BRIEF REPORT

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# Punishment sensitivity and the persistence of anorexia nervosa: High punishment sensitivity is related to a less favorable course of anorexia nervosa

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## Abstract

**Objective:** Cross-sectional research provides robust evidence that individuals with anorexia nervosa (AN) report higher punishment sensitivity (PS) than individuals without an eating disorder (ED). High PS might interfere with treatment motivation and the ability to learn from experience. The current study took a longitudinal approach to test predictions that follow from the proposed relevance of PS as a factor in the persistence of AN symptoms. More specifically we tested (1) if higher PS at the start of treatment was related to less improvement in ED symptoms after one year, and (2) if a decrease in ED symptoms was associated with a concurrent decrease in PS.

**Method:** Participants were 69 adolescents with a diagnosis of AN at the start of treatment of whom 62 participated again one year later. ED symptom severity and PS were assessed at both time points.

**Results:** Findings showed that (1) higher PS at the start of treatment was related to less improvement in ED symptoms, and (2) an improvement in ED symptoms was related to a decrease in PS.

**Discussion:** These findings are consistent with the proposed relevance of PS in the persistence of AN and suggest that it might be beneficial to address high PS in treatment.

**Public Significance:** Consistent with the view that punishment sensitivity (PS) is related to the persistence of anorexia nervosa, high PS at the start of treatment was related to less improvement in eating disorder symptoms in patients with anorexia nervosa. Furthermore, an improvement in eating disorder symptoms was associated with a concurrent decrease in PS, suggesting that PS can be subject to change and may be a relevant target for treatment.

KEYWORDS
adolescents, anorexia nervosa, eating disorder symptoms, punishment sensitivity

## 1 | INTRODUCTION

Anorexia nervosa (AN) is a severe mental disorder that mostly affects adolescent girls and young women (Schmidt et al., 2016). Individuals with AN are characterized by such an extreme food restriction that it results in a harmfully low weight and becomes a threat to their health (Kask et al., 2016). Established therapies for AN—cognitive behavior therapy (CBT) and family based therapy—show only limited

effectiveness, and relapse after successful treatment is common (between 9% and 52%) (Brockmeyer et al., 2018; Khalsa et al., 2017). Characterizing factors that might underlie the persistence of AN may inform attempts to improve the effectiveness of treatment. One of these characteristics is punishment sensitivity (PS; Harrison et al., 2010).

Theoretical models suggested that people with AN are sensitive to criticism and prone to avoid negative situations (Schmidt & Treasure, 2006; Steinglass et al., 2011). In other words, they have been suggested to be generally sensitive to negative or undesirable (punishing) stimuli (i.e., PS) (Elliot & Thrash, 2002; Gray & McNaughton, 2000). High PS might interfere with treatment motivation, and the ability to learn from experience (A. M. Monteleone et al., 2018; Wierenga et al., 2014). There is robust evidence that individuals with AN report higher PS than individuals without an eating disorder (ED) (Claes et al., 2006; Glashouwer et al., 2014; Jappe et al., 2011; Jonker et al., 2020; Matton et al., 2015; P. Monteleone et al., 2014). However, the cross-sectional design of these studies precludes conclusions about whether high PS is associated with the persistence of AN. If PS is a relevant factor, patients with higher PS should show less improvement in ED symptoms over time (cf. Stice, 2002). The current study examined whether higher PS at the start of treatment is related to less change in ED symptoms over time in adolescents with AN.

PS has been suggested to represent a relatively stable personality characteristic (Harrison et al., 2016), suggesting that it cannot be easily reduced in treatment. Indeed, it was found that PS of adults with AN did not systematically change between the start and end of a 20-week treatment program (Harrison et al., 2016). However, the treatment also resulted in only a small change in ED symptoms, and the relationship between change in ED symptoms and change in PS was not examined. It is therefore possible that, although on average there was no change in PS, for those individuals who responded to treatment there was a decrease in PS. Therefore, the current study also examined whether PS changed over time and whether reductions in ED symptoms were related to reductions in PS.

In short, we investigated the relevance of PS as a factor in the persistence of AN. We used a longitudinal approach to test whether (1) higher PS at the start of treatment is related to less improvement in ED symptoms after 1 year, and (2) if a decrease in ED symptoms was associated with a concurrent decrease in PS.

