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Sensitivity to punishment and eating pathology among undergraduate women: The mediating role of shame

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ABSTRACT

Punishment sensitivity can contribute to eating pathology, but the mechanisms of this relationship are understudied. In a longitudinal study of undergraduate females (N = 95), results supported an indirect association between sensitivity to punishment and eating pathology via shame. Findings suggest that sensitivity to punishment was associated with greater shame, which in turn predicted greater eating pathology over time. Further, there was an indirect effect of sensitivity to punishment on eating pathology via greater levels of behavioral shame. Future studies may wish to examine the potential role of behavioral shame in the development and exacerbation of eating problems, especially in the context of temperamental traits such as punishment sensitivity.

1. Introduction

Both punishment and reward sensitivity have been independently and widely linked with psychopathology, including dysregulations in eating behaviors (Bijttebier, Beck, Claes, & Vandereycken, 2009; Harrison, O'Brien, Lopez, & Treasure, 2010). These aspects of temperament are viewed as distinct but related components of a larger reinforcement system where sensitivity to reward describes the tendency to respond with behavioral activation when faced with pleasant stimuli, while sensitivity to punishment describes the tendency towards behavioral inhibition in response to negative feedback (Gray, 1970; McNaughton & Corr, 2004). Trait levels of sensitivity to reward have been found to differ between eating disorder diagnoses, suggesting that reward sensitivity may help distinguish patterns of disordered eating (e.g., Harrison et al., 2010). In contrast, sensitivity to punishment has been found to be elevated across eating disorder diagnoses (Harrison et al., 2010), as well as in individuals with subthreshold disordered eating and those with a past eating disorder (Harrison, Treasure, & Smillie, 2011; Loxton & Dawe, 2007). These findings suggest that sensitivity to punishment may be a risk factor for disordered eating broadly and may be particularly relevant for advancing transdiagnostic interventions.

Despite evidence for associations between punishment sensitivity and disordered eating, little is known about possible mechanisms for this relationship. Prior research has documented positive associations between sensitivity to punishment and shame (Guimón, Las Hayas, Guillén, Boyra, & González-Pinto, 2007). While sensitivity to punishment is thought to be a stable trait driven by neurobiological differences (e.g., McNaughton & Corr, 2004), shame is a self-conscious emotion evoked by negative self-evaluation. Feelings of shame are prone to vary based on context (Tangney, Stuewig, & Mashek, 2007) and can differ across domains (e.g., one's character, behaviors, or appearance). Indeed, significant within-person fluctuations in shame have been found using daily diaries (Conroy, Ram, Pincus, & Rebar, 2015). Together, these findings suggest that shame is an affective response that differs from sensitivity to punishment but may be influenced by punishment sensitivity. Women who are higher in sensitivity to punishment may be more likely to feel ashamed after experiencing criticism from an authority figure or peer. Disordered eating may develop as a coping response to shame, such as binge eating to escape self-conscious emotions and associated negative affect (Heatherton & Baumeister, 1991). These findings suggest that the path from punishment sensitivity to disordered eating could operate through shame. Investigating these associations in non-clinical populations may have important prevention implications given the high rates of disordered eating among women, particularly in cultures that value thinness (Smith et al., 2018).

Prior cross-sectional work suggested that shame statistically mediated associations between higher sensitivity to punishment and disordered eating (Brockdorf, Kennedy, & Keel, 2018). However, the design limited interpretation of these findings. Therefore, the current

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study employed a longitudinal design to test the a priori hypothesis that shame mediates prospective associations between sensitivity to punishment and eating pathology. Exploratory analyses examined the unique contributions of different elements of shame (i.e., shame about one's character versus one's behavior).

2. Method

2.1. Participants and procedure

Participants (N = 95 female undergraduates; Brockdorf et al., 2018) were re-contacted and invited to complete a follow-up survey approximately 1 year after baseline assessments (mean follow-up duration = 1.06 [SD = 0.22] years); 63 women provided informed consent and completed the follow-up survey (66.3% of the original sample). Using Maximum Likelihood (ML) estimation, all 95 participants who completed measures at baseline were included in analyses. The mean age of participants at follow-up was 20.5 (SD = 1.7) years old. The mean body mass index (BMI) of participants was 23.1 (SD = 3.6) kg/m^2 at baseline and 24.3 (SD = 6.2) kg/m^2 at follow-up. Racial/ethnic composition was 63% White/Caucasian, 22% Hispanic, 16% Black/African American, 5% Asian/Asian American, and 2% Pacific Islander. Percentages exceed 100% because participants could endorse more than one category.

