THE MODERATIONAL ROLE OF ANXIETY SENSITIVITY IN FLIGHT PHOBIA.

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ABSTRACT

Anxiety sensitivity (AS) is the tendency to interpret anxiety-related bodily sensations in a threatening way. Previous research in a subclinical population identified AS as a vulnerability factor in flight phobia: AS moderates the relationship between somatic sensations and flight anxiety. The present study aimed at gaining further evidence for the moderational role of AS in a large clinical population with flight phobia.

The data were obtained from 103 participants: 54 flight phobic participants and 49 controls. Just before taking a flight participants were asked to complete the Anxiety Sensitivity Index and to report their level of anxiety and bodily sensations

Results showed that AS moderates the relationship between somatic sensations and flight phobia: somatic sensations significantly predicted flight anxiety in subjects with higher AS scores, while this was not the case for subjects scoring lower on AS. Present findings implicate that treatment protocols should be supplemented by interventions specifically aimed at reducing AS, especially for individuals high in AS.

Keywords: anxiety sensitivity, phobia, anxiety, bodily sensations, clinical sample, fear

1. INTRODUCTION

With civil aviation establishing itself as a growing industry, traveling by airplane has become a part of day-to-day life. But not for some: 10-30 % of the general population has flight phobia (Van Gerwen, Spinhoven, Diekstra, & VanDyck, 1997), or in other words a fear of flying. Most research efforts have focused on investigating the effects of treatment of this particular phobia. However, in order to set up effective treatment interventions, knowledge of the underlying mechanisms can be crucial. The current study aims at clarifying the role of anxiety sensitivity in flight phobia.

Taking a flight can produce a number of bodily sensations due to specific factors associated with the flying environment, like for example acceleration (Jaffee, 2005), pressure changes (Harding & Mills, 1983) and turbulence (Jaffee, 2005). Also, changes in the partial pressure of oxygen can lead to a condition called hypoxia (Mortazavi, Eisenberg, Langleben, Ernst, & Schiff, 2003). Hypoxia is an oxygen deficiency at a cellular level, meaning there is a low oxygen saturation in the blood. Humpfreys, Deyermond, Bali, Stevenson, & Fee (2005) found that more than half of aircraft passenger have an oxygen saturation of 94% or lower, this is a level where, at sea level, one would be administered supplemental oxygen. Symptoms of hypoxia include shortness of breath, heart racing, and dizziness, which are strikingly similar to the bodily correlates of fear. Analogous to the panic model of Clark (1999) it would thus be possible that the aversive sensations caused by hypoxia are misinterpreted as signs fear and panic. Clark proposed that panic attacks are caused by the catastrophic misinterpretation of bodily symptoms. Such misinterpretation leads to fear which in turn leads to more bodily sensations, eventually resulting in a vicious cycle. Anxiety sensitivity (AS) is thought essential to his vicious cycle. Anxiety sensitivity is the tendency to interpret anxiety-related bodily sensations as threatening (Reiss, 1991). AS has most commonly been associated with PD (McNally, 2002; Taylor, 1995): studies in non-clinical samples have shown that elevated AS is associated with the incidence of panic attacks, moreover, studies in clinical samples have shown that AS is greater in PD than in other anxiety disorders. However, elevated AS levels have been found in others types of anxiety disorders. A recent meta-analytic review by Naragon-Gainey (2010) has shown that AS is most strongly related to PD, Generalized Anxiety Disorder (GAD) and Post-Traumatic Stress Disorder (PTSD). Social Anxiety, Agoraphobia and OCD are moderately related to ASI. Specific phobia has the weakest link with AS, although it can still be elevated. Interestingly, only fear of confinement (claustrophobia) and fear of bodily harm were related to AS, while fear of blood/injection/injury and animal phobias were not. However, Rivas and co-workers (2000) have demonstrated an association between fear of flying and elevated levels of anxiety sensitivity: an elevated AS was found among individuals with fear of flying and moreover, a higher intensity of the fear of flying was associated with a higher AS. Moreover, in a previous study we have explored the specific role of AS as a vulnerability factor in fear of flying, in the sense that anxiety sensitivity moderates the relationship between somatic sensations and flight anxiety (Vanden Bogaerde & De Raedt, 2008). About 160 student participants were asked to complete the Flight Anxiety Situations Questionnaire, the Flight Anxiety Modality Questionnaire (Van Gerwen, Spinhoven, Van Dyck & Diekstra,1999) and the Anxiety Sensitivity Index (Vancleef, Peters, Roelofs & Asmundson, 2006). Results showed that the relationship between somatic sensations and in-flight anxiety is stronger for people with higher anxiety sensitivity than for people with lower anxiety sensitivity, indicating that AS is, as hypothesized, a moderator in fear of flying. In order to gain more evidence about the role of anxiety sensitivity in flight phobia, some issues needed to be addressed. First, the previous findings were based on a non-clinical population. Second, measurement of flight anxiety and somatic sensations relied solely on questionnaire data that was gathered in an non-anxious situation.

