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Case Study

Investigating the Relationship between the Traffic Load in the Place of Residence and Noise Sensitivity and Aggression in Housewives: A Case Study in Yazd City

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ABSTRACT

Background: Exposure to noise causes auditory and psychological effects in humans. Among the sources of sound generation are the means of transportation, which can cause anger and aggression. The present study was conducted with the aim of investigating the relationship between living in different places in terms of traffic and noise sensitivity with aggression in housewives in Yazd city. **Method:** This was a cross-sectional study conducted in 2019-2020 among housewives in Yazd city. First, the city of Yazd was divided into three areas with high, medium and low traffic using GIS software, and 100 people from each area, were included in the study in a stratified random manner. Information was collected using Weinstein's bass and Perry questionnaires and sensitivity to sound. Finally, the data were statistically analyzed using SPSS version 24 and R version 4.0.2. **Result:** Findings revealed that those who lived in high traffic have a higher aggression score (P-Value=0.009), while no significant difference was observed in the noise sensitivity score among people of different groups (P value=0.071). In addition, a direct and significant relationship was observed between aggression and sensitivity to sound (r=0.28 and P value<0.001). Only two variables of noise sensitivity and place of residence were included in the regression model and (R Square) was equal to 0.096. **Conclusion:** The results showed that the two factors of traffic load and noise sensitivity have a direct and significant relationship with aggression scores among housewives in Yazd city. It is also suggested to use different sound insulation and barriers in buildings.

Keywords: Aggression; Noise; Traffic; Noise Sensitivity; Residence

Introduction

Today, one of the most important problems is environmental pollution. Noise in the environment is one of the most pervasive pollutants that results from most of human activities.[1] Sound pollution or noise is unwanted waves that can have a negative effect on human

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activities.[2] Today, noise pollution in cities is increasing due to various reasons such as the increase of motor vehicles, construction activities, population density and industries in the vicinity of cities.[3] It has been proven that the noise pollution in big cities is mostly due to the traffic caused by motor vehicles.[4]

In a study conducted in the three cities of Los Angeles, Atlanta and New York, a direct relationship was found between traffic and noise.[5] The results of various surveys demonstrated that in the European Union, more than 200 million citizens are exposed to traffic noise. This has affected the public health of the residents in this union.[6] Furthermore, various studies have shown that more than 30% of people living in European cities are exposed to noise greater than 55 dbA and 20% are exposed to noise greater than 65 dbA. This is while the Supreme Environmental Protection Council has set the permissible noise level in residential areas at 50 dbA during the day (7 am to 10 pm) and 45 dbA during the night (10 pm to 7 am).[7] The WHO maintains that the permitted noise level in residential and high-traffic areas is 55 and 70 dB, respectively, in network A.[8] The results of investigations carried out in Tehran reveal that the sound pressure level of traffic in different areas of this city is between 72 and 78 decibels in Network A, which is more than the amount announced by the WHO and the Supreme Council for Environmental Protection.[9]

Zamaniyan et al.'s study investigated the impact of noise pollution caused by traffic on sleep disorders and the life quality of Shiraz citizens. The results suggested that the quality of life in high-traffic areas is lower than in low-traffic areas. Furthermore, sleep disorders are more common in high-traffic areas than in low-traffic areas. These relationships were statistically significant.[10] In addition to causing auditory effects, exposure to sound can have psychological and physiological consequences. They are created gradually and in the long term. The consequences of psychological effects include stress, anxiety, mental and physical fatigue, aggressive behavior, sleep disorders and distraction. [11,12] A large amount of noise can reduce concentration and brain activities by affecting the nerves.[13] On the other hand, the results of various studies show that people's exposure to noise has a positive and significant relationship with noise annoyance. Noise annoyance is a reaction that a person has when faced with noise.[14]

In a study, the relationship between air traffic noise and the level of noise annoyance was investigated. The results of this study showed that there is a significant relationship between sound level and noise annoyance.[15] One of the most common anti-social behaviors around the world is violence and aggression.[16] Aggression is a topic in psychology that is much discussed nowadays.[17] In fact, aggression is a physical or verbal behavior that may be accompanied by argumentative behavior and violence.[18] In several studies, the effect of sound on people's mood has been investigated. The results indicated that about 63% of people exposed to noise pollution suffer from some degree of anger and rage.[12] In another study, it was found that noise can cause mood disorders in people by affecting the endocrine glands.[19] The noise caused by traffic has a lot of indirect costs on people's health like people's annoyance. [(20, 21)] Violence and aggression are directly related to people's undesirable behaviors. WHO has included anger and aggression in the 20 main causes of years of life lost due to disability. [22, 23]

Noise pollution can disrupt the mental peace and life quality of people living in big cities. Yazd is one of the most important industrial cities of Iran, with many industries such as tiles and ceramics, steel, textile, etc. Among its sources of noise pollution are the traffic caused by cars and motorcycles, the activity of a number of urban industrial workshops, and the passage of trains and airplanes near some areas of the city. The present study was conducted with the aim of investigating the relationship

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between living in different places in terms of traffic and noise sensitivity, and aggression in housewives from 2019 to 2020 in Yazd city.