2.2. Measures

The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) assessed punishment and reward sensitivity (Torrubia, Ávila, Moltó, & Caseras, 2001) at baseline (Table 1). The Sensitivity to Punishment subscale measures inhibitory behavioral responses to punishment, with good internal consistency in the current study (α = 0.82, M = 13.2, SD = 5.0).

The Experience of Shame Scale (ESS) assessed shame (Andrews, Qian, & Valentine, 2002) at baseline. The scale is comprised of three subscales: characterological shame consists of 12 items (α = 0.92, M = 26.3, SD = 8.0), behavioral shame has 9 items (α = 0.90, M = 23.0, SD = 6.3), and bodily shame has 4 items (α = 0.85, M = 10.4, SD = 3.1). To minimize overlap in our measure of shame as a predictor and our measure of disordered eating as an outcome, the current analysis utilized a composite score of the characterological and behavioral subscales to assess general shame (α = 0.94, M = 49.3, SD = 13.3).

The Eating Attitudes Test (EAT-26) assessed behaviors and symptoms of eating disorders, primarily relating to anorexia nervosa and bulimia nervosa (Garner, Olmsted, Bohr, & Garfinkel, 1982), at baseline (α = 0.89, M = 65.0, SD = 16.5) and follow-up (α = 0.88, M = 68.0, SD = 17.3). Mean EAT-26 scores increased significantly ($p < .011$) between the first and second assessment periods. The non-clinical scoring procedure was used for our undergraduate sample.

2.3. Data analytic strategy

Data were analyzed in Mplus (Muthén & Muthén, 1998–2017). Eating pathology data were missing at follow-up from individuals who did not participate in the second assessment (n = 32). Consistent with best practices for handling missing data (Enders, 2010), all 95 participants who completed measures at baseline were included in analyses using Maximum Likelihood (ML) estimation, which uses known parameters to search for the "most likely" set of missing parameter estimates that would explain the observed data. The participants who completed the follow-up did not differ significantly from those who did not complete the follow-up in terms of age, BMI, punishment sensitivity, composite shame, behavioral shame, characterological shame, or eating pathology at baseline ($p \geq .17$ for each analysis).

To test the prospective role of general shame in explaining the association between sensitivity to punishment and later eating pathology, a mediation model was tested using indirect effects. Further, to parse the specific roles of characterological and behavioral shame in explaining the association between punishment sensitivity and later eating pathology, an exploratory multiple mediation model examined separate indirect paths for each type of shame. Bias-corrected bootstrapping with 5000 samples was used to obtain 95% confidence intervals (CI) for the indirect effects (Preacher, Rucker, & Hayes, 2007). If the CI does not include zero, an indirect effect is supported. Bootstrapping is preferred over the traditional Sobel Test because it performs well in small samples, minimizes Type I error rate, and does not assume normal distributions (Preacher & Hayes, 2008). A Monte Carlo power analysis of indirect effects (Schoemann, Boulton, & Short, 2017) conducted in R (R Core Team, 2017) determined that a sample size of 95 would yield 0.74 power at α = 0.05, conservatively assuming a medium effect size for the covariance between the shame subscales, given that these scales are derived from the same measure, and small effect sizes for all other respective paths in the multiple mediation model.

Table 1
Correlations between study variables (N = 95).

	1	2	3	4	5	6	7	8
1. Baseline sensitivity to punishment[a]	–	0.70***	0.68***	0.62***	0.01	0.07	0.37***	0.35**
2. Baseline shame – Cbe[b]		–	0.94***	0.91***	0.13	−0.04	0.48***	0.54***
3. Baseline characterological shame			–	0.72***	0.10	0.00	0.50***	0.45***
4. Baseline behavioral shame				–	0.14	−0.10	0.38***	0.58***
5. Baseline age					–	−0.06	0.09	0.17
6. Baseline BMI						–	0.19	0.30*
7. Baseline eating pathology[c]							–	0.74***
8. Follow-up eating pathology								–

Note. BMI = body mass index. Cbe = the composite score of shame.

[a] Sensitivity to Punishment: Higher scores represent greater punishment sensitivity. A sample item is, "Do you often refrain from doing something because you are afraid of it being illegal?" and participants are asked to respond either "yes" or "no".

[b] Cbe represents the composite score of characterological (e.g., "Have you worried about what other people think of the sort of person you are?") and behavioral shame (e.g., "Have you tried to cover up or conceal things you felt ashamed of having done?" Participants are asked to respond on a 4-point Likert-type scale ranging from "not at all" to "very much" with higher scores representing greater shame.

