

Comparative Study of the Effect of Aircraft Noise on Emotional States Between Airport Neighboring and City Residents

Bahman Kord Tamini,^{1*} and Mostafa Mirbaluchzahi Pak²

¹Psychology Department, University of Sistan and Baluchestan, Zahedan, Iran

²MA Student in Psychology, Psychology Department, University of Sistan and Baluchestan, Zahedan, Iran

*Corresponding author: Bahman Kord Tamini, Psychology Department, University of Sistan and Baluchestan, Zahedan, Iran, E-mail: bahmanpsy@ped.usb.ac.ir

Received 2016 November 01; Revised 2016 December 10; Accepted 2016 December 13.

Abstract

Background: Environmental factors have a dominant impact on health especially aircraft noise is one of the environmental factors, which have a strong effect on emotional states.

Objectives: The aim of the present study was to investigate the effect of aircraft noise on emotional states between airport neighboring and city residents in Zahedan City, Iran.

Methods: The sample size of this study consisted of 200 residents of Zahedan city (100 city residents and 100 residents from airport neighboring) that were selected through the convenience sampling method. To collect the data, depression, anxiety, and stress scale-21 (DASS-12) was used. Data were analyzed by one-way MANOVA using SPSS version 16.

Results: Results showed that there were significant differences regarding anxiety, stress and overall scores of DASS between airport neighboring and city residents in Zahedan city. However, there was no significant difference between the two groups regarding depression.

Conclusions: Findings of this study show that aircraft noise has a negative effect on the level of emotional states and it increases the amount of anxiety, stress, and overall scores of DASS among the neighboring residents of International Airport of Zahedan city.

Keywords: Aircraft Noise, Emotional States, Airport Neighboring Residents

1. Introduction

One of the most important environmental stressors is noise annoyance and its relationship to mental health has been investigated (1). It seems that being at the exposure of noise might lead to minor emotional symptoms but the evidences have shown that aircraft noise leading to psychiatric hospital admissions and psychiatric problems in the public population. Environmental noise level, psychological and physical symptoms, psychiatric symptoms and use of health services are related to noise annoyance (2). Aircraft noise is one of the main environmental factors which can diminish the amount of quality of life and mental health. Janic (3) noted that aircraft noise has a negative impact on the quality of life of people who are living nearby airports. Also, the aircraft noise has been recognized as an important environmental stressor for airport neighboring residents, its association to mental health has been studied. Before referring to related results of aircraft noise and mental health, the definitions of psychological disorders are investigated in this study.

Some psychological disorders related to mental health such as depression, anxiety and stress are considered as neurotic disorders which are not much severe as psychosis disorders and they can disturb individuals with severe

mood swings, frequent sadness, and worry (4, 5). Depression is a situation that is recognized with low mood and disgust to work which it has an impact on the peoples' thinking, behaving, feeling and sense of well-being (6, 7). Anxiety is considered as a negative mood and often leads individuals to have a wrong interpretation about their physical symptoms. Depressed and anxious individuals tend to be in rumination. However, although affective states of individuals can influence the somatic changes, these individuals are not hypochondriacs (8). Sapolsky stated that stress is defined as a "feeling of strain and pressure" (9). He emphasized that a minor level of stress might be favorable, worthy, and good for health. A prolonged level of stress has a negative effect on body. Different diseases such as being at risk of strokes, heart diseases, psychological problems like depression and physical symptoms such as ulcers have emerged due to stress. In continue of this research, related studies regarding the effect of aircraft noise on mental health will be discussed. The results of Beutel et al. study (1) showed that the total noise annoyance degree can lead to depression and anxiety in comparison to no annoyance. When the results of this study were compared to other sources, aircraft noise annoyance was prominent affecting almost 60% of the population. Related findings to noise sensitivity were related to