## 2 | METHOD

### 2.1 | Participants

Participants were 69 adolescents (67 females, $Mean_{age} = 15.55$, $SD_{age} = 1.70$, range = 12–22[1]) referred for inpatient or outpatient treatment at the Accare department of EDs which is located in the Northern part of the Netherlands.[2] ED symptoms were assessed with the child version of the Dutch Eating Disorder Examination (EDE) interview (Bryant-Waugh et al., 1996; Decaluwé & Braet, 1999). Patients fulfilled DSM-5 criteria for AN restrictive type ($n = 39$), AN binge purge (AN-BP) type ($n = 10$), atypical AN restrictive type ($n = 11$), or atypical AN-BP ($n = 9$). Patients reported that this was either their first ($n = 62$) or second AN episode ($n = 7$). One year after baseline, 62 participants (90%) completed the EDE, and 60 participants completed all follow-up assessments (87%; $Mean_{age} = 16.47$, $SD_{age} = 1.57$). Patients dropped-out because they were not doing well ($n = 3$) or just started a new intensive treatment program ($n = 3$), or for unknown reasons ($n = 1$). At follow-up, 34 patients (49.3%) were still in treatment, 27 were not (39.1%), and 1 patient did not provide this information.

### 2.2 | Materials

#### 2.2.1 | BMI

Because BMI changes substantially with age, age and gender adjusted BMI was calculated ([actual BMI/median BMI for age and gender] × 100) (Cole et al., 2000).

#### 2.2.2 | ED symptom severity

ED symptoms severity was assessed with the ED examination questionnaire (EDE-Q; Fairburn & Beglin, 2008). Adaptations were made to make the language appropriate for adolescents (cf. Jansen et al., 2007). The average score of the 22 items answered on a 7-points Likert scale was used to index ED symptom severity (cf. Aardoom et al., 2012). Internal consistency was excellent at baseline and follow-up (Cronbach's alpha = .97 and .93). ED symptom severity was also indexed with the average score of the four subscales of the EDE-interview (Bryant-Waugh et al., 1996; Decaluwé & Braet, 1999). Internal consistency was excellent at baseline and follow-up (Cronbach's alpha = .89 and .94).

#### 2.2.3 | Punishment sensitivity

PS was assessed with the behavioral inhibition scale (BIS) of the BIS/BAS (Carver & White, 1994), and the sensitivity to punishment (SP) subscale of the SPSRQ (Torrubia et al., 2001). Although either questionnaire can be used to measure punishment sensitivity, there is an important difference between the questionnaires. The SPSRQ was designed to measure sensitivity to specific punishing cues (e.g., "return to a store when given the wrong change") (Torrubia et al., 2001), whereas in the BIS/BAS the type of punishment is not specified (e.g., "something unpleasant"). These questionnaires have

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[1]Only 8.7% ($n = 6$) of the participants were younger than 14 or older than 18 at baseline; so over 91% of all participants were aged 14–18.

[2]No information was collected on race and ethnicity. However, in the northern parts of the Netherlands there is little ethnic diversity with people typically being from Dutch descent.

been used interchangeably in AN literature, and including both will increase our confidence in the findings of the current study. The BIS contains seven items that are answered on a 4-point scale ranging from *very false to me* (1), to *very true to me* (4). Internal consistency at baseline and follow-up was acceptable to good (Cronbach's alpha = .78 and .85). The SP contains 24 items that are answered with *yes* (1) or *no* (0). The SP score was calculated by summing the items that were answered with yes. Internal consistency at baseline and follow-up was good (Cronbach's alpha = .85 and .91).[3]

## 2.3 | Procedure

This study was approved by the medical ethical committee of the University Medical Center in Groningen, the Netherlands (NL.51694042.14), and is part of a larger project (e.g., Jonker et al., 2019, 2020).

*Baseline*: Participants and their parents (when participants were younger than 18) signed informed consent forms. Baseline assessment took place at the treatment center after intake (median 53 days after intake). Some patients participated later for reasons such as hospital admission. Therefore, BMI during intake and baseline assessment are reported. At the baseline assessment, participants completed the BIS/BAS, SPSRQ, and EDE-Q. Last, patients' height and weight were measured.

*Treatment*: Treatment for AN provided at Accare is individually tailored. Participants (*n* = 60) reported to have received different therapy components, such as CBT–Enhanced (Fairburn & Beglin, 2008; *n* = 50), diet management and exposure (*n* = 46), consultations with a dietician (*n* = 45), intensive family treatment (*n* = 34), and psychomotor therapy (*n* = 21).

*Follow-up*: Follow-up assessment took place 1 year after baseline assessment (median 373 days after baseline) following the same procedure. Participants completed the BIS/BAS, the SPSRQ, and the EDE-Q. At the end the EDE interview was performed and patients' height and weight were measured.

## 2.4 | Analyses

### 2.4.1 | Baseline PS and improvement of ED symptoms after 1 year

Linear regression analyses were conducted with change in ED symptoms as outcome measure and baseline PS as predictor. Baseline ED symptoms and change in PS were added before the predictor.

### 2.4.2 | Change in ED symptoms and change in PS

As a first step a paired samples *t*-test was performed to examine whether PS changed between baseline and follow-up. Following,

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[3]These measures also include indexes for reward sensitivity. Although this is beyond the scope of this study these are provided in the Supplementary Materials for the sake of completeness.

linear regression analyses with change in ED symptoms as outcome measure and change in PS as predictor were conducted.

