

# Fear of Flying, Stress and Epileptic-Like Symptoms

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**Background:** Intense fear of flying, called aviophobia, is a highly prevalent psychological phenomenon, afflicting (in some estimates) up to 40% of the population of industrialized countries and although aviophobia is a highly prevalent mental health problem, published studies about its epidemiology and treatment are rare.

**Methods:** In this study, including 61 participants (28 males and 33 females; mean age 26.85) engaged in business related travels in the last two years, we assessed relationships of fear of flying problems with symptoms of stress also reflecting childhood traumatic stress experiences and its influences on brain sensitization and epileptic-like symptoms. In this assessment we also studied fear of flying symptoms and work related psychological problems described as burnout.

**Results:** The results show that the participants who manifest higher levels of stress symptoms have higher levels of aviophobic experiences. Stress symptoms measured by TSC-40 manifested significant correlations with aviophobic experiences measured by Flight Anxiety Modality Questionnaire (FAS) (Spearman  $R=0.46$ ,  $p<0.01$ ). Other correlations were found between FAS and Limbic System Checklist (LSCL-33) (Spearman  $R=0.39$ ,  $p<0.01$ ) and FAS and Burnout Measure (BM) (Spearman  $R=0.30$ ,  $p<0.01$ ).

**Conclusion:** The results of this study indicate that the experience of fear of flying is related to past and recent stressful events and also to levels of work related problems described and experienced as burnout.

**Keywords:** anxiety, aviophobia, stress, epileptic-like symptoms, sensitization

## Introduction

Intense fear of flying, called aviophobia, is a highly prevalent psychological phenomenon, afflicting (in some estimates) up to 40% of the population of industrialized countries.<sup>1-4</sup> Although aviophobia is a highly prevalent mental health problem, published studies about the epidemiology and therapy related to the fear of flying are rare. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5)<sup>5</sup> the disorder falls within the specific phobia category. A typical aviophobic experience is a fear that is intense, distinctive, enduring and clearly non-rational in proximity to the given stimulus-flight in an aircraft. This fear may be oriented towards the possibility of the aircraft's crash causing potential harm.<sup>5</sup> Alternatively or additionally, the cognitive reaction of these patients towards flight may also include a general fear of death, as well as fears of embarrassment or loss of self-control.<sup>3,4,6-8</sup> Physiological responses conversely may include increases in heart rate and blood pressure, hyperventilation, "gastric distress" and frequent panic attacks.<sup>3,7,8</sup>

The disorder represents an additional challenge in the form of diagnostic "trickyness". Van Gerwen, Spinhoven, Van Dyck and Diekstra<sup>9</sup> note (in apparent dissent from the DSM-IV) that the disorder

can be conceptualized both as a situational phobia as well as the expression of other non situational phobias. It could be the expression of other phobias such as fear of heights, fear of injury, fear of confinement, claustrophobia, fear of loss of control, or even a combination of these.

This difficulty has impeded research into the disorder.

Further, the personal implications to a sufferer of aviophobia may be profound.<sup>3,4,7</sup> In addition to the previously detailed highly unpleasant experience, the very naturally resulting avoidance behavior is very likely to create problems within personal relationships.<sup>6,7</sup> Further, a high level of emotional distress in the form of shame may be associated with flying.<sup>7,10,11</sup>

The current study proposed to examine the relationship between aviophobia as measured by the widely used “Flight Anxiety Modality Questionnaire”, “Burnout Measure”, the “Limbic System Checklist”, and “Trauma Symptom Checklist”, intending to provide a deeper psychological assessment which may assist to understand basic mechanisms of this syndrome based on individual histories mainly linked to various traumatic experiences and stress related sensitization to various stimuli that may become exaggerated and too sensitively experienced as dangerous or life threatening.<sup>12–14</sup>