The present study aimed at gaining additional evidence for the moderational role of anxiety sensitivity in flight phobia. Therefore, the present study was based on a clinical and a healthy control sample. Additionally, in this study we included measurements of somatic sensations and flight anxiety just before participants took a flight to ensure ecological validity of the measurements. Generally, we expect AS levels to be higher in flight phobic subjects than in controls. More specifically, the hypothesis is that AS moderates the relationship between somatic sensations and flight anxiety: individuals with higher AS will respond more anxiously to somatic symptoms than individuals with lower AS, presence of (higher levels of) AS thus strengthens the relationship between somatic sensations and flight anxiety, indicating might function as a vulnerability factor.

2. METHOD

2.1. Participants

Data collected in this study were obtained from a total of 103 white Caucasian participants. Of the participants 54 participants had fear of flying, 49 were controls. In the flight phobic group 29 were female (54%) and 25 were male (47%). The average age of this group was 40.2 years, ranging from 19 to 65 years (women: M=39.9, SD=10.58 and men: M=40.6, SD=12.85). The control group consisted of 29 males (60%) and 18 females (40%). The average age of the participants in this group was 41.9 years, ranging from 21 to 67 years old (women: M=39.7, SD=12.40 and men: 43.2 SD=10.77).

Participants with fear of flying were recruited from a treatment program for fear of flying. Participants self-referred for this treatment program. The program is a two-day group cognitive-behavioral program with exposure as the core intervention. Each treatment session group consisted of six participants coached by two clinical psychologists. Before the start of the training there was a diagnostic phase, were participants were asked to fill out a number of questionnaires concerning fear of flying (see below). Also participants had an individual contact with a clinical psychologist to properly assess their flight phobia. This was done with a semi-structured interview[1], using not only the DSM IV (APA, 2000) criteria, but also a number of questions pertaining to flight history and the onset and development of the flight phobia. Moreover, all participants in the clinical group were assessed with the subdivisions of the MINI – Mini International Neuropsychiatric Interview pertaining to anxiety. Exclusion

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[1] Although this semi-structured interview is not a validated instrument to diagnose the presence of fear of flying, it contains questions that asses the specific content, focus, onset and development and the severity of the flight phobia based on the DSM IV criteria for fear of flying.

criteria for participating in the group treatment program were: a concurrent panic disorder, posttraumatic stress disorder related to an aircraft emergency or any other anxiety disorder that is primary to the fear of flying. These exclusion criteria were set because the specific treatment program was specifically developed to treat fear of flying as a primary phobia. During the first day of the group program, information was given on the technical and aerodynamic aspects of flying, after which psycho-education is given on anxiety and the role of avoidance. The second day the participants underwent exposure, taking two flights (return) coached by two clinical psychologists. These therapeutic flights were normal commercial flights in Europe with flying time varying between one and two hours per flight.

Control participants were passengers on the same flights as the therapeutic flights in the treatment program. Participants were selected using specific questions (from the MINI) that indicate presence of fear of flying or panic disorder. Individuals were asked whether they had a persistent and exaggerated fear of flying and whether they had experienced panic attacks (using the DSM IV criteria). If individuals answered ‘yes’ to either of these questions they were excluded from the study. Due to timing constraints we were not able to use the complete MINI in the control sample. However, we excluded individuals with PD, because its specific relationship with AS.

All participants had flown before, but there was a difference in the distribution of the number of flights taken and time since the last flight between the control and the flight phobic group (Table 1). In the flight phobic group a large majority (57.4%) reported having taken between 10 to 50 single flights, and 43.5% indicated having taken their last flight more than 5 years ago. In the control group 32.7% reported having taken more than 100 flights, with 51.1% having taken their last flight taken less than one month ago. Chi square tests for proportions indicated that number of flights were significantly different between both groups, $\chi^2(4, N=101)=32.64$, $p<.001$, the same was true for time since last flight $\chi^2(4, N=101)=35.21$, $p<.001$. Age when taking the first flight was significantly different, $t(63)=8.17$, $p<.05$, with flight phobics taking their first flight on average at 14.94 years old (SD= 8.08) and controls at 20.26 years old (SD=9.07).

