Behaviour Research and Therapy 51 (2013) 98–105

Contents lists available at SciVerse ScienceDirect

Behaviour Research and Therapy

journal homepage: www.elsevier.com/locate/brat

Anxiety sensitivity moderates the relationship of changes in physiological arousal with flight anxiety during in vivo exposure therapy

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ARTICLE INFO

Article history:
Received 30 March 2012
Received in revised form
22 October 2012
Accepted 30 October 2012

Keywords:
Anxiety sensitivity
Flight phobia
Somatic sensations
Physiological arousal
Exposure in vivo

ABSTRACT

Physiological sensations and discomfort constitute the major symptoms reported by aviophobics. Anxiety sensitivity (AS) seems to moderate the relationship between self-reported somatic sensations and flight anxiety, and AS has been identified as a vulnerability factor for flight phobia. In this study we examined whether AS moderates the effects of somatic sensations and autonomic nervous system reactivity on flight anxiety induced by real flight.

In fifty aviophobics participating in Cognitive Behaviour Group Therapy (CBGT), flight anxiety, somatic sensations and autonomic nervous system reactivity were assessed during a guided return flight. Results indicate that physiological reactivity interacted with AS. Changes in heart rate and parasympathetic activity were more strongly associated with changes in reported flight anxiety for high AS participants, and less for participants low on AS. Results did not indicate a moderating effect of AS on the relationship between self-reported somatic sensations and flight anxiety.

Our results suggest that therapy for flight phobia might benefit from addressing the physical effect of anxiety, by means of cognitive restructuring and exposure to interoceptive stimuli, particularly in aviophobics high in AS.

Introduction

Taking a flight is common practice for many people in the western world, but not for all. Up to 40% of the general population in industrialized countries experience mild fear before or during flight (Curtis, 1998; Depla, Ten Have, van Balkom, & de Graaf, 2008; Van Gerwen, Diekstra, Arondeus, & Wolfger, 2004). Some 7% of all people experience serious interference in daily life and social functioning due to fear of flying (FOF). Most symptoms reported by aviophobics are related to bodily experiences (Roth, 2005; Van Gerwen, Spinhoven, Van Dyck, & Diekstra, 1999).

Fear of flying is a heterogeneous problem and can be conceptualized both as a situational phobia as well as the expression of other non-situational phobias with or without agoraphobia. Flying phobics can fear accidents, have complaints of acrophobia and claustrophobia, report panic attacks in anticipation of flights, want to be in control over the situation or are afraid to loose control over themselves. Social anxiety can be part of FOF as well (Van Gerwen, Spinhoven, Diekstra, & Van Dyck, 1997). In general, aviophobics with agoraphobia are more concerned about panic and its consequences, whereas aviophobics without agoraphobia in general report more concern about external aspects of flying like crashing (McNally & Louro, 1992).

Fear in general is often described by physical discomfort as sweating, heart racing and muscle tension. During flight one is exposed to sudden loud and strange noises, unexpected movements during turbulence, vibration, acceleration and pressure changes. All of these can lead to physical discomfort as well. While some people just notice these bodily responses, others might misinterpret these signals as danger signals. Anxiety sensitivity (AS) can be viewed as a key moderator between the experience of these bodily responses and anxiety. Anxiety sensitivity is the tendency to fear anxiety-related bodily sensations, based on the belief that the sensations have harmful consequences (Reiss, 1991). Although AS is most strongly related to panic, generalized anxiety disorder and posttraumatic stress disorder, specific phobia is also significantly associated with elevated AS (Naragon-Gainey, 2010).

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http://dx.doi.org/10.1016/j.brat.2012.10.009

The meta-analysis of Naragon-Gainey indicated a correlation with a medium effect size between AS and blood/injection/injury and animal phobias, while the correlation between physical confinement (claustrophobia) and the fear of bodily harm with AS was large. Especially the physical subcomponent of the latter two showed a rather large correlation with AS.

Several studies link FOF with elevated levels of AS. Rivas and Tortella-Feliu (2000) assessed 523 non-clinical participants and found that participants with FOF had an elevated AS score, while a higher intensity of FOF was associated with a higher AS. Vanden Bogaerde and De Raedt (2008) performed a moderator analyses on questionnaire data of 160 students and concluded that AS moderates the relationship between somatic sensations and flight anxiety. Somatic sensations predicted flight anxiety in individuals with high AS, while this was not the case for students with low AS. The same authors corroborated these findings in a second more ecological valid study. Anxiety and somatic symptoms of 54 aviophobics and 49 controls without FOF were measured just before take-off on a regular line flight (Vanden Bogaerde & De Raedt, 2011). Results again showed the same moderating effect of AS on the relationship of somatic symptoms with flight anxiety. Furthermore, flight phobics had in general higher levels of AS than the control participants. While the 2008 study used a non-clinical student sample not controlled for a concurrent panic disorder, the 2011 study found similar results with a clinical sample of flight phobics without a concurrent panic disorder or anxiety disorder that was primary to the fear of flying.