This psychological sensitivity and progressive sensitization to stress stimuli according to some findings may be related to neurophysiological processes related to temporal and limbic epileptiform disturbances that Persinger called “temporal lobe lability”.<sup>15</sup> Persinger<sup>15</sup> described that such temporal lobe symptomatology may cause a wide range of experiences and postulated continuum of temporal lobe lability and its associated manifestations.<sup>15–17</sup> These symptoms were, in the history of neurology discovered and described by the famous neurologist Hughlings Jackson.<sup>18</sup> Jackson observed these symptoms in patients with temporal lobe epilepsy and called them “dreamy states”, and described their relationship to dissociated consciousness caused by a failure of higher integrative brain functions due to neurological dysfunctions.<sup>19,20</sup> Following these lines of thought later Janet and Freud proposed that similar deficits in integrative functions of consciousness may also be caused by a psychological trauma.<sup>18,21</sup> Although these symptoms are related to temporo-limbic epileptiform discharges they usually do not produce epileptic discharges that could be measured using scalp electroencephalogram.<sup>12,14,22</sup> These symptoms, reflecting temporo-limbic epileptiform discharges, are usually manifested as very strong cognitive and affective impairment that suddenly appears and stops, and produce various cognitive, affective, memory, sensory, behavioral and somatic symptoms such as brief hallucinations, affective disturbances, anxiety and panic, and also various paroxysmal and somatic disturbances, like for example, symptoms of pain or local anesthesia in certain parts of the body.<sup>12,14,22</sup> Although these symptoms were originally described in patients with temporal lobe epilepsy, some subsequent studies reported that these symptoms may also manifest in patients with affective disorders, anxiety disorders, posttraumatic stress disorder, schizophrenia and other mental diseases, and may manifest as a continuum of symptoms also in a normal population ranging from mild symptoms to severe psychopathological states.<sup>12,14,22,23</sup>

In this context that the symptoms of temporal lobe lability may also manifest in patients with affective disorders, anxiety disorders, posttraumatic stress disorder, schizophrenia and other mental diseases it is possible that aviophobia could be related to these epileptiform processes. Mainly because aviophobia symptoms often manifest as very strong and sudden emotional discomfort and fear, it might be possible that these symptoms may be, in some cases, related to temporal lability and complex partial seizure-like symptoms related to past stress experiences and in some cases also to neurological deficits. In addition, of particular interest is also the potential relationship between aviophobia and burnout that appears to relate to a deficit in emotional self-regulation, which may in turn also indicate underlying causation in maladaptive responses to stress experiences that may have very severe consequences for work related adaptation and effectiveness.

## Methods

### Participants

This study examined data obtained from 61 volunteers of both genders (28 males and 33 females), mean age 26.85, age range 20–35, SD=4.70 with predominantly university education. The sample included consecutive participants residing in Illinois, United States, who were engaged in business related travels in the last two years, who were interested in this research as advertised. Those who responded to the advertisement filled-in the questionnaires assessing their aviophobic experiences, stress symptoms and also responded to questions assessing deficits in their work motivation and difficulties defined as “burnout”. Exclusion criteria involved alcohol or drug addiction and any psychiatric, neurological or metabolic disorders based on self-reported declaration from the participants. All procedures performed in research involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed written consent was obtained from all participants included in the study.

### Psychometric Measures

To evaluate the subjective distress experienced in the proximity of flight-related stimulus we used the Flight Anxiety Modality Questionnaire (FAS) designed using a 5 point Likert scale ranging from “no anxiety” to “overwhelming anxiety” with a high

score being indicative of highest levels of distress. Sample questions included assessment of experienced anxiety when: “seeing an airplane”; “waiting for a boarding call” and “hearing the landing announced”.<sup>9</sup>

To evaluate subjects’ self-reported level of stress symptoms associated with childhood or adult traumatic experiences as well as symptoms of PTSD, we used Trauma Symptom Checklist (TSC-40) designed using a 4-point Likert scale spanning from 0 “never” to 3 “often” with a total score ranging from 0 to 120 and higher scores equating to higher levels of traumatic stress. Examples of items include “Insomnia”; “Feeling isolated from others”; and “Not feeling satisfied with your sex life”.<sup>24</sup>

To evaluate subjects’ level of “burnout” we used the Burnout Measure (BM) evaluated on a 7 point Likert scale which ranges from 1 “never” to 7 “always” indicative of highest levels of “burnout”, an assessment of physical, emotional and mental exhaustion. Sample questions include “I have felt full of optimism”; “I have felt physically drained”; and “I have felt unhappy”.<sup>25</sup>

To subjectively measure experienced stress related irritability and sensitization due to repeated stressors which may cause increased limbic irritability symptoms that might be related to subclinical epileptic-like activity, we used Limbic System Checklist (LSCL-33), which is a self-reported questionnaire rated on a 4 point Likert scale ranging from “Never” to “Often” with higher scores indicative of greater severity of symptoms. Sample questions include the experience of: “Sensation of something crawling under your skin”; “Dizziness”; and “Hearing a buzzing or ringing sound”.<sup>12,26</sup>