2.2. Materials

2.2.1. Flight Anxiety

The Flight Anxiety Situations Questionnaire (FAS) (Van Gerwen et al.,1999) is a 32-item self-report inventory. Each item is rated on a five-point Likert type scale, ranging from 1 (no anxiety) to 5 (overwhelming anxiety). The questionnaire assesses the intensity of anxiety, experienced in different flight, or flight-related, situations. The FAS consists of three subscales. First, the Anticipatory Flight Anxiety Scale, which contains 12 items that pertain to the anxiety experienced when anticipating a flight. Next, the In-Flight Anxiety Scale contains 10 items pertaining to the anxiety experienced at particular events during a flight. And last, the Generalized Flight Anxiety Scale which contains 7 items that refer to the anxiety when confronted with stimuli associated with flying and airplanes in general, regardless of personal involvement in a flight situation. The FAS has been shown to be a reliable and stable measure of fear of flying with Cronbach's α above .88 and test-retest correlations above .90 (Van Gerwen et al.,1999). Cronbach's α of .96 in the current sample was very good.

Participants were also asked to report their level of anxiety on a 10 cm Visual Analogue Scale (VAS): 'How anxious are you at this moment?'. The scale ranged from "no anxiety all" tot "extremely anxious". Research has shown that visual analogue scales are an adequate measure of state anxiety (Bond, Shine, & Bruce, 1995; Davey, Barratt, Butow, & Deeks, 2007) .

2.2.2. Somatic Sensations

The Flight Anxiety Modality Questionnaire (FAM) (Van Gerwen et.al., 1999) is an 18-item self report questionnaire, designed to measure the specific modality of anxiety symptoms in flight situations. Each item is rated on a five-point Likert type scale, ranging from 1 (not at all) to 5 (very intensely). The FAM consists of two subscales: the Somatic Modality Scale, which assesses the physical symptoms during a flight, and the Cognitive Modality Scale, relating to the presence of distressing cognitions during a flight. The FAM has been shown to be a reliable and stable measure of these two modalities of fear of flying with Cronbach's α above .89 and test-retest correlations above .79 (Van Gerwen et al., 1999). Cronbach's α of .89 in the current sample was very good.

For operationalization of somatic sensations we used the Somatic Modality Scale, since we were interested in the bodily sensations experienced during a flight.

2.2.3. Anxiety Sensitivity (AS)

Anxiety sensitivity was measured by the Dutch version of the anxiety Sensitivity Index (ASI) (Vancleef et al.,2006). The ASI is a self report inventory consisting of 16 statements that assert the fear of bodily sensations. Each item is rated on a five-point Likert type scale, ranging from 0 (very little) to 4 (very much). For the operationalisation of anxiety sensitivity we used the total score on the ASI. The ASI has been shown to be a reliable and stable measure of fear of anxiety-related bodily sensations with

Cronbach's α above .88 and test-retest correlations above .70 (Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004). Cronbach's α of .84 in the current sample was very good.

2.3. Procedure

Individuals in the flight phobic group were asked to fill out the FAS, FAM and ASI as part of the diagnostic phase prior to participating in the treatment program. Individuals in the control group were asked to complete these questionnaires just prior to the flight. Then, just before take-off, while already being seated in the airplane, participants in both groups were asked to indicate, in the face of the upcoming flight, (1) how anxious they were using the VAS anxiety scale and (2) their bodily sensations using the FAM Somatic subscale. We will refer to this last measurement with the term FAM Somatic Pre-flight, as opposed to FAM Somatic General variable which pertains to the FAM Somatic subscale participants filled out when completing the questionnaires (in the flight phobic group during the diagnostic phase, in the control group prior to boarding the aircraft).

3. RESULTS

3.1. Flight Anxiety and clinical characteristics

In order to verify that both groups differed significantly in flight anxiety, independent samples T-tests were conducted on all scales of the diagnostic questionnaires FAS and FAM (General). The results showed that both groups differed on al scales (see Table 2): flight phobics scored significantly higher on all subscales.

