology	.21*
3. Characterological → Eating Pathology	.51***	3. Behavioral → Eating Pathology	.39***	3. Bodily → Eating Pathology	.58***	3. Behavioral → Eating Pathology	.39***
4. Sensitivity to Punishment (Characterological) → Eating Pathology	-.01	4. Sensitivity to Punishment (Behavioral) → Eating Pathology	.15	4. Sensitivity to Punishment (Bodily) → Eating Pathology	.13	4. Sensitivity to Punishment (Behavioral) → Eating Pathology	.14

** $p < 0.01$; *** $p < 0.001$.

punishment sensitivity. Furthermore, interventions to reduce shame may reduce eating pathology among those with higher punishment sensitivity and those with higher reward sensitivity.

Notably, all shame subscales were associated with SP and mediated its relationship with eating pathology. Our findings suggest that higher levels of SP may lead to an increase in shame by making women more sensitive to a range of feedback that they are not good enough and are inherently flawed. This global sense of inadequacy and shame may increase susceptibility to respond to sociocultural standards for beauty with extreme efforts to live up to the thin ideal as a means to reduce their feelings of shame. This suggests that shame emerging from sensitivity to punishment may develop prior to eating pathology and implicates shame as a potential risk and maintenance factor for ED development. In contrast, behavioral shame was the only shame subscale correlated with SR. Someone who is high in reward sensitivity may be more likely to engage in risky or impulsive behaviors that are viewed as immediately pleasurable, such as binge eating, but have negative consequences. This may induce behavioral shame over one's actions. Consequently, this shame may act as a motivating factor to engage in future disordered eating to reduce negative affect experienced after an episode. This may perpetuate the cycle of shame leading to disordered eating behaviors and disordered eating behaviors leading to shame.

Given these findings, prevention efforts to reduce feelings of shame may be warranted to reduce disordered eating. Kelly, Carter, and Borairi (2014) have reported success in reducing feelings of shame in individuals with ED using self-compassion therapy, a treatment focused on alleviating shame by elevating self-compassion. Specifically, larger initial decreases in shame were associated with a greater decrease of eating pathology over the course of treatment (Kelly et al., 2014). Thus, adapting such a treatment for prevention may be helpful in reducing future onset of eating pathology. Importantly, after someone has developed eating pathology, shame is still valuable to target. Findings suggest unique and independent contributions of SP, SR, and eating pathology to feelings of shame. It is possible that shame and eating pathology may reinforce one another as feelings of shame may lead to increased disordered eating, which then further compounds feelings of shame. Kelly and Tasca (2016) found that participants' eating symptomatology was greater after they experienced increased shame and that shame decreased with reduction in disordered eating behaviors. Similarly, reductions in shame have been shown to improve treatment success and recovery from EDs (Kelly et al., 2014). This suggests that interventions designed to reduce shame may also be effective in promoting better ED outcomes.

As all shame subscales mediated the relationship between SP and eating pathology, interventions to reduce shame in any or all of these domains may be effective in breaking the link between SP and ED. Several evidence-based

prevention programs for ED have focused on improving body image (Becker, Ciao, & Smith, 2008; Stice, Durant, Rohde, & Shaw, 2014), and it is possible that these have reduced ED risk by reducing bodily shame. Our findings further suggest that more broad-based programs that address shame unrelated to the body may also be effective for reducing ED risk. Furthermore, such programs may reduce risk for other disorders, such as depression, given established links between shame and depression (Andrews et al., 2002; Tilghman-Osborne, Cole, Felton, & Ciesla, 2008). It is possible that a similar relationship may exist between SP, shame, and other forms of psychopathology, given that SP is a risk factor for other internalizing disorders.

There were several limitations to this study that should be noted. As shame was the only measure of emotion tested in the mediation models, it is possible that the relationship between shame and sensitivity to punishment could be explained by general emotional sensitivity. Future research should include other measures of emotion and negative affect to test this further. This study was cross-sectional, so we cannot conclude that our mediation models demonstrate temporal or causal relationships. However, the use of regression analyses to compare competing models provides important information to support more intensive longitudinal and experimental designs. Only females were included in this study, which limits generalizability to men. Future studies would need much larger samples of men to have sufficient power to study these associations, given lower prevalence of EDs, and reduced variability in ED measures in men. Further, such studies would need to include broader measures of eating pathology to capture behaviors linked to increasing muscle mass (McCreary, 2007). Similarly, this study only included college students, which limits generalizability of results to other populations. This study relied on self-report measures which may have been subject to participant memory or demand characteristics.

A longitudinal study would be valuable to test the temporal relationship between elevated SP, SR, shame, and eating pathology. Future studies may also investigate what interventions are most effective for reducing shame. This could be accomplished by testing existing treatment approaches, such as self-compassion therapy, testing how shame changes in response to treatment designed to impact eating pathology, or by developing a novel treatment specifically designed to reduce shame. The effect of these interventions on shame could then be used to determine if experimentally reducing shame causes reductions in eating pathology, among those high in SP or SR, and if experimentally reducing eating pathology reduces shame, particularly among those high in SR. The current research is a first step toward uncovering these relationships and providing support for the importance of shame in the link between temperament and eating pathology.

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