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Original article

Attentional focus moderates the relationship between attention to threat bias and delusion-like experiences in healthy adults

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ABSTRACT

Background: The role of cognitive biases in delusion and delusion-like experiences has been widely investigated in recent years. However, little is known about individual differences, which may influence association between cognitive biases and formation of delusional beliefs. The aim of this study was to examine the moderating effect of self-reported attentional control on the relationship between attention to threat bias (ATB) and delusion-like experiences (DLEs) in healthy adults.

Methods: Participants (n = 138) completed the Davos Assessment of the Cognitive Biases Scale (DACOBS), the Attentional Control Scale (ACS) and the Peters et al. Delusions Inventory (PDI). The moderation analysis was performed to check the influence of different components of attentional control (i.e. general ability to allocate attention, focusing, shifting and divide attention) on the interplay between ATB and DLEs.

Results: The results supported the moderation model. Specifically, we found that a higher level of ability to focus attention is associated with a stronger effect of attention to threat bias on the overall frequency of DLEs. Our results indicate that ATB contributes to the number of DLEs only in individuals with high and moderate capacity to focus attention, whereas in those who scored low on the ACS focusing attention subscale, the presence of attentional bias does not influence the frequency of DLEs.

Conclusions: Our findings show that the individual difference variable, such as ability to voluntarily focus attention, may moderate the relationship between attention to threat bias and delusion-like experiences in healthy adults.

1. Introduction

Delusion-like experiences (DLEs) have recently received increased attention since population studies reported an overlap in delusional ideation between clinical and non-clinical groups [1–6]. According to the psychosis continuum hypothesis, the clinically relevant delusions represent only a small proportion of psychotic phenomena, whereas the majority of delusional experiences do not reach the threshold of clinical relevancy [2,4,6]. The prevalence of delusion-like experiences varies across studies; however, population-based surveys consistently show that DLEs are more commonly reported than full-blown delusions, with a prevalence rating from 5% [6] to 8.4% [7] when assessing in clinical interview, and from 25.2% [8] to 29.8% [9] as measured with self-reports. Compared with clinically relevant delusions, DLEs usually do not require medical help, however, they may constitute a risk factor of future development of psychotic disorders [10,11], since individuals with DLEs may develop excessive preoccupation or distress caused by unusual beliefs [12], as well as dysfunctional coping styles when they are faced with such experiences [13–15]. The direct linkage between DLEs and full-blown psychotic symptoms was repeatedly demonstrated in survey including general population [16], as well as in the prospective studies among children [11,17]. Although the use of self-report methods may lead to overestimation of delusion-like experiences in community, since a large proportion of self-reported DLEs are not confirmed in clinical interview [18], previous studies indicated that the also self-reported DLEs are strongly associated with further appearance of psychosis and have clinical and prognostic relevance [18,19]. Therefore, the studies including individuals reporting DLEs provide a unique opportunity for studying factors contributing to the development and maintenance of psychotic disorders. Among these factors, the cognitive impairments have been found to play a prominent role [20–25].

According to cognitive models of positive psychotic symptoms [13,15], delusional beliefs develop due to biased cognitive processes. The most frequently investigated delusion-related

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biases are: jumping to conclusion bias (JTC) which is the tendency to make hasty decisions based on insufficient data [26]; bias against disconfirmatory evidence (BADE), i.e. the tendency to neglect information inconsistent with previously held hypotheses [25,27]; belief inflexibility bias (BIB) which refers to the meta-cognitive capacity of reflecting on one's beliefs [28,29]; external attribution bias (ETB), i.e. the inclination to make external, personal attributions of causes of negative events [30–32], and the attention to threat bias (ATB), described as the tendency to preferentially process threatening stimuli [13,23,33]. Delusional ideation may develop since attentional bias along with data gathering bias of JTC favour the development of false interpretations of neutral events, which are then maintained and fixed by other biases, such as confirmation bias, belief inflexibility and external attribution bias. The presence of cognitive biases was commonly verified not only among patients with overt delusions, but also among individuals with delusion-like experiences [20–22,24,25,34–37]; however, the additional factors which may moderate the impact of these biases on DLEs remain unclear.

Studies concerning anxious individuals, who also exhibit cognitive biases, suggest that attentional control may be a possible factor influencing the formation of cognitive impairments [38–40]. Attentional control (AC) refers to the individuals' ability to regulate attentional allocation; AC is a part of the executive system that is related to more voluntarily attentional functions, as opposed to more reactive, stimulus-driven attentional system [38,41]. The impairment of attentional control has already been shown as contributing in the capture of attentional resources by threatening objects, and in difficulties in disengagement of attention away from threat. Previous studies confirmed that anxious individuals with poor attentional control reveal stronger ATB bias, i.e. they are less able to disengage attention from threat than those with high AC [38,40]. Recently, the difficulty in disengaging attention from threatening objects has also been detected among people with posttraumatic stress symptoms and poor attentional control [42]. Individuals who score high on Attention Control Scale [38,43] were also found to display stronger decrease in attentional bias after attending to the cognitive bias modification task (CBM), which aims to reduce ATB [44]. These findings suggest that the individual ability to allocate attention may serve as a factor, which could make individuals more or less susceptible to threatening stimuli; high attentional control may also favour the possibility to modify attentional bias.