the present psychiatric disorder and it can cause negative effects (10, 11). Hardoy et al. (12) studied the effect of aircraft noise on mental health. They showed that noise can increase a lot of acute symptoms and this is especially more dominant for night working, low mood such as irritability, depressive symptoms, sleeping problems, pain and inflammation in ankles, burning/cutting/minor accidents and skin rash. Aircraft noise increases tinnitus and ear problems, which are two of the chronic symptoms. However, low noise can cause other chronic symptoms. Studies revealed that much of the environmental noise is related to psychiatric symptoms in comparison to specific symptoms. Results showed an increased risk for a long-lasting generalized anxiety disorder and aircraft noise is associated with health complaints such as tiredness and headache, while a lot of the physical complaints were not related to noise aircraft (13). Results of the similar study demonstrated that the related health complaints such as tiredness and headache were associated with aircraft noise, whereas most other physical complaints were not related to noise aircraft (14). Reijneveld et al. (15) studied the effect of aircraft noise on the quality of life of people living near the Frankfurt Airport. The results suggested a recursive relationship between noise and health. In another study, Kroesen et al. (16) showed that heightened noise sensitivity has an impact on fear, but he demonstrated that it was not cause of the psychiatric disorder.

Results of some studies showed that aircraft noise annoyance is very stable through time and changes in aircraft noise annoyance were associated with the identified psychological factors (17). Findings of a study demonstrated that the prevalence of insomnia and daytime hypersomnia was higher among people who were exposed to the aircraft noise in comparison to the control group (18). Some evidences showed that people who are at aircraft exposure had higher levels of hypertension (19). A study investigated the amount of health and annoyance reaction to aircraft noise among children in South Africa and results demonstrated that being at exposure to aircraft noise for long-time have a prolonged effect on annoyance of children, but it has no impact on their subjective health rating (20). Evidence of a study revealed that exposure to nighttime aircraft noise brings some changes in the endothelial function and adrenaline release is stimulated (21). Findings of a meta-analysis showed that aircraft noise increases the prevalence of hypertension, but the reason for an association between aircraft noise exposure and the incidence of hypertension is still inconclusive (22).

Research evidences around the world have shown that aircraft noise has a dominant impact on mental health of airport neighboring residents and it increases the negative emotional states among them. Moreover, most stud-

ies in this respect have been conducted in western countries and it is necessary to conduct a research about this topic in Iran to find out whether the previous research findings have coordination with the results of this study or not. The present study was conducted in the international airport of Zahedan city, which is the main airport in the southeast of Iran and it has a lot of national and international flights daily. Moreover, some localities are nearby to this airport and noise annoyance may decrease the mental health levels of the residents dramatically. Therefore, this study aimed to examine the effect of aircraft noise at Zahedan International Airport on emotional states of people who are living nearby the airport and also to compare their mental health with city residents.

2. Methods

2.1. Study Design

This study was conducted on 200 residents (99 male and 101 female) in Zahedan city. 100 residents (50 male and 50 female) from Zahedan localities that were not much at the exposure of aircraft noise and 100 residents (49 male and 51 female) from localities nearby to International airport of Zahedan who were facing with aircraft noise annoyance were selected through the convenience sampling method for this study. Since the two population sizes were unclear and there was no exact statistics about the number of people of the two populations, the convenience sampling method was used and 200 participants were selected for this comparative study.

To assess the level of emotional states (depression, anxiety and stress) of airport neighboring and city residents, depression, anxiety, and stress scale-21 (DASS-21) was used and this scale was constructed by Lovibond et al. (23). The short version consists of 21 items (DASS-21); this scale has been recognized as a valid and reliable self-administered psychological tool that measures the three components of depression, anxiety and stress. Each component consisted of seven questions measuring three domains of mental health symptoms: depression, anxiety and stress. Participants are requested to clarify the presence of the symptoms of depression, anxiety and stress they experienced for the last week on a four-point Likert scale in which the scores are ranged from 0 to 3. The higher scores on this scale exhibit more severe symptoms on each component and clinical and non-clinical samples use frequently from this scale (22, 23). The reliability values of this scale using alpha Cronbach for depression, anxiety and stress were 0.91, 0.84 and 0.90, respectively. To assess the validity of DASS in Iran, 40 students were selected and test-retests were conducted on them. The validity values of retest coefficients

were reported 0.82, 0.78, 0.80, and 0.82 for depression, anxiety, stress, and overall DASS, respectively (24). To evaluate the reliability of DASS, Cronbach alpha was used and the coefficients were 0.85, 0.75, and 0.87 for depression, anxiety and stress respectively.

