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A 5-year longitudinal study of the adolescent reinforcement sensitivity as a risk factor for anxiety symptoms in adulthood: Investigating the indirect effect of cognitive emotion regulation

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ABSTRACT

This study investigated the longitudinal effects of the Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS) on anxiety symptomatology and tested the indirect effect of cognitive emotion regulation as a possible mechanism underlying this link. In this study, 274 individuals were assessed two times (T_1 and T_2), at a 5-year interval. We found an excellent fit for the hypothesized model, with BIS (T_1) predicting both maladaptive cognitive emotion regulation (mCER) and T_2-anxiety even after controlling for T_1-anxiety. Further, mCER significantly mediated the relationship between BIS and T_2-anxiety, and between T_1-anxiety and T_2-anxiety. However, an alternative model, supposing that BIS and T_1-anxiety indirectly affect mCER through T_2-anxiety, showed a similar fit. While BAS predicted higher levels of adaptive cognitive emotion regulation (aCER), it was unrelated to mCER and showed a small positive association with anxiety only at higher levels of BIS. These findings provide longitudinal support for BIS as a risk for anxiety symptoms and support the importance of targeting mCER in the prevention and treatment of anxiety, especially among individuals with BIS sensitivity. Finally, the results suggest a possible overlap between anxiety and mCER that requires further longitudinal research to clarify the direction of their relationship.

1. Introduction

The Reinforcement Sensitivity Theory (RST), proposed by Gray (1982), is considered a milestone in personality research and significantly contributed to a consensus on the association between personality factors and emotional systems (Pickering & Corr, 2008). RST postulates that three major brain subsystems, the Behavioral Approach System (BAS), the Behavioral Inhibition System (BIS) and the Fight–Flight System (FFS), are responsible for individual differences in personality and psychopathology (Gray, 1982). In this model, BAS is defined as a sensitivity to reward signals, whereas BIS is characterized by sensitivity to aversive stimuli (signals of punishment, non-reward and novelty), is activated by potential threats and underlies anxiety (Corr & McNaughton, 2008; Gray, 1982). Anxiety symptoms have been positively associated with BIS but unrelated to BAS (e.g., Hundt, Williams, Mendelson, & Nelson-Gray, 2013). BIS resolves approach-avoidance conflicts by increasing the valence of negative stimuli. This leads to a subjective state of worry and constant checking of the environment for potential signs of danger, which in turn contributes to anxiety (Pickering & Corr, 2008), as supported by previous empirical evidence (e.g., Maack, Tull, & Gratz, 2012).

1.1. BIS/BAS, emotion dysregulation, and anxiety

The underlying mechanism through which BIS leads to anxiety is largely unknown. Research suggests that emotion dysregulation is a possible explanation for this link (Bijttebier, Beck, Claes, & Vandereycken, 2009). Accordingly, previous cross-sectional studies have shown that BIS is associated with more emotion dysregulation among young adults (Leen-Feldner, Zvolensky, Feldner, & Lejuez, 2004; Tull, Gratz, Latzman, Kimbrel, & Lejuez, 2010). Markarian, Pickett, Deveson, and Kanona (2013) showed that emotion dysregulation mediates the relationship between BIS and anxiety. These findings are consistent with current theories on BIS, which link this construct with a variety of emotionally negative outcomes (Gray, 1982). Higher levels of negative emotions associated with BIS (Hundt, Brown, Kimbrel, Walsh, Nelson-Gray and Kwapil, 2013) might facilitate emotion dysregulation (Fox, Henderson, Marshall,

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Nichols, & Ghera, 2005). In contrast, BAS has been related to higher levels of positive affect (Hundt, Brownet al., 2013), but it has shown an insignificant or small negative association with emotion dysregulation (Markarian et al., 2013).

The existing literature on the link between BIS/BAS and emotion dysregulation has mostly focused on emotion regulation difficulties such as awareness as measured with the Difficulties in Emotion Regulation Scale (DERS, Gratz & Roemer, 2004), while particular emotion regulation strategies are strongly associated with psychopathology (Garnefski, Kraaij, & van Etten, 2005). In this study, we focus on a definition of emotion regulation as cognitive strategies for handling the intake of emotionally arousing information and ways of responding to stressful events (Garnefski, Kraaij, & Spinhoven, 2001). Maladaptive cognitive emotion regulation strategies (mCER) such as self-blame, rumination, catastrophizing, and suppression have been shown to positively predict anxiety (Garnefski et al., 2005), while adaptive cognitive emotion regulation (aCER) such as acceptance and positive refocusing, have a marginal or non-significant association with anxiety symptomatology (Garnefski & Kraaij, 2007). The association between aCER and psychopathology seems to be weaker, less constant and more dependent on the context, compared to mCER (Aldao & Nolen-Hoeksema, 2012).

While we did not identify a study investigating the association between BIS/BAS and aCER, some studies have shown that BIS predicts higher levels of mCER. These, however, are cross-sectional and focus only on rumination (Leen-Feldner et al., 2004; Randles, Flett, Nash, McGregor, & Hewitt, 2010). The negative affect associated with BIS (Hundt, Brown et al., 2013) might contribute to negative cognitions such as mCER (Mausbach, Roepke, Depp, Patterson, & Grant, 2009). Further, BIS may lead to cognitive intrusions due to the increased sensitivity to punishment signals and constant checking of the environment for potential threats (Nigg, 2000), which in turn facilitate mCER such as rumination. Accordingly, Viana and Gratz (2012) demonstrated that catastrophizing explains the BIS-anxiety link among adolescents.