To complement the results of the statistical analyses following the frequentist approach, results were also reported with the Bayesian approach to increase the confidence in our results. Moreover, more importantly it provides the opportunity to test the evidence in favor of the null hypotheses that change in ED symptoms was not be related to a change in PS. Bayesian analyses were conducted with JASP (JASP Team, 2018). Prior was set at the recommended default $r = .354$ (JASP Team, 2018). We will report $BF_{10}$, which quantifies the probability of the data under the model including the variable that was included in that step (e.g., change in punishment sensitivity) relative to the model without that variable (e.g., model with only baseline ED symptoms). It thus provides the Bayesian equivalent to the *F*-change statistic. A Bayes factor of 1 is considered *no evidence*, between 1 and 3 *anecdotal*, between 3 and 10 *moderate*, between 10 and 30 *strong*, between 30 and 100 *very strong*, and more than 100 *extremely strong* evidence that the data are more likely under the model including the variable (Wagenmakers et al., 2017).

## 3 | RESULTS

### 3.1 | Descriptives

Table 1 shows means and standard deviations of the variables during intake, baseline, and follow-up of participants completing (at least part of) the follow-up.[4] Between baseline and follow-up, BMI significantly increased, and ED symptoms as measured with the EDE and the EDE-Q significantly decreased.

### 3.2 | Baseline PS and improvement of ED symptoms after 1 year

Higher baseline BIS and SP were related to less reduction in ED symptoms as measured by both the EDE and EDE-Q (Table 2, step 3 of Model 1A, 1B, 2A, and 2B). Bayesian analyses showed that the evidence for the model in which baseline BIS predicts change in EDE-Q (Model 1A) was moderate and in which baseline BIS predicts change in EDE (Model 2A) was strong. The evidence for the model in which baseline SP predicts change in EDE-Q (Model 1B) was moderate and in which baseline SP predicts change in EDE (Model 2B) was very strong.

### 3.3 | Change in PS and the relationship with change in ED symptoms

Paired samples *t*-tests showed no significant change in BIS, and a small significant decrease in SP (Table 1). A stronger reduction in

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[4]See Supplementary Materials for descriptive information regarding the different subtypes.

**TABLE 1**  Group characteristics (N = 62)[a]

|  | Intake | | Baseline | | Follow-up | | Paired samples *t*-test | | | |
|---|---|---|---|---|---|---|---|---|---|---|
|  | Mean | SD | Mean | SD | Mean | SD | t | p | Cohen's d | α |
| BMI (n = 62) | 82.30 | 11.11 | 83.81 | 11.09 |  |  | 2.58 | .012 | 0.14 | .025 |
|  |  |  | 83.81 | 11.09 | 95.23[b] | 14.91 | 7.54 | <.001 | 0.85 | .013 |
| EDE (n = 60) | 3.70 | 1.14 |  |  | 1.81 | 1.51 | −9.49 | <.001 | 1.40 | .008 |
| EDE-Q (n = 60) |  |  | 4.08 | 1.13 | 2.57 | 1.58 | −8.09 | <.001 | 1.07 | .010 |
| BIS (n = 60) |  |  | 3.31 | 0.53 | 3.18 | 0.57 | −1.91 | .061 | 0.23 | .050 |
| SP (n = 59) |  |  | 15.80 | 5.02 | 13.73 | 6.43 | −3.11 | .003 | 0.35 | .017 |

[a]The power of these tests ware at least 98% to find a medium effect.
[b]BMI was available for 61 participants at posttest.
Abbreviations: BIS, behavioral inhibition scale; BMI, adjusted body mass index. Adjusted BMI scores smaller than 85% are considered underweight and between 85% and 120% as normal weight (Van Winckel & Van Mil, 2001); EDE, eating disorder examination interview; EDE-Q, total score on the eating disorder examination questionnaire; SP, sensitivity to punishment scale; α, Bonferroni–Holm corrected.