## Statistical Analysis

Data were analyzed utilizing software Statistica version 10. Because stress related data are usually found to be not normally distributed, non-parametric Spearman correlation coefficient was utilized to analyze associations between assessed variables. In the event that it is utilized, the non-parametric analysis is a very conservative approach to outliers and leverage points, unlike in the case of using parametric correlations or regression analyses, which may create false results and increase the risk of inappropriate rejection of the null hypothesis.<sup>27</sup> In addition, previous research has indicated that this statistical analysis is appropriate for psychopathological data reflecting traumatic stress symptoms that usually do not have normal distribution<sup>28</sup> but for comparison of the validity of results we have also used parametric *t*-test.

## Results

Results indicated that the participants who manifested higher levels of stress symptoms (G2 subgroup, N=30) had higher levels of aviophobic experiences than participants (G1, N=30) who experienced lower levels of stress (G2 higher than median [TSC-40>26] and G1 equal and lower than median) as indicated by Mann–Whitney test and *t*-test analysis (Table 1) and also by Spearman correlation analysis (in the next paragraph). By using Mann–Whitney test and *t*-test analysis we also compared subgroups of women (N=33) and men (N=28) and the results showed that women manifested higher level of aviophobic experiences measured by FAS using Mann–Whitney test,  $p<0.017$  (Table 2), other variables did not show statistical differences between the subgroups of women and men.

Stress symptoms measured by TSC-40 manifested significant correlations with aviophobic experiences measured by Flight Anxiety Modality Questionnaire (FAS) (Spearman  $R=0.46$ ,  $p<0.01$ ) (Figure 1). Other correlations were found

**Table 1** Statistical Comparison of Groups with Higher (G2) and Lower (G1) Levels of Stress Measured by TSC-40 ( $P<0.01$ )

	Mean $\pm$ SD G1	Mean $\pm$ SD G2	U	Z	t-test
Age	27.56 $\pm$ 4.77	26.07 $\pm$ 4.59	381.00	1.20	0.23
FAS	12.03 $\pm$ 11.55	26.79 $\pm$ 24.20	270.50	-2.79	0.01
TSC-40	16.44 $\pm$ 7.26	42.86 $\pm$ 15.60	0.00	-6.70	0.00
LSCL-33	10.25 $\pm$ 6.55	29.00 $\pm$ 13.56	80.50	-5.54	0.00
BM	22.66 $\pm$ 5.53	34.45 $\pm$ 7.56	81.00	-5.53	0.00

**Abbreviations:** FAS, Flight Anxiety Modality Questionnaire; TSC-40, Trauma Symptoms Checklist; LSCL-33, Limbic System Checklist; BM- Burnout Measure.

**Table 2** Statistical Comparison of Women and Men in the Sample

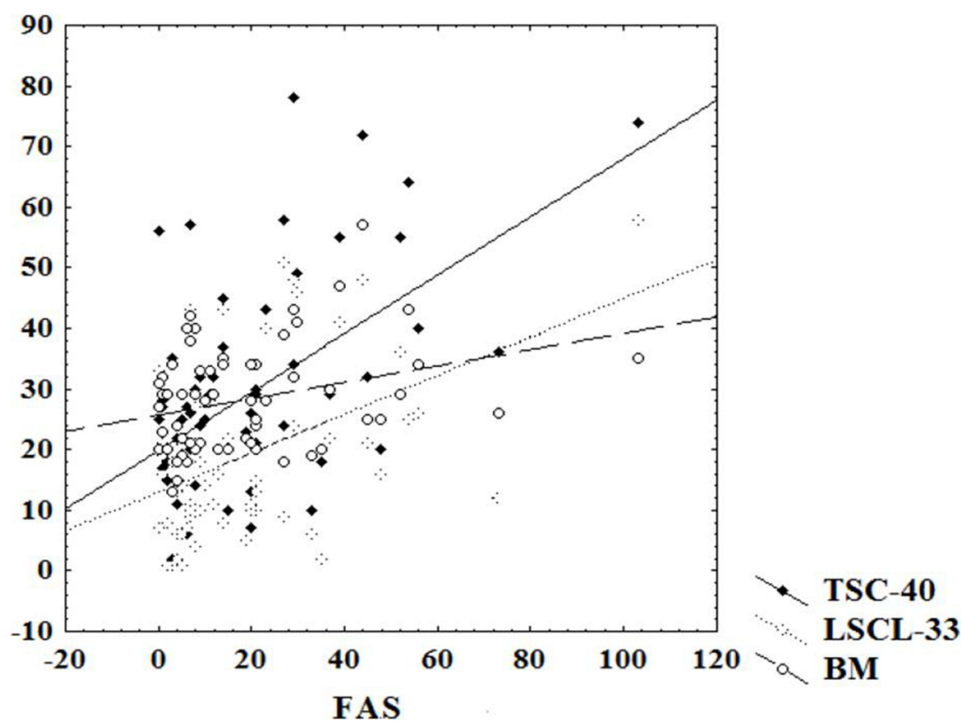
	Mean $\pm$ SD Men	Mean $\pm$ SD Women	U	Z	t-test
<b>Age</b>	27.57 $\pm$ 4.61	26.24 $\pm$ 4.77	385.50	1.11	1.10
<b>FAS</b>	13.82 $\pm$ 16.22	23.48 $\pm$ 21.89	297.00	-2.39	-1.93
<b>TSC-40</b>	27.04 $\pm$ 18.23	30.67 $\pm$ 17.58	386.00	-1.10	-0.79
<b>LSCL-33</b>	17.04 $\pm$ 12.99	20.97 $\pm$ 14.82	372.50	-1.30	-1.09
<b>BM</b>	27.00 $\pm$ 9.58	29.33 $\pm$ 8.09	377.50	-1.22	-1.03

