



The interplay between trait anxiety, cognitive biases and attentional control in healthy individuals with psychotic-like experiences



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A B S T R A C T

Although both anxiety and cognitive biases contribute to psychosis, it is still unclear whether these factors interact in their influence on psychotic symptoms. The aim of the study was to examine the interactions between trait anxiety, cognitive biases and delusion-like experiences (PLEs) in a non-clinical sample; the moderational role of attentional control on this relationship was also considered in the study. Two subgroups of participants, 92 individuals ($M=24.76$; $SD=6.33$) with heightened (HA) trait anxiety and 78 individuals ($M=23.09$; $SD=5.66$) with lowered (LA) trait anxiety took part in the study. Anxiety, cognitive biases and attentional control were measured using self-report questionnaires. Regression analyses and moderation analyses were performed. External attribution bias predicted psychotic-like experiences in both groups, whereas attention to threat bias and belief inflexibility predicted PLEs within LA group. Further moderation analyses revealed that in LA group attention to threat bias increases PLEs only among individuals with a high and moderate ability to focus attention. The results indicated that trait anxiety is an important factor influencing the relationship between cognitive biases and PLEs, and that the ability to voluntarily focus attention is a significant moderator of the linkage between attention to threat bias and delusion-like experiences among low-anxious healthy individuals.

1. Introduction

According to the continuum hypothesis (van Os et al., 2000, 2009; Linscott and van Os, 2013; van Os and Reininghaus, 2016) psychosis does not constitute a dichotomous construct created by the juxtaposition of health and psychotic symptoms, but includes a wide range of phenomena which differ in terms of frequency, intensity, the degree of distress they cause and the extent of medical help they require. Although clinical psychosis is an important part of this continuum, being one of its extremes, the majority of psychotic experiences do not reach the threshold of clinical relevance and do not meet the diagnostic criteria for psychotic disorders. These subclinical forms of psychosis are often referred to as psychotic-like experiences (PLEs) and are systematically shown to be more frequent in general population than their clinical counterparts (McGrath et al., 2015; Saha et al., 2011; Peters et al., 1999, 2004; van Os et al., 2009).

A growing body of evidence indicates that phenomena lying at different points of the psychosis continuum share many core features and potential risk factors (Kelleher and Cannon, 2011). Among them distortion of gathering, processing and interpreting data, typically

referred to as ‘cognitive biases’ were consistently demonstrated to be relevant to psychotic symptoms in both clinical and non-clinical groups (e.g. Gawęda et al., 2015; McLean et al., 2017; Randjbar et al., 2011; Ross et al., 2015; So et al., 2015). Of the cognitive biases attention to threat bias (ATB) has been reported to play a key role in the initial stages of psychotic symptoms development, since it impairs data processing at the very early stages of attention orienting (Arguedas et al., 2006; Green et al., 2001; Prochwicz et al., 2017; Prochwicz and Kłosowska, 2017). Apart from ATB, a few other cognitive biases, such as jumping to conclusion bias (JTC), external attribution bias (ETB) and bias against disconfirmatory evidence (BADE), have been shown to precede and actively contribute to psychotic symptoms (e.g. An et al., 2010; Dudley et al., 2016; Fine et al., 2007; Freeman et al., 2008; Garety et al., 2005; Kaney and Bentall, 1989; Kinderman et al., 2003; Lincoln et al., 2010a; Moritz and Woodward, 2006; Woodward et al., 2007). Recent empirically-based cognitive models of psychosis also emphasize the crucial role of biased cognitive processes in the formation of positive psychotic symptoms (Garety et al., 2001; Freeman et al., 2002). According to those models, however, apart from cognitive distortion, negative emotional states, such as heightened levels of anxiety,

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also affect the development of psychosis (Freeman et al., 2002).

Although both anxiety and cognitive biases have been shown to be present at all stages of delusion formation (Freeman et al., 2002), studies that examined the association between these factors provided inconsistent results. Some of them have shown that anxiety and cognitive biases interact in their impact on positive psychotic symptoms (Garety et al., 1991; Lincoln et al., 2010b), whereas other indicated that anxiety and biased cognitive processes affect delusions independently (Garety et al., 2005; So et al., 2008).

Most consistent findings on the relationship between cognitive biases and anxiety regard attention to threat bias which has been repeatedly shown to be linked with heightened anxiety (Mogg and Bradley, 1998). The recent attentional control theory (Eysenck et al., 2007) postulates that anxiety has an effect on ATB through its adverse impact on attentional control (AC). According to Corbetta and Shulman (2002), attention is governed by two systems that interact to effectively focus and redirect attentional resources: the bottom-up stimulus driven system that rapidly orients attention to salient stimuli, and the top-down goal driven system influenced by the individuals' current goals, expectations and knowledge. AC is related to more voluntarily attentional functions, and refers to the individuals' ability to regulate attentional allocation. According to the attention control theory anxiety disturbs the balance between bottom-up and top-down systems by enhancing the role of stimulus driven processes, thereby favouring capturing attentional resources by threatening stimuli irrelevant to the current task (Eysenck et al., 2007).