Although different lines of research relate both BIS and emotion dysregulation to anxiety, we know very little about their concomitant relations to anxiety symptoms. Such studies are of special importance considering findings on emotion dysregulation as a risk and maintaining factor, as well as a treatment target for anxiety disorders (Cisler, Olatunji, Feldner, & Forsyth, 2010).

1.2. The present study

This study addresses the aforementioned gap using structural equation modeling (SEM) to test the direct and indirect effects of BIS/BAS on anxiety symptoms. We hypothesized that BIS predicts higher levels of anxiety and mCER, when measured after a 5-year interval, and that BAS is less strongly related to mCER and anxiety. Further, we assumed that mCER mediates the relationship between BIS and anxiety, while aCER is only insignificantly or weakly related to both BIS and anxiety. Additionally, given the evidence for higher levels of BIS (Markarian et al., 2013), mCER (Garnefski & Kraaij, 2006), and anxiety (Viana & Gratz, 2012) among women, we controlled for the gender effect.

2. Materials and methods

2.1. Participants and procedure

The sample was drawn from the population-based Greifswald family study (Aldinger et al., 2014; Barnow, Lucht, & Freyberger, 2002; Barnow, Rüge, Spitzer, & Freyberger, 2005), a subpopulation from the Study of Health in Pomerania, Germany (SHIP; John et al., 2001). Longitudinal data were collected three times, at 5-year intervals, the second and the third of which (T_1 and T_2) were used in this study.

Between 1997 and 2000 (T_0), 381 offspring from 315 families participated in the study. Between 2005 and 2008, the first follow-up (T_1) was conducted with 334 participants (mean age = 19.56). From 2011 to 2013 (T_2), the participants were investigated again. Data for 85% of T_1 participants were available from this assessment ($N = 284$). Individuals who participated in T_2 did not differ in age from those who dropped out after T_1 ($F = 0.07$, $p = .79$). There was an insignificant tendency to more dropouts among men ($\chi = 3.50$, $p = .061$) and individuals who did not follow the T_2 assessment had significantly lower BIS ($F = 4.77$, $p = .03$) and depression ($F = 8.43$, $p = .004$), and higher BAS ($F = 4.43$, $p = .04$) at T_1. Further, 10 individuals with missing values for at least one relevant variable, were excluded from the analysis, resulting in a final sample of 274 participants (154 women and 120 men) with a mean age of 19.50 years (14–27) at T_1 and 24.99 years (19–34) at T_2 (see Table 1). All participants provided written informed consent and the study was approved by the local ethics committee.

2.2. Measures

2.2.1. BIS/BAS sensitivity

At T_1, BIS/BAS sensitivity was measured with the short version of Action Regulating Emotion Systems (ARES; Hartig & Moosbrugger, 2003). The ARES is a German alternative to the Behavioral Inhibition/Activation System scales (Carver & White, 1994) and consists of a 10-item BIS and a 10-item BAS, ranging from 1 (*strong disagreement*) to 4 (*strong agreement*). Both BIS and BAS subscales show good internal consistency ($\alpha = .89$ and $\alpha = .80$, respectively; Hartig & Moosbrugger, 2003).

2.2.2. Symptom checklist-revised (SCL-90-R) and brief symptom inventory (BSI)

T_1-anxiety and T_2-anxiety were measured with the German version of the SCL-90-R (Franke, 1995) and its short form, the BSI (Franke, 2000), respectively. Items are rated on a five-point Likert scale, ranging from *not at all* (0) to *extremely* (4). Both versions are comparable and measure psychopathology with nine scales assessing symptoms over the last seven days (Franke, 1995, 2000). SCL-90-R and BSI have shown excellent reliability and validity ($\alpha = .965$ and $\alpha = .963$, respectively) (Franke, 2000; Hessel, Schumacher, Geyer, & Brähler, 2001) and their anxiety subscales show good stability over one week ($r = 0.85$ and $r = 0.88$, respectively; Franke, 1995, 2000). In order to facilitate comparability of T_1-anxiety and T_2-anxiety, we extracted BSI items from SCL-90-R and summed them to produce the T_1-anxiety score.

2.2.3. The Cognitive Emotion Regulation Questionnaire (CERQ)

The CERQ (Garnefski et al., 2001), which consists of 36 Likert-type items ranging from *sometimes* (1) to *always* (5), was applied at T_2. The CERQ measures cognitive strategies of self-blame, rumination, catastrophizing, other-blame, acceptance, positive reappraisal, positive refocusing, planning, and putting into perspective. It has shown adequate internal consistency ($.60 < \alpha < .86$) and an acceptable to good test–retest reliability ($.65 < r < .83$), except for the "blaming others" and "positive refocusing" ($r = .51$ and $r = .48$, respectively; Loch, Hiller, & Witthöft, 2011).

2.3. Statistical analysis

We analyzed data using IBM SPSS version 20 and analysis of movement structure (AMOS) version 22. We analyzed descriptive statistics for each variable and calculated Pearson correlation coefficients between the variables. Using SEM, we designed and tested the hypothesized model in AMOS with a 95% confidence interval and using the following fit indices: an insignificant chi-square, chi-square/*df* ratio < 2.0, Comparative Fit Index (CFI) > .90, Goodness of Fit Index (GFI) > .90 and Root Mean Square Error of Approximation (RMSEA) < .08 (Tabachnick & Fidell, 2007). We conducted a curve estimation for all the relationships in our model and determined that all were sufficiently linear to be tested using covariance-based SEM. In keeping