2.2. Procedure

To conduct this study, the localities that were at the exposure of aircraft noise nearby the International Airport of Zahedan city and localities that were away from airport were identified and there was tried to consider both gender for this study. Before completing the study scale, the participants were assured that there were no correct or wrong responses on each item and their personal information will be kept confidential and will be used for research purposes only. To analyze the data, SPSS version 16 and a one-way between-groups multivariate analysis of variance (MANOVA) were used.

3. Results

The results of Table 1 showed the study participants with regard to gender.

Table 1. Frequency and Percentage of Males and Females

Residential Area	Gender	No. (%)	Valid Percent
Airport neighboring residents	Male	50 (50.)	50.
	Female	50 (50.)	50.
City residents	Male	49 (49.5)	49.5
	Female	50 (50.5)	50.5
Total		200 (100.)	100.

The results of the Table 1 showed that there were 50 males (50%) and 50 females (50%) in the sample of the study for airport neighboring residents and 49 males (49.5%) and 51 females (50.5%) for city residents, giving a total of 200 participants for the study.

To respond to the research questions, the one-way MANOVA analysis was performed to investigate the effect of aircraft noise on depression, anxiety, stress and overall scores of DASS between airport and city residents. Four dependent variables such as depression, anxiety, stress, and overall scores of DASS were used. The independent variable was aircraft noise. The results are given in the Tables 2 - 4.

The results of Table 2 showed the mean and standard deviation between city and airport neighboring residents. Table 2 showed the mean and SD of depression (7.99 ± 1.04), anxiety (7.60 ± 0.87), stress (8.51 ± 1.78), and overall scores of DASS (24.08 ± 3.07) for city residents, and the

Table 2. Mean and Standard Deviation of Emotional States Between Airport Neighboring and City Residents

Variable	Residential Area	Mean \pm SD	N
Depression	City	7.97 ± 1.04	100
	Airport Neighboring	8.25 ± 2.16	100
	Total	8.11 ± 1.70	100
Anxiety	City	7.60 ± 0.87	100
	Airport Neighboring	8.40 ± 2.07	100
	Total	8.00 ± 1.63	100
Stress	City	8.51 ± 1.78	100
	Airport Neighboring	9.41 ± 3.07	100
	Total	8.96 ± 2.54	100
DASS	City	24.08 ± 3.07	100
	Airport Neighboring	26.06 ± 6.54	100
	Total	25.06 ± 5.18	100

mean and SD of depression (8.25 ± 2.16), anxiety (8.40 ± 2.07), stress (9.41 ± 3.07), and overall scores of DASS (26.06 ± 6.54) for airport neighboring residents.

Results of Table 3 showed that there was a statistically significant difference between airport neighboring and city residents on the combined dependent variables, $F(4, 195) = 4.462$, $P = 0.0005$; Wilks' Lambda = 0.936; $\eta^2 = 0.064$.

Results of Table 4 showed that when the results for the dependent variables were considered separately, the only difference to reach the statistical significance, using a Bonferroni-adjusted alpha level of 0.012, was for anxiety, $F(1, 198) = 12.47$, $P = 0.001$, and partial eta squared = 0.060, for stress, $F(1, 198) = 6.48$, $P \leq 0.012$, and partial eta squared = 0.032, and for overall scores of DASS, $F(1, 198) = 7.50$, $P = 0.007$, and partial eta squared = 0.037. There was no significant difference between the two groups regarding depression. An inspection of the mean scores on the Table 2 indicated that airport neighboring residents reported slightly higher anxiety, stress and overall scores of DASS compared to the city residents. Therefore, aircraft noise had a significant effect on anxiety, stress and overall scores of DASS.