[c] Eating pathology: Higher scores represent greater endorsement of symptoms of eating pathology. A sample item is, "I am terrified about being overweight," with a 6-point Likert-type scale ranging from "always" to "never".

* $p < .05$.

** $p < .01$.

*** $p < .001$.

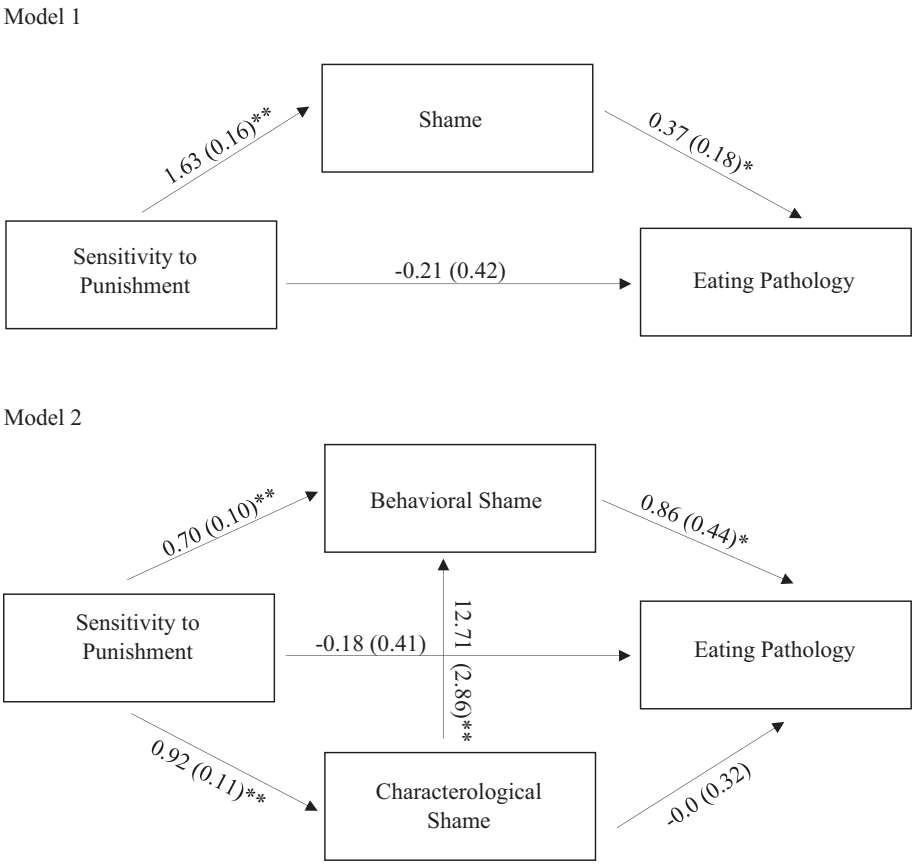

Fig. 1. Statistical models.
Note. Unstandardized coefficients (SEs) are presented for all paths. Baseline eating pathology was controlled for at each step in both models. In Model 1, there was an indirect effect of sensitivity to punishment on eating pathology via composite shame, b = 0.60, β = 0.18, 95% CI [0.03, 1.18]. In Model 2, there was an indirect effect of sensitivity to punishment on eating pathology via behavioral shame, b = 0.60, β = 0.18, 95% CI [0.047, 1.326], but not characterological shame, b = 0.00, β = 0.00, 95% CI [−0.608, 0.560].
* $p < .05$, ** $p < .01$.

3. Results

Baseline sensitivity to punishment was significantly associated with the characterological and behavioral shame subscales and the composite scale representing general shame at baseline, as well as with eating pathology at baseline and at one-year follow-up (Table 1). All measures of shame at baseline were significantly associated with eating pathology at baseline and at one-year follow-up. Given associations between baseline measures of eating pathology, shame, and sensitivity to punishment, eating pathology at baseline was included as a covariate in the model. Two other possible covariates at baseline, age and BMI, were also considered as potential covariates. However, neither age nor BMI were significantly correlated with any variables at baseline at the bivariate level and were not included (Table 1).