**TABLE 2**  Regression models of complete sample[a]

| Dependent variable | Model | Step | Independent | β | T | Adj-$R^2$ | $F_{change}$ (p) | $A$[b] | $BF_{10}$ |
|---|---|---|---|---|---|---|---|---|---|
| Change in EDE |  | 1 | Baseline EDE | −.39 | −3.14 | .13 | 9.85 (.003) | .05 | 20.80 |
|  | 1A[c] | 2 | Change in BIS | .28 | 2.34 | .20 | 5.45 (.023) | .05 | 2.84 |
|  |  | 3 | Baseline BIS | .36 | 2.89 | .29 | 8.32 (.006) | .025 | 9.39 |
|  | 1B[d] | 2 | Change in SP | .42 | 3.67 | .30 | 13.44 (.001) | .025 | 58.74 |
|  |  | 3 | Baseline SP | .30 | 2.77 | .37 | 7.69 (.008) | .05 | 6.94 |
| Change in EDE-Q |  | 1 | Baseline EDE-Q | −.26 | −2.08 | .05 | 4.31 (.042) | .05 | 1.55 |
|  | 2A[c] | 2 | Change in BIS | .36 | 3.03 | .17 | 9.20 (.004) | .05 | 12.76 |
|  |  | 3 | Baseline BIS | .38 | 3.06 | .28 | 9.37 (.003) | .05 | 14.23 |
|  | 2B[d] | 2 | Change in SP | .43 | 3.67 | .22 | 13.43 (.001) | .025 | 59.75 |
|  |  | 3 | Baseline SP | .39 | 3.52 | .35 | 12.39 (.001) | .025 | 42.93 |

[a]The power of these tests were at least 75% to find a medium effect.
[b]A Bonferroni–Holm correction was applied to control for increased familywise error rate. That is, for both models the smallest *p*-value was tested against an alpha of .025, and the largest against .05. Since only one variable is added per step, the *p*-value of the *t*-test is identical to the *p*-value of the $F_{change}$ statistic. Negative change in EDE and EDE-Q symptoms indicates a decrease in symptoms and thus an improvement.
[c]n = 60.
[d]n = 59.

BIS and SP was related to a stronger decrease in ED symptoms as measured with the EDE and EDE-Q (Table 2). Bayesian analyses showed that the evidence for the model in which change in BIS predicts change in EDE-Q (Model 1A) was anecdotal and in which change in BIS predicts change in EDE (Model 2A) was strong. The evidence for the models in which change in SP predicts change in EDE-Q (Model 1B) and change in EDE (Model 2B) was very strong.

## 4 | DISCUSSION

The core aim of this study was to investigate the proposed relevance of PS as a factor in the persistence of AN symptoms. The main findings can be summarized as follows: (1) higher PS at baseline was related to less improvement in ED symptoms over the course of a year, and (2) at a group level, PS did not show a robust change over

the course of 1 year, yet an improvement in ED symptoms was systematically related to a concurrent decrease in PS.

Our finding that high PS at baseline was related to less improvement of ED symptoms over time is consistent with the view that PS is related to the persistence of AN, and is in keeping with the idea that high PS might interfere with treatment motivation, and might prevent the ability to learn from experience (A. M. Monteleone et al., 2018; Wierenga et al., 2014). However, since treatment was not under experimental control, the implications can range from patients with high PS (i) benefiting less from similar treatments as patients with lower PS, (ii) receiving different—less effective—treatment, or (iii) having a higher chance of dropping out of treatment. Future studies are needed to examine how exactly PS might be related to the persistence of AN.

In line with the suggestion that PS is a relatively stable personality characteristic (Harrison et al., 2016), we found no robust change in PS over the course of a year. However, a decrease in ED symptoms was related to a concurrent decrease in PS. This finding suggests that at

least part of the heightened PS found in patients with AN can be subject to change. Future studies should examine causality by manipulating PS and testing whether this has an impact on severity of ED symptoms. Since PS has been considered a stable personality characteristic, no validated manipulations are available. One potential approach could use psychoeducation and CBT techniques to help individuals decrease their focus on punishing cues and increase the focus on rewarding cues in the environment.

Strengths of the study entail: a large sample of adolescents with AN, low drop-out rates, a longitudinal approach, the assessment of ED symptoms with a diagnostic interview as well as self-report, and including two commonly used PS measures. Some limitations should be kept in mind when interpreting these results. First, the current study examined the relationship between PS and the course of AN and therefore treatment was not under experimental control. Therefore, the possibility that therapists somehow adjusted their treatment to differences in PS cannot be ruled out. Second, it is unknown whether the adolescents with AN also fulfilled the criteria for comorbid mental disorders. However, since the current study used a within group design, this is primarily a limitation on generalizability.

To conclude, higher PS at baseline was related to less improvement in ED symptoms suggesting that PS might indeed be a factor that contributes to the persistence of AN. Consistent with this, our findings indicated that the decrease in ED symptoms was associated with a concurrent decrease in PS over the course of a year, suggesting that PS can also be subject to change. An important next step would therefore be to test whether therapeutically addressing high PS is effective in reducing symptoms of AN.

## ACKNOWLEDGMENT

## CONFLICT OF INTEREST

The authors have no conflict of interest.

## AUTHOR CONTRIBUTIONS

**Nienke C. Jonker:** Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; software; writing – original draft; writing – review and editing. **Klaske A. Glashouwer:** Conceptualization; methodology; writing – review and editing. **Peter J. de Jong:** Conceptualization; funding acquisition; methodology; writing – review and editing.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy or ethical restrictions.

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