4. Discussion

This study aimed to investigate the effect of aircraft noise on negative emotional states between city and airport neighboring residents. The obtained results from this study indicated that there was a significant difference between city and airport neighboring residents on anxiety, stress and overall scores of DASS; however, there was no significant difference between the two groups regarding depression. Airport neighboring residents reported slightly

Table 3. Results of Multivariate Tests of the Wilks' Lambda Between Airport Neighboring and City Residents on Emotional States

Source	Value	F	Df1	Df2	P Value	Partial Eta Squared
Airport Neighboring and City Residents	0.936	4.462	4	195	0.005	0.064

Table 4. Results of Between Subjects Effects on Negative Emotional State Between Airport Neighboring and City Residents

Dependent Variable	Type III Sum of Squares	df	Mean Squares	F	P Value	Partial Eta Squared
Depression	3.97	1	3.97	1.37	0.243	0.007
Anxiety	31.36	1	31.36	12.47	0.001	0.060
Stress	40.67	1	40.67	6.48	0.012	0.032
Overall Scores of DASS	195.15	1	195.15	7.50	0.007	0.037

higher anxiety, stress and overall scores of DASS in comparison to the city residents. Therefore, it can be concluded that aircraft noise has a significant negative effect on anxiety, stress and overall scores of DASS in airport neighboring residents. The differences found between the two groups are in accordance with the results of the previous studies (1, 10-13, 18-21). Schreckenberget al. (14) suggested a recursive relationship between noise and mental health near the Frankfurt Airport. Insomnia is a disorder that can be related to anxiety and the aircraft noise can accelerate this disorder in airport neighboring residents. Findings of a study demonstrated that the prevalence of insomnia and daytime hypersomnia was higher among people who were at exposure to aircraft noise in comparison to the control group (17). Some other studies revealed that people who are at aircraft exposure show higher levels of hypertension (18). People who are living near airport have a higher level of stress in comparison to people who are living in the city. Evidences revealed that exposure to nighttime aircraft noise brings some changes in the endothelial function and adrenaline release is stimulated (20). Huang et al. (21) conducted a meta-analysis study and the results showed that aircraft noise increases the prevalence of hypertension, but an association between aircraft noise exposure and hypertension is still inconclusive. The aircraft noises can cause that airport neighboring residents use a lot of nervous energy, and are worry about this situation in which they might experience panic. Moreover, aircraft noise creates some difficulties for them, for instance, they cannot get relax well. Also, the aircraft noise puts the residents of airport neighboring in arousal and they might be intolerant of anything that keeps them from getting on with what they are doing. Another reason that aircraft noise is caused to anxiety and stress of airport residents is that they feel scare and have these feelings that just now aircraft crashing is happening, so these type of thoughts

diminish their mental health levels and increase the level of stress among them and prolonged stress leads to anxiety and thus they might generalize this situation to other situations and feel scaring with any good reason at their lives. The mentioned causes can justify differences on negative emotional states (anxiety and stress) between city and airport neighboring residents in Zahedan city.

The results of this study demonstrated that residents nearby of the International Airport of Zahedan city who were at exposure to aircraft noise experienced more depression, stress symptoms in comparison to the city residents. It seems that aircraft noise annoyance diminish the amount of mental health among the residents. The same results were reported by previous researchers. Being at exposure to aircraft noise increases the amount of stress and due to noise annoyance adrenaline hormone is released. Aircraft traffic and noise has been recognized as an environmental factor which can cause stress and depression among airport nearby residents. With regard to results of this study, it is suggested to change the location of Zahedan city airport and build a new one which should be away from residential areas.