As shown in Fig. 1 (Model 1), when controlling for baseline eating pathology, greater sensitivity to punishment was associated with higher shame [b = 1.63 (SE = 0.16), ß = 0.61 (SE = 0.06), $p < .001$]. Further, shame predicted eating pathology at follow-up when controlling for baseline eating pathology [b = 0.37 (SE = 0.18), ß = 0.29 (SE = 0.14), $p < .04$]. There was no direct effect between sensitivity to punishment and follow-up eating pathology when controlling for baseline eating pathology ($b = -0.21$, β = -0.06). Finally, there was an indirect effect of sensitivity to punishment on eating pathology at follow-up via shame when controlling for baseline eating pathology [b = 0.60, β = 0.18, 95% CI (0.03, 1.18)]. The overall model accounted for 55.0% of the variance in shame and 57.7% of the variance in eating pathology at follow-up.

The unique contributions of characterological shame and behavioral shame in explaining eating pathology were examined in a multiple mediation model (Fig. 1, Model 2). Residuals from scores on the shame subscales were allowed to covary, b = 12.71 (SE = 2.86), β = 0.48 (SE = 0.09), $p < .001$. Behavioral shame, b = 0.86 (SE = 0.44), β = 0.33 (SE = 0.16), p = .049, but not characterological shame, b = 0.00 (SE = 0.32), β = 0.00 (SE = 0.15), $p > .05$, significantly predicted eating pathology at follow-up. Further, there was an indirect association between sensitivity to punishment and eating pathology via behavioral shame, b = 0.60, β = 0.18, 95% CI [0.047, 1.326], but not via characterological shame, b = 0.00, β = 0.00, 95% CI [−0.608, 0.560]. This model accounted for 40.5% of the variance in behavioral shame, 53.5% of the variance in characterological shame, and 57.3% of the variance in eating pathology at follow-up.

4. Discussion

Current results extend prior cross-sectional findings (Brockdorf et al., 2018) by showing that shame mediated prospective relations between sensitivity to punishment and eating pathology. Further, exploratory analyses reveal that behavioral, but not characterological shame, mediated relations between sensitivity to punishment and future eating pathology. If replicated, findings suggest that punishment sensitivity contributes to eating pathology specifically through behavioral shame. Future research should examine whether those high in punishment sensitivity are more likely to employ disordered eating behaviors to cope with shame elicited over specific behavioral transgressions.

Given these findings, shame and in particular *behavioral* shame may be an important risk factor for eating pathology among those with higher trait sensitivity to punishment. Investigating risk factors for eating pathology among college women may be especially valuable given the high prevalence of disordered eating and poor body image among young women. Supporting this, mean eating pathology increased significantly and mean BMI increased by one point between the first and second assessment periods. Prior longitudinal studies support temporal associations between shame and disordered eating behaviors (e.g., Kelly, Carter, & Borairi, 2014); future work could extend this by examining specificity of links to characterological versus behavioral

domains of shame.

Experimental paradigms could establish whether temporal associations reflect causal associations between shame and eating pathology and could extend the investigation to a range of internalizing disorders. Eating disorders demonstrate high comorbidity with several internalizing disorders, including depression and anxiety disorders (Hudson, Hiripi, Pope, & Kessler, 2007; Udo & Grilo, 2018), and shared pathways may explain these links. Future research could explicitly examine whether manipulating shame predicts change in eating behaviors and other related internalizing problems, such as rumination or depressive symptoms.

A key strength of this study is the use of a longitudinal design to test an *a priori* hypothesis originally supported in a correlational design. This allowed us to extend support for shame as a contributor to the temporal association between sensitivity to punishment and eating pathology. However, there are limitations worth noting. With data collection limited to two timepoints, we were unable to demonstrate that sensitivity to punishment preceded and predicted shame. Importantly, sensitivity to punishment represents a temperamental feature that exists as an individual difference from early life (Farmer, 2005), whereas shame develops in response to internalization of societal norms in later life and often fluctuates on a daily basis (e.g., Conroy et al., 2015; Gilbert & McGuire, 1998). However, the best approach to examining true temporal mediation requires at least three timepoints. Sensitivity to punishment and shame were strongly correlated, suggesting that our self-report measures could have assessed these constructs in similar ways; thus, future work should employ multiple methods of assessment, such as using behavioral measures of punishment sensitivity or shame induction tasks. This study used a nonclinical convenience sample of only female college students, which reduces generalizability to other groups. Future studies should determine whether results are replicated in more diverse samples. These limitations notwithstanding, the study contributes to the current literature by indicating the potential role of behavioral shame as a risk factor for eating problems among those who are more sensitive to punishment.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Alexandra N. Brockdorf: Writing - review & editing, Writing - original draft. **Cara C. Tomaso:** Writing - review & editing. **Pamela K. Keel:** Writing - review & editing.

Declaration of competing interest

The authors declare that they have no conflict of interest.

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