Yet, only limited studies have examined the linkage of attention to threat bias and delusion-like experiences. Arguedas et al. [34] showed that individuals with high frequency of DLEs demonstrate dysfunctional preference to process threatening (angry) faces compared with other facial expressions [22,34]; ATB measured by the Davos Assessment of the Cognitive Biases Scale [45] was also detected to predict the occurrence of DLEs in healthy adults, and to mediate the relationship between personality traits and DLEs [21]. These studies, however, did not take into account the possible impact of basic attentional processes on the relationship between ATB and DLEs. Therefore, there is still a lack of research testing whether attentional control may be associated with psychotic-like experiences and whether AC may affect the linkage between cognitive biases and DLEs.

The aim of our study was to fulfil this gap and to examine the moderating role of different aspects of attentional control (i.e. the general ability to allocate attention, the ability to focus, shift attention and divide attention) on the linkage between cognitive biases measured by the DACOBS questionnaire [45] and self-reported delusion-like experiences measured by Peters et al. Delusions Inventory [9]. Given a lack of knowledge on the role of attentional control in DLEs, our study was exploratory with no specific hypothesis stated.

2. Methods

2.1. Participants

The total study sample consisted of 202 university students. All participants were screened with the self-report questionnaire in order to exclude individuals who have been diagnosed with psychiatric or neurological disorders and had first or second degree relatives diagnosed with psychiatric conditions. Individuals who fulfilled exclusion criteria were not considered in the analyses ($n = 18$ because of being diagnosed with psychiatric disorders or psychological problems; $n = 14$ because of using illicit drugs; $n = 32$ because of having first or second degree relatives diagnosed with psychiatric conditions; in total 64 individuals were excluded). Thus, the final sample consisted of 138 healthy adults (126 female and 12 male, age between 20-50; mean age = 24.83; S.D. = 6.4).

2.2. Procedure

Questionnaires were administered to university students during regular classes in the presence of a researcher. A scripted introduction describing the purpose of the questionnaire, students' rights as research participants and instruction on completing the questionnaire were read to the students in each class. Participants were also told that participation is voluntary and all of their answers would be confidential. No financial remuneration or course credit was offered as an incentive to participate.

2.3. Measures

2.3.1. Peters et al. Delusions Inventory [9]

Peters et al. Delusions Inventory [9] is a self-report questionnaire, which assesses the delusion-like experiences in non-clinical population. The PDI contains 21 items related to different unusual beliefs. Participants are asked if they had experienced any of the beliefs, they provide their answers on the dichotomous (yes/no) scale. The PDI main score is the number of experiences being endorsed by a participant; it ranges from 0 to 21 and reflects the frequency of DLEs. For each of endorsed items participants rate on a 5-point Likert scale: the degree of distress raised by the experience, conviction that the belief is true, and the level of preoccupation with this experiences. As reported elsewhere, the PDI showed good construct and criterion validity [9]. Since in our study we focused only on the frequency of DLEs, we took into account only the number of endorsed items. In the current study, we used the Polish version of PDI; the internal consistency of the scale was found to be acceptable in the present sample (Cronbach's $\alpha = 0.80$).

2.3.2. Davos Assessment of the Cognitive Biases Scale (DACOBS) [45]

The DACOBS is a self-report scale which measures the subjective experience of cognitive biases related to psychosis. The DACOBS contains 42 items to be scored on a 7-point Likert scale; items are grouped into seven subscales related to different types of biases: jumping to conclusion bias (JTC), belief inflexibility bias (BIB), attention to threat bias (ATB), external attribution bias (ETB), social cognition problems (SocCP), subjective cognitive problems (SubCP), and safety behaviours (SB). A score of each subscale is calculated by summing the items, with higher scores indicating higher level of biases. In our study, we focused only on four dimensions related to cognitive biases. These four subscales were reported to show acceptable convergent validity [45]. In the current study we used the Polish version of DACOBS; Cronbach's alphas calculated for total scores of cognitive biases was $\alpha = 0.80$; JTC $\alpha = 0.60$; BIB $\alpha = 0.60$; ATB $\alpha = 0.60$; ETB $\alpha = 0.60$; ETB $\alpha = 0.60$ [21].