There are some limitations in this study that have been highlighted as follows:

The sample size of this study was consisted of International Airport of Zahedan City neighboring residents and city residents; thus, the results of this study should be generalized cautiously to other populations and other samples and cultures.

The sampling method of this study was convenience sampling; so, this method is not purely at random and using such a sample cannot scientifically make generalizations about the total population from this study sample because it would not be sufficiently representative.

Acknowledgments

We donate our sincere thanks to Zahedan International airport residences and city residences for their voluntary contribution in this study. This research work is a small piece of M.A dissertation of psychology department at the University of Sistan and Baluchestan and all rights are reserved.

Footnote

Authors' Contribution: Bahman Kord Tamini wrote the article and Mostafa Mirbaluchzahi Pak collected the data and finally the manuscript was submitted by Bahman Kord Tamini.

References

1. Beutel ME, Junger C, Klein EM, Wild P, Lackner K, Blettner M, et al. Noise Annoyance Is Associated with Depression and Anxiety in the General Population- The Contribution of Aircraft Noise. *PLoS One*. 2016;**11**(5):e0155357. doi: [10.1371/journal.pone.0155357](https://doi.org/10.1371/journal.pone.0155357). [PubMed: [27195894](https://pubmed.ncbi.nlm.nih.gov/27195894/)].
2. Stansfeld SA. Noise, noise sensitivity and psychiatric disorder: epidemiological and psychophysiological studies. *Psychol Med*. 1992;**Suppl 22**:1-44. [PubMed: [1488472](https://pubmed.ncbi.nlm.nih.gov/1488472/)].
3. Janic M. Aviation and externalities: the accomplishments and problems. *Transport Rese*. 1999;**4**(3):159-80.
4. Watson D, Clark LA. Negative affectivity: the disposition to experience aversive emotional states. *Psychol Bull*. 1984;**96**(3):465-90. [PubMed: [6393179](https://pubmed.ncbi.nlm.nih.gov/6393179/)].
5. Tellegen A. In: Anxiety and the Anxiety disorders. Tuma AH, Maser JD, editors. Hillsdale: Erlbaum; 1985. pp. 681-706. Structures of mood and personality and their relevance to assessing anxiety, with an emphasis on self-report.
6. Salmans S. Depression: questions you have-answers you need. Peoples Medical Society; 1995.
7. American Psychiatric Association . Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). ; 2013.
8. Grudnikov K. Circumstantial Evidence. How your mood influences your corporeal sensations. *Psychol Today*. 2011;**44**:42.
9. Sapolsky RM. Why zebras don't get ulcers. New York: WH Freeman; 1994.
10. Stansfeld SA. Noise, noise sensitivity and psychiatric disorder: epidemiological and psycho-physiological studies. *Psychol Med Monogr Suppl*. 1992;**Suppl 22**:1-44. [PubMed: [1343357](https://pubmed.ncbi.nlm.nih.gov/1343357/)].
11. Tarnopolsky A, Watkins G, Hand DJ. Aircraft noise and mental health: I. Prevalence of individual symptoms. *Psychol Med*. 1980;**10**(4):683-98. [PubMed: [7208727](https://pubmed.ncbi.nlm.nih.gov/7208727/)].
12. Hardoy MC, Carta MG, Marci AR, Carbone F, Cadeddu M, Kovess V, et al. Exposure to aircraft noise and risk of psychiatric disorders: the Elmas survey-aircraft noise and psychiatric disorders. *Soc Psychiatry Psychiatr Epidemiol*. 2005;**40**(1):24-6. doi: [10.1007/s00127-005-0837-x](https://doi.org/10.1007/s00127-005-0837-x). [PubMed: [15624071](https://pubmed.ncbi.nlm.nih.gov/15624071/)].