3.2. The role of anxiety sensitivity

First, an independent groups t-test was performed to detect group differences in the level of anxiety sensitivity (AS) between the flight phobic and control group. Because Levene's test for equality of variances was significant, we used the tests for 'equal variances not assumed'. Results showed that there was a significant difference between groups with flight phobics reporting much higher levels of AS than controls. Also, there were significant differences between the anxiety (VAS) and somatic sensations (FAM Somatic subscale). Means, standard deviations and the t-tests of these variables are described in Table 3.

Second, a moderator analysis (Baron & Kenny, 1986) was conducted with the FAM Somatic Situation score and ASI score as predictors for flight anxiety (VAS anxiety). A multiple hierarchical regression was performed with somatic sensations and AS as predictors for flight anxiety. Results indicated a main effect for somatic sensations, a significant main effect for AS as a predictor for flight anxiety . Moreover, as predicted, we found a significant interaction effect (Table 4). This significant interaction effect indicates that AS acts as a moderator variable between somatic symptoms and flight anxiety.

Next, we tested simple slopes as specified by Aiken & West (Aiken & West, 1991; Holmbeck, 2002). First, new conditional moderator values for the continuous moderator variable AS are computed (i.e. low AS as 1 SD below the mean and high AS as 1 SD above the mean) for all participants. We also computed two new interaction terms that incorporated each of these new conditional moderator variables. With these new variables, we ran post-hoc regressions. Results for the high AS subjects indicated that somatic sensations do significantly predict flight anxiety, β =.48, $t(87)=4.19$; $p<.001$, whereas this relationship was not significant for the subjects with low AS group, β =.93; $t(87)=.447$; p =.656. Both regression lines were plotted by substituting high (1SD above the mean) and low (1 SD below the mean) values of somatic sensations (Figure 1). In conclusion, results show that AS does moderate the relationship between somatic symptoms and flight anxiety, in such a way that somatic sensations significantly predict flight anxiety in individuals with high AS, whereas this is not the case for individuals with low AS.

4. DISCUSSION

The current study aimed to provide additional evidence for the moderational role of anxiety sensitivity (AS) in fear of flying. First, the results of the current study confirm that flight phobic subjects have higher levels of AS. Moreover, in line with our hypothesis that AS would moderate the relationship between somatic sensations and fear of flying, somatic sensations significantly predicted flight anxiety in subjects with higher AS scores, while this was not the case for subjects scoring lower on AS. This means that AS seems to play a crucial role in flight phobia: when subjects experience aversive bodily sensations due to the flying environment, subjects with higher levels of AS are prone to interpret these in a threatening way which leads to higher levels of anxiety.

The current study had several advantages over our previous study as to the moderational role of anxiety sensitivity (Vanden Bogaerde & De Raedt, 2008). First, whereas the previous study used a non-clinical student sample, these data were gathered from a clinical and healthy control population. Second, measures of anxiety and somatic sensations were taken just before take-off in the airplane. This ensures a greater ecological validity as compared to self-report measures asking to imagine how anxious one is during a flight and which bodily sensations one would experience. Third, a shortcoming in the previous study was the lack of information on concurrent panic disorders in the sample. Because anxiety sensitivity is known to be significantly associated with panic disorder (Taylor, 1995), this might have been an alternative explanation for the results. In the current sample, we specifically checked, and if necessary excluded, any participants with a concurrent panic disorder.

Next to the abovementioned advantages, there are also some critical remarks that need to be pointed out. On a practical level, the timing of administration of the questionnaires FAS, FAM, and ASI differed between both groups, with flight phobic subjects filling them out before treatment started and subjects in the control group filling them out just before the flight. However, anxiety sensitivity –which was the variable of interest here, is regarded as a relatively stable trait-like construct. Also, as mentioned above, the anxiety sensitivity index (ASI)has very good reliability with Cronbach's α above .88 and test-retest correlations above .70. Therefore, difference in timing in administration of the ASI is not likely to account for differences in the role of anxiety sensitivity found here.

Moreover, in order to make causal inferences on the role of AS, a correlational study does not suffice. To test whether AS is truly a vulnerability factor, a longitudinal study would be necessary. According to the diathesis-stress model, a certain vulnerability or predisposition interacts with the environment and life events to trigger behavior. AS could be such a predisposition that, in combination with a conditioning event, triggers flight anxiety. A longitudinal study could clarify precisely what levels of AS constitute a risk factor to develop fear of flying, and what type of conditioning events (internal versus external) are of importance in the development of flight phobia.

