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Effects of the behavioral inhibition system (BIS), behavioral activation system (BAS), and emotion regulation on depression: A one-year follow-up study in Chinese adolescents



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ABSTRACT

Depression is a worldwide mental health problem among adolescents. The current study aimed to examine the roles of the behavioral inhibition system (BIS), behavioral activation system (BAS), and emotion regulation on adolescent depression. A total of 330 Chinese adolescents were recruited to complete initial assessments of BIS/BAS, emotion regulation, and depression, with a follow-up after one year. Depression on these two occasions was positively correlated with gender, age, initial scores of BIS/BAS activity, and with Cognitive Emotion Regulation Questionnaire scores for self-blame, rumination, putting into perspective, catastrophizing, and blaming others, and negatively correlated with initial positive reappraisal scores. Structural equation modeling demonstrated that higher BIS activity, catastrophizing, rumination, and lower positive reappraisal predicted depression after one year. However, after controlling for initial depression, these variables were indirectly related to subsequent depression. Implications are discussed for assessments of depression and interventions targeted at the BIS, BAS, and emotion regulation.

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1. Introduction

Adolescent depression is a worldwide mental health problem. Studies have found the prevalence of adolescent depression to be between 1% and 50% (Pinar and Dilsad, 2004). In recent years, Gray's biopsychological model has proven to be a useful framework for understanding the onset and maintenance of depression (Gray, 1994). The model focuses on the roles of two motivational systems, the behavioral inhibition system (BIS) and the behavioral activation system (BAS). The BIS is hypothesized to be sensitive to cues of threat or punishment, and is associated with avoidant or withdrawal behaviors (Zinbarg and Lira Yoon, 2008; Bijttebier et al., 2009). The BAS is hypothesized to be sensitive to cues of reward or appetite, and is associated with approach behaviors (Fowles, 1988; Depue and Iacono, 1989; Gray, 1994). Many studies have shown that individual differences in the BIS/BAS are related to various forms of psychopathology, such as anxiety (e.g., Fowles, 1988), depression (e.g., Pinto-Meza et al., 2006), substance use (e.g., Knyazev, 2004; Knyazev et al., 2004), and addiction behaviors (e.g., O'Connor et al., 2009; Wardell et al., 2013).

However, the relationship between BAS/BIS and depression is still a matter of some disagreement. Several studies have proposed that depression is characterized by deficits or dysfunction in the BAS (Fowles, 1988; Depue and Iacono, 1989; Gray, 1994; Davidson, 1998). Some studies have shown that depression is associated only with a higher level of BIS activation (Meyer et al., 2001; Johnson et al., 2003), although others have reported an association with higher BIS activation and lower BAS activation (Kasch et al., 2002; Campbell-Sills et al., 2004; Pinto-Meza et al., 2006; Li et al., 2009). The inconsistent results may be associated with the choice of participants, who have varied from clinically depressed patients (Pinto-Meza et al., 2006; McFarland et al., 2006; Li et al., 2009; Mellick et al., 2014), individuals with depression and comorbid anxiety (Hundt et al., 2007; Li et al., 2013), to adults or adolescents with no clinical condition (Jones and Day, 2008; Markarian et al., 2013). Further, such studies have primarily used a cross-sectional design, and have been limited in terms of fostering understanding of the role of the BIS/BAS in depression. Of the available longitudinal studies, Kasch et al. (2002) found that within a depressed group, lower BAS levels were associated with greater concurrent depression severity and predicted a worse eight-month outcome. McFarland et al. (2006) also found that lower self-reported BAS sensitivity, not BIS sensitivity, predicted a worse course of depression in a six-month follow-up study. These studies suggest that a lower BAS activation may be a sensitive "trait" index for the

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risk of clinical depression in adults. So it is reasonable to hypothesize that lower BAS activation would also be associated with a poorer course of depression. However, it is not yet clear that the same results would necessarily be obtained in adolescents in general.

The mechanisms through which the BIS and BAS operate to increase the risk for depression remain unclear (Bijttebier et al., 2009). One possible mechanism that may be particularly relevant is emotion regulation. Emotion regulation refers to “extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, their intensive and temporal features in particular, to accomplish one’s goals” (Thompson, 1994, p. 27). A growing body of research suggests that emotion regulation strategies influence the development of depression (Compass et al., 1993; Garnefski et al., 2001, 2002b, 2003; Martin and Dahlen, 2005; Garnefski and Kraaij, 2006; Joormann and D’Avanzo, 2010; Hofmann et al., 2012; Ehring et al., 2010). Indeed, maladaptive emotion regulation and deficits in adaptive emotion regulation, for example, rumination, catastrophizing, and self-blame, are strongly associated with depression, and may be factors predicting vulnerability to depression (Sullivan et al., 1995; Nolen-Hoeksema, 2000; Martin and Dahlen, 2005; Wei and Fu, 2008). These findings have been well-confirmed in the general adult population (Garnefski and Kraaij, 2006, 2007; Zhu et al., 2008; Omran, 2011), adolescents (Garnefski et al., 2001, 2002a; Öngen, 2010; Perte and Miclea, 2011), and psychiatric patients (Garnefski et al., 2002b; Perte and Miclea, 2011). However, almost all findings have used cross-sectional study designs. Studies on the association between emotion regulation and subsequent depressive symptoms are rare. Berking et al. (2014) found that the successful application of emotion regulation skills negatively predicted subsequent depressive symptom severity over a five-year period, even when controlling for initial symptom severity. However, this longitudinal study did not investigate a broad range of emotion regulation strategies with regard to their predictive value for subsequent depressive symptoms.