13. Franssen EA, van Wiechen CM, Nagelkerke NJ, Lebreit E. Aircraft noise around a large international airport and its impact on general health and medication use. *Occup Environ Med*. 2004;**61**(5):405-13. [PubMed: [15090660](https://pubmed.ncbi.nlm.nih.gov/15090660/)].
14. Schreckenber D, Meis M, Kahl C, Peschel C, Eikmann T. Aircraft noise and quality of life around Frankfurt Airport. *Int J Environ Res Public Health*. 2010;**7**(9):3382-405. doi: [10.3390/ijerph7093382](https://doi.org/10.3390/ijerph7093382). [PubMed: [20948931](https://pubmed.ncbi.nlm.nih.gov/20948931/)].
15. Reijnveld SA. The impact of the Amsterdam aircraft disaster on reported annoyance by aircraft noise and on psychiatric disorders. *Int J Epidemiol*. 1994;**23**(2):333-40. [PubMed: [8082960](https://pubmed.ncbi.nlm.nih.gov/8082960/)].
16. Kroesen M, Molin EJ, van Wee B. Determining the direction of causality between psychological factors and aircraft noise annoyance. *Noise Health*. 2010;**12**(46):17-25. doi: [10.4103/1463-1741.59996](https://doi.org/10.4103/1463-1741.59996). [PubMed: [20160387](https://pubmed.ncbi.nlm.nih.gov/20160387/)].
17. Kwak KM, Ju YS, Kwon YJ, Chung YK, Kim BK, Kim H, et al. The effect of aircraft noise on sleep disturbance among the residents near a civilian airport: a cross-sectional study. *Ann Occup Environ Med*. 2016;**28**(1) doi: [10.1186/s40557-016-0123-2](https://doi.org/10.1186/s40557-016-0123-2).
18. Rosenlund M, Berglind N, Pershagen G, Jarup L, Bluhm G. Increased prevalence of hypertension in a population exposed to aircraft noise. *Occup Environ Med*. 2001;**58**(12):769-73. [PubMed: [11706142](https://pubmed.ncbi.nlm.nih.gov/11706142/)].
19. Seabi J. An epidemiological prospective study of children's health and annoyance reactions to aircraft noise exposure in South Africa. *Int J Environ Res Public Health*. 2013;**10**(7):2760-77. doi: [10.3390/ijerph10072760](https://doi.org/10.3390/ijerph10072760). [PubMed: [23823713](https://pubmed.ncbi.nlm.nih.gov/23823713/)].
20. Schmidt FP, Basner M, Kroger G, Weck S, Schnorbus B, Muttray A, et al. Effect of nighttime aircraft noise exposure on endothelial function and stress hormone release in healthy adults. *Eur Heart J*. 2013;**34**(45):3508-14a. doi: [10.1093/eurheartj/ehz269](https://doi.org/10.1093/eurheartj/ehz269). [PubMed: [23821397](https://pubmed.ncbi.nlm.nih.gov/23821397/)].
21. Huang D, Song X, Cui Q, Tian J, Wang Q, Yang K. Is there an association between aircraft noise exposure and the incidence of hypertension? A meta-analysis of 16784 participants. *Noise Health*. 2015;**17**(75):93-7. doi: [10.4103/1463-1741.153400](https://doi.org/10.4103/1463-1741.153400). [PubMed: [25774612](https://pubmed.ncbi.nlm.nih.gov/25774612/)].
22. Cheung T, Yip PS. Depression, Anxiety and Symptoms of Stress among Hong Kong Nurses: A Cross-sectional Study. *Int J Environ Res Public Health*. 2015;**12**(9):11072-100. doi: [10.3390/ijerph120911072](https://doi.org/10.3390/ijerph120911072). [PubMed: [26371020](https://pubmed.ncbi.nlm.nih.gov/26371020/)].
23. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther*. 1995;**33**(3):335-43. [PubMed: [7726811](https://pubmed.ncbi.nlm.nih.gov/7726811/)].
24. Samani S, Jokar B. Investigation the Validity and Reliability of the Short Version of DASS. *Soc Sci Human J Shiraz Univ*. 2007;**26**(3):65-77.