Previous empirical studies conducted within anxious individuals confirmed that impairment of attentional control is an important factor modulating the linkage between anxiety and ATB. Anxious individuals with poor attentional control were found to reveal stronger attentional bias, i.e. they are more inclined to direct attention towards threatening objects and less able to disengage attention from threat than subjects with efficient AC (e.g. Derryberry and Reed, 2002; Koster et al., 2006a, 2006b). Although a heightened level of anxiety usually impairs attentional control, this way enhancing the tendency to search the environment for danger, some studies indicate that anxious individuals may constrain their attention to threat bias as long as they are skilled in controlling their attention, particularly if they are able to shift attentional resources away from threat and direct it towards safety (Derryberry and Reed, 2002). In light of these findings, the ability to voluntarily control attention may be considered as a protective factor that helps to keep anxiety low, and thus make anxious people less vulnerable to clinical disorders.

Since both anxiety and attentional bias predict PLEs, it is likely that the causal relationship between anxiety and oversensitivity in detecting danger (especially interpersonal threat) may increase the frequency of psychotic-like experiences. Indeed, some studies confirmed that individuals with PLEs reveal an enhanced tendency to preferentially process threatening stimuli (Green et al., 2001; Arguedas et al., 2006) which is considered to be a risk factor of PLEs development. In light of previous studies on anxiety disorders it is plausible that anxiety raises ATB, and thus leads to the development of psychotic-like experiences only when it is accompanied by poor attentional control. Indeed, very recently our team demonstrated that the linkage between attention to threat bias and PLEs is moderated by individual differences in the ability to regulate attentional allocation (Prochwicz and Kłosowska, 2017). Surprisingly, that study indicated, that ATB contributes to psychotic-like experiences only among subjects with a high and moderate capacity to voluntarily focus attention, whereas among those with poor attentional focus attention to threat bias is not related to PLEs. This finding suggests that high ability to focus attention is necessary for attention bias to lead to the increase of delusional ideations, and that the dysfunction of AC results in breaking the link between ATB and PLEs. Unfortunately, in our prior study the level of anxiety was not controlled for; therefore, it is still impossible to determine whether the interplay between attentional bias and attentional control contribute to

the PLEs differently, depending on the level of anxiety. Thus, the first aim of the current research was to fulfil this gap by testing the predictive role of cognitive biases, particularly attention to threat bias, on PLEs among healthy individuals of lowered and heightened trait anxiety. The second aim was to examine the possibility of an interaction between anxiety, ATB and attentional control in predicting psychotic-like experiences. Particularly, we checked whether different components of AC could moderate the linkage between ATB and PLEs differently in groups of low-anxious and high-anxious individuals. Given that previous studies in this field provided inconsistent results, the character of our study was exploratory, without specific hypothesis formulated.

2. Methods

2.1. Participants

The initial study sample consisted of 245 Polish Caucasian adults who were university students and students of postgraduate courses. All participants took part in the study voluntarily after providing informed consent and being presented with a short introduction describing the purpose of the research. Responders were asked to complete a series of questionnaires measuring study variables and a self-report questionnaire regarding the exclusion criteria used in the study. The criteria were as follows: current or past psychiatric diagnosis, use of illicit drugs 6 months prior to the study and presence of psychiatric illness among their first, second or third degree relatives. On the basis of the self-report data 75 (30.6%) individuals were excluded from the analysis: 20 were excluded due to being diagnosed with psychiatric disorders, such as depression ($n = 12$), anxiety disorders ($n = 4$), bipolar disorder ($n = 2$), eating disorders ($n = 2$); 8 were excluded due to usage of illicit drugs; 47 were excluded due to having relatives diagnosed with psychiatric conditions. The final sample consisted of 170 participants (153 females, 15 males, 2 participants did not specify their gender) ranging in age from 19 to 50 years ($M = 24.01$, $SD = 6.07$). The final sample was subsequently divided into two subgroups according to a median score of the anxiety-trait subscale from the State and Trait Anxiety Inventory (STAI-T): the subgroup with lowered level of trait-anxiety (LA) and the subgroup with heightened level of trait-anxiety (HA) (see Table 1 for a detailed group description).

2.1.1. Participants with lowered level of anxiety (LA)

This group consisted of 92 participants (79 females, 13 males) with the STAI-T scores below the median value of the STAI-T subscale (< 44). The mean age of these participants was 24.76 years ($SD = 6.33$).

2.1.2. Participants with heightened level of anxiety (HA)

This group consisted of 78 participants (74 females, 2 males) with the STAI-T scores above the median value of the STAI-T subscale (> 44). The mean age of these participants was 23.09 years ($SD = 5.66$).

2.2. Measurements

2.2.1. Peters et al. Delusions Inventory (PDI) (Peters et al., 2004; Prochwicz and Gawęda, 2015)

The PDI is a self-report scale invented to assess delusion-like experiences in a non-clinical population. The PDI contains 21 items related to different types of unusual beliefs rated on the dichotomous yes/no scale. The sum of endorsed items reflects the number of delusion-like experiences reported by participants and ranges from 0 to 21. For endorsed items participants are asked to use three 5-point Likert scales to assess the degree of emotional distress raised by the belief, the degree of preoccupation with this belief and the degree of conviction that the belief is true. The score on each subscale is calculated separately and ranges from 0 to 84. Seeing that in the current study we focused only on

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