**Abbreviations:** FAS, Flight Anxiety Modality Questionnaire; TSC-40, Trauma Symptoms Checklist; LSCL-33, Limbic System Checklist; BM, Burnout Measure.

between FAS and Limbic System Checklist (LSCL-33) (Spearman  $R=0.39$ ,  $p<0.01$ ) and FAS and Burnout Measure (BM) (Spearman  $R=0.30$ ,  $p<0.01$ ). We also found that Burnout Measure (BM) manifested significant relationship with TSC-40 (Spearman  $R=0.80$ ,  $p<0.01$ ) and Limbic System Checklist (LSCL-33) (Spearman  $R=0.68$ ,  $p<0.01$ ).

## Discussion

The results of this study are in agreement with the proposed hypothesis that experienced fear of flying could be linked to work and personal difficulties and show that fear of flying is also significantly related to symptoms linked to experiences of past and recent stressful events and also to levels of work related problems described and experienced as burnout. In this context, results of this study are in agreement with previously published findings that high levels of emotional chronic distress may be associated with flying.<sup>3,4,7,10,11</sup> Taken together, these findings indicate that individual histories mainly linked to various traumatic experiences and stress related sensitization to various conditioned “phobic” stimuli may be exaggerated and too sensitively experienced as dangerous or life threatening.<sup>12–14</sup> In addition, results of this study also agree with some data that personal difficulties and work related and career effects may be related to fear of flying.<sup>2,3,10</sup> Although extensive research has not been performed yet, it seems to be apparent that, experiencing severe



**Figure 1** Spearman correlations of aviophobic experiences measured by FAS with stress symptoms (measured by TSC-40 and LSCL-33) and symptoms of burnout (BM).

excessive distress from or avoiding air travel may be severely detrimental to both current operational efficiencies and also longer term work related consequences.<sup>3,4,7</sup>

The study has a few limitations, mainly the relatively small sample size, which could limit the generalizability of the findings and the study is based on self-reported measures. In addition, the correlational design does not allow conclusions about causality and it is possible that other factors not measured in the study could influence the relationship between stress symptoms and fear of flying.

As expected from previously reported studies, the stress related sensitization might also be related to aviophobia, based on its relationship with stress experiences mainly associated with individual and family history, which suggests that the effects of childhood stress may in these cases also be linked to epileptiform neurophysiological alterations.<sup>12,14,29</sup>

## Conclusion

In this context, findings of this study also suggest a perspective for further research that in addition to various psychotherapeutic methods, certain sensitively indicated low doses of anticonvulsant medication might help to treat aviophobia and for example, that utilizing mild doses of anticonvulsant medication only in advance of the air travel might offer a useful alternative treatment method.

## Data Sharing Statement

Data will be available upon request from the corresponding author.

## Ethics Approval and Consent to Participate

The project has been approved by Charles University hospital ethical board. All participants included in the study provided written informed consent prior to study commencement.

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## Disclosure

The authors declare no conflict of interest.

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