Interestingly the moderating effect of AS on the relationship of bodily sensations with flight anxiety has only been studied by means of questionnaires and verbal report. Although the focus of AS lies on the experience of bodily sensations, up till now only one experimental study combined AS, FOF and actual physiological measurements (Busscher, van Gerwen, Spinhoven, & de Geus, 2010). Here measurements of AS and self-reported anxiety of 127 aviophobics were combined with measures of autonomic nervous system reactions to a neutral video and a anxiety provoking flight video. Although changes in Heart Rate (HR) and Respiratory Sinus Arrhythmia (RSA, a measure of parasympathetic activity) were correlated with changes in self-reported anxiety, AS did not moderate this association. Flight phobics who are afraid of anxiety-related bodily sensations did not report more distress than phobics who score low on this trait, even when they show stronger physiological responses. This is contra intuitive and not in line with research on AS and interoceptive awareness in other domains of anxiety-related disorders. For instance, Sturges and Goetsch (1996) found that women high on anxiety sensitivity were significantly more accurate at heartbeat perception than women low on AS, although absolute heart rate did not differ across groups. Accurate perception of changes in pulse transit time and several other measures of sympathetic activity were consistently related to higher levels of AS in a study by Richards and Bertram (2000). In a review combining these and other studies by Domschke, Stevens, Pfeiderer, and Gerlach (2010), enhanced interoceptive awareness was characteristic of high AS individuals. The weighted mean effect size (Cohen's *d*) for the relationship between AS and heartbeat perception was .63, indicating a medium to large effect. Individuals high in AS are generally more accurate perceivers of interoceptive processes associated with anxiety compared to individuals low in AS. Given the fact that high AS individuals are more accurate perceivers, that is better perceivers of anxiety-related arousal, one would expect higher levels of self-reported anxiety in these high AS individuals when arousal is indeed elevated in anxiety provoking situations.

The aim of this study was to investigate to what extent flight phobics who score high on AS and who react with an increase in physiological arousal to phobic stimuli report a higher flight anxiety than aviophobics who score low on AS, even when these individuals show a concordant increase in physiological arousal. First, we tried to replicate the findings of our colleagues (Vanden Bogaerde & De Raedt, 2011) regarding the moderating effect of AS on self-reported somatic sensations and flight anxiety. Next, we tried to extend their findings by including measurements of autonomic nervous system reactions induced by real flight into our analyses.

Method

Participants

The 50 participants in this study were aviophobics who participated in a treatment program for fear of flying at the VALK foundation in Leiden, The Netherlands. The VALK Foundation is a collaborative venture by the Leiden University, Amsterdam Airport Schiphol, KLM, Transavia.com, Martinair and ArkeFly, specialized in treating fear of flying (FOF). The treatment program starts with a diagnostic assessment during the first visit in Leiden, followed by individual therapeutic sessions and a two day cognitive-behavioural group treatment (CBGT) as described in detail elsewhere (Van Gerwen, Spinhoven, & Van Dyck, 2006; Van Gerwen, Spinhoven, Diekstra, & Van Dyck, 2002). Most participants were self-referrals, some were referred by health care agencies, health professionals and company health programs. Airline personnel were excluded from this study. Other reasons for exclusion were current use of cardioactive medication like β blockers and a concurrent panic disorder of such severity according to the treating clinician that it would seriously interfere with the treatment of fear of flying. 79 individuals with aviophobia were considered eligible and participated in this study. Inclusion criteria for this study were complete data on all essential questionnaires (ASI, SUD, VAFAS) and complete data of all physiological variables (HR, RSA, PEP) during both flights. The security check at the airport appeared to be a major barrier for the physiological measurements. The ambulatory measurement device and attached electrodes required a physical padding of all participants. After security screening 19% of the recording devices did not record all variables properly. Physiological data of two participants was lost due to equipment failure. One flight was cancelled due to adverse weather, excluding another 2 participants. Finally, ten participants were excluded from analyses because of incomplete data on the relevant questionnaires. This left 50 phobic clients (22 men) with an average age of 38.4 (SD = 10.6). Extensive missing value analysis on all physiological data and all questionnaire data available revealed no systematic differences between the fifty remaining participants and the 29 participants with incomplete data, with only small effect sizes for differences between both groups on questionnaire data ($\eta^2 < .01$). The largest effect size on the physiological variables was found for differences in HR during taxi-out on the first flight: $\eta^2 = .014$.

Instruments

Physiological recordings

Heart Rate (HR), Respiratory Sinus Arrhythmia (RSA) and the Pre-Ejection Period (PEP) were recorded using the VU-AMS (version 4.6, Vrije Universiteit Amsterdam, The Netherlands; www.vu-ams.nl). The VU-AMS is a light-weight ambulatory device that records the impedance cardiogram (ICG) and electrocardiogram (ECG) continuously in freely moving subjects by means of six Ag–AgCl electrodes attached to the torso region (De Geus, Willemsen, Klaver, & van Doornen, 1995; Willemsen, De Geus, Klaver, Van Doornen, & Carrol, 1996). The apparatus has an inbuilt vertical accelerometer, which output can be used to select movement free periods for