From a cognitive processing point of view AS is an interpretation bias: it is the tendency to interpret anxiety-related bodily sensations in a threatening way. It would also be worthwhile to explore additional cognitive vulnerabilities such as selective attention. It could be possible that next to interpreting bodily sensations in a threatening way, some individuals are more attentive to bodily sensations, thus experiencing them more readily. There also is growing evidence that anxious individuals are more interoceptively aware, which is an individual's sensitivity to bodily signals (Pollatos, Traut-Mattausch, Schroeder, & Schandry, 2007). Interoceptive awareness has been shown to be positively related to anxiety, in non-clinical (Critchley, Wiens, Rothstein, Ohman, & Dolan, 2004) as well as clinical samples (Ehlers & Breuer, 1992; Pineles & Mineka, 2005; Van der Does, Antony, Ehlers, & Barsky, 2000; Zoellner & Craske, 1999).

The current study shows that in subjects with high levels of AS, somatic sensations predict the level of flight anxiety. Given that having higher levels of AS seem to complicate treatment efforts in panic disorder (Chavira et al., 2009), this might also be the case for flight phobia. This would imply that flight phobic individuals should be screened thoroughly in order to identify subjects with high level of AS in advance. For these subjects treatment should not only include cognitive – behavioral interventions targeting fear for externally threatening events (flight related situations), but also to internally threatening events (aversive bodily sensations). Although AS does seem to be a relatively stable construct, this does not mean that it cannot be altered. It has been shown that cognitive – behavioral interventions are effective in reducing AS (McNally, 2002).

To summarize, the main conclusion of the current study is that although fear of flying is classified as a ‘simple’ situational phobia, it seems that it’s underlying mechanisms are more complex. Flight phobia would not only be attributable to external conditioning events, but cognitive vulnerability factors such as anxiety sensitivity might also play an important role in its development and / or maintenance.

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Table1: Percentages of participants reporting the number of flights taken and time since last flight.

	Flight phobics	Controls
Number of fligths	%	%
< 5	20.4	4.5
5 – 10	14.8	4.5
10 – 50	57.4	34.1
50-100	7.4	20.5
>100	0	36.4
Time since last flight	%	%
< 1 month	0	51.1
1 – 6 months ago	21.7	33.3
6 – 12 months ago	21.7	6.7
1 – 5 years ago	13.0	8.9
>5 years ago	43.5	0

Table 2: FAS and FAM scores of flight phobic and control group.

		Flight Phobics		Controls				
		M	*SD*	*M*	*SD*	***t***	***df***	***p***
FAS	Anticipation	42.61	12.15	12.77	2.57	17.61	58.424	<.001
	In Flight	41.37	7.97	13.23	3.53	23.45	75.180	<.001
	Association	14.26	5.54	7.21	.78	9.23	55.399	<.001
	Total	109.85	23.81	36.45	6.29	21.80	61.377	<.001
FAM	Somatic	30.15	14.54	12.11	2.37	8.98	56.292	<.001
	Cognitive	27.78	8.66	8.02	2.43	16.04	62.593	<.001

Table 3: ASI, VAS anxiety and somatic sensations scores of flight phobic and control group.

	Flight Phobics		**Controls**				
	M	*SD*	*M*	*SD*	*t*	*df*	*p*
Anxiety ***(VAS)***	5.97	2.87	.58	.703	12.39	53.61	<.001
Somatic Sensations ***(FAM-Somatic)***	18.64	10.57	11.93	1.10	6.50	49.13	<.001
Anxiety Sensitivity ***(ASI)***	31.94	10.70	10.16	7.31	12.05	89.04	<.001

Table 4: Regression table for the multiple hierarchical regression approach of the moderation analysis.

		B	*SE B*	β	*t*	*p*
Step 1						
	Constant	3.409	.225		15.18	.000
	Somatic sensations	.188	.032	.498	5.81	.000
	ASI	.091	.021	.379	4.43	.000
Step 2						
	Constant	3.938	.262		15.05	.000
	Somatic sensations	.314	.048	.832	6.586	.000
	ASI	.067	.021	.281	3.28	.002
	Interaction	.006	.002	.351	3.436	.001

Figure 1: Plotted regression lines of the simple slopes analyses for the high and low AS groups.