Regarding the association between the BIS/BAS and emotion regulation, Researchers have found positive associations between BIS activity and maladaptive emotion regulation, such as rumination, catastrophizing, and self-blame (Tull et al., 2010; Pickett et al., 2011; Li et al., 2013). It is suggested that individual differences in the BIS and BAS may have implications for the development of emotion regulation (Depue and Iacono, 1989).

Furthermore, a wide range of previous studies have revealed gender and age differences in the BIS/BAS, use of emotion regulation, and depression. For example, it was found that females are more vulnerable to depression and more likely to report higher BIS scale scores (Seiffge-Krenke and Stemmler, 2002; Knyazev, 2004; Markarian, et al., 2013). Early adolescents (i.e., ages 9–12) exhibit lower levels of BAS Drive and lower BAS total scores as compared to late adolescents (i.e., ages 13–17) and young adults (i.e., ages 18–23), with no differences between the two latter age groups (Urošević et al., 2012). Regarding emotion regulation, females have been reported to use rumination, catastrophizing, and positive refocusing more often than males (Garnefski et al., 2004; Öngen, 2010). However, there has been some disagreement with regard to gender differences in the relationships between emotion regulation and depression. For example, Garnefski et al. (2004) found rumination and catastrophizing could predict depression in both genders. In contrast, Öngen (2010) found that higher extents of self-blame and rumination were related to depression in male Turkish adolescents, whereas in females, depression was associated with blaming others to a greater extent. These inconsistent results might be explained by cultural differences. Taken together, these studies suggest that it is necessary to examine the role of gender and age with regard to the relationships among the BIS/

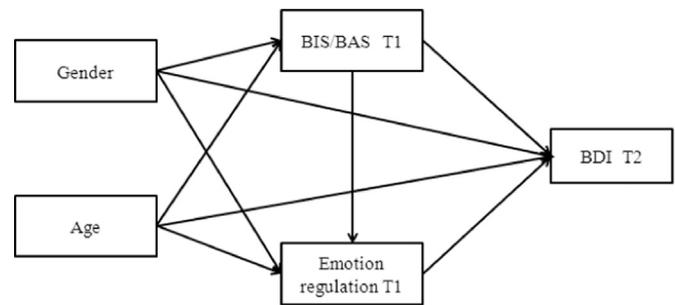


Fig. 1. Hypothesized model for adolescent depression. T1 and T2 refer to initial and one-year measurements, respectively.

BAS, emotion regulation, and depression.

The above findings suggest that there are close associations among the BIS/BAS, emotion regulation, and depression. However, few studies have explored how the BIS/BAS and emotion regulation interact and effect depression. The aim of the present study was to develop and test a path model to investigate the relationships among the BIS/BAS, emotion regulation, and depression in a sample of Chinese adolescents by designing a one-year follow-up paradigm. The hypothesized model is depicted in Fig. 1. We hypothesized that (1) BIS/BAS and emotion regulation would be associated with depression, (2) depression would be determined by the BIS/BAS and emotion regulation, (3) the BIS/BAS would be mediated and moderated by various emotion regulation strategies, and (4) gender and age might be significant factors in the relationships among the BIS/BAS, emotion regulation, and depression.

2. Methods

2.1. Participants

A total of 485 adolescents from Gaoxian High School, in Sichuan Province, China, were recruited to participate in our initial cross-sectional study. Of these, 443 signed a consent form and completed all questionnaires, which consisted of the BIS/BAS Scale, Cognitive Emotion Regulation Questionnaire (CERQ), and Beck Depression Rating Scale (BDI-II). One year later, 330 of these 443 individuals responded to the same questionnaires again; the 113 students (56 female, 57 male) who did not return for the second session failed to do so due to the college entrance examination, graduation, or transfer to another school. The data of these 330 students were used for subsequent analyses. There were no differences between the students who responded on two occasions ($N=330$) versus only at Time 1 (113) in terms of age ($t=0.22$, $P>0.05$), gender ($\chi^2=2.54$, $P=0.11$), the BIS/BAS, and emotion regulation strategies at initial assessment, except that the putting into perspective score was slightly higher among the 113 students (i.e., Time 1 only group). The ages of the 330 students (138 males and 192 females) ranged from 15 to 20 years old ($M=17.14$, $SD=0.86$), with no age difference observed between males and females ($t=1.54$, $P>0.05$).

2.2. Measures

2.2.1. Behavioral inhibition system and behavioral activation system scales (BIS/BAS scale)

The BIS/BAS Scale (Carver and White, 1994) is a widely used measure that assesses sensitivities to cues of threat and reward. It consists of 20 items, each of which is rated from one (“strongly disagree”) to four (“strongly agree”). BIS activity is measured by a single subscale, whereas the BAS scale can be subdivided into

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