Method

This was an analytical and cross-sectional study conducted in 2019-2020 among housewives in Yazd city. People who had no history of hearing problems based on their statements were included in the study. Further, Yazd city area was divided into three areas with low, medium and high traffic. This division was based on the traffic load and the distance from the main streets of the city (figure 1).

Considering previous studies and using the aggression score and sound sensitivity score, the sample size was estimated.

To calculate the sample size, the minimum correlation coefficient (r=0.35) between the sound sensitivity score and the aggression score, as well as the first (alpha=0.05) and second (beta=0.20) type errors were considered. 300 people were included in the study. Through stratified random sampling, authors included 100 people from each category (with low, medium and high traffic) in the study.

Figure. 1: Categorization of Yazd city into Three Areas with Low, Medium and High Traffic

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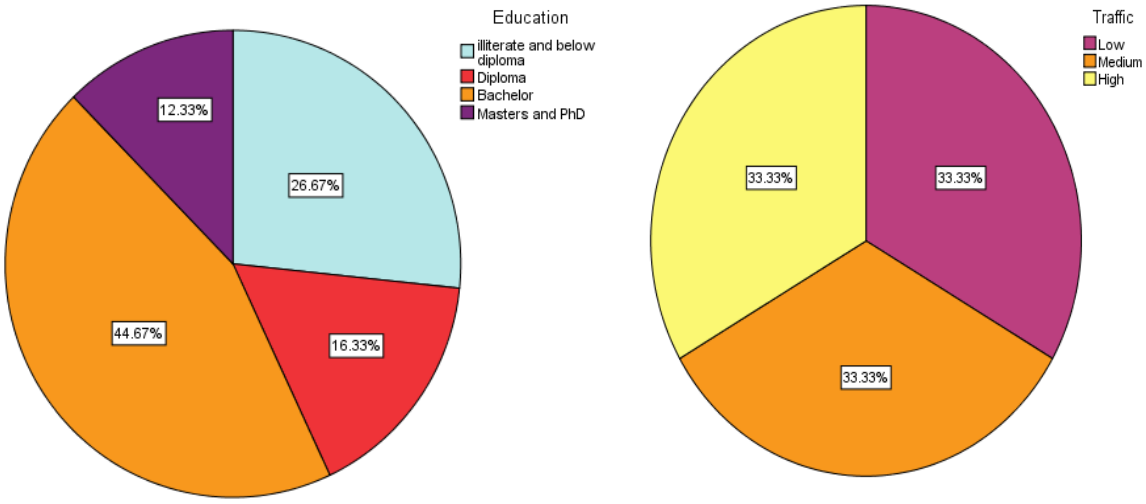
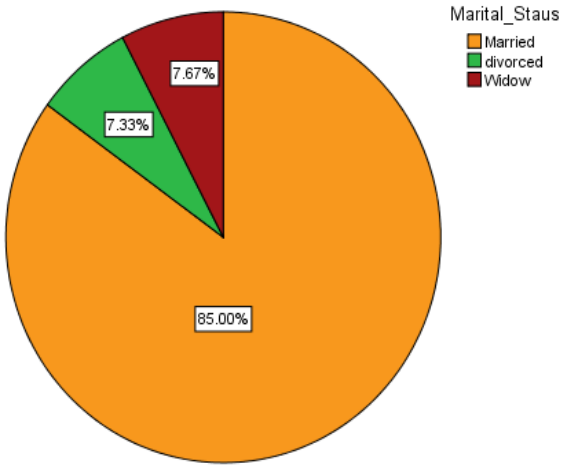


a. Education Level

b. Marital Status



c. Traffic Status

Figure. 2: Status of Education Level, Marriage and Traffic among the Participants

Information collection tools

Bass and Perry Aggression Questionnaire (1992)

This questionnaire is one of the most successful tools for measuring aggression, validated by Mohammadi et al. in 2015 and Samani in 2016. [24,25] This questionnaire is a self-report instrument including 29 items and four subscales, which are physical aggression (PA), verbal aggression (VA), anger (A), and hostility (H). Subjects answered each of the statements on a 5-point scale from: completely like me (5), somewhat like me (4), neither like me nor not like me (3), somewhat not like me (2), he doesn't look like me at all (1). There were reversed items in the questionnaire, items 9 and 16. The total score for aggression is obtained by summing the scores of the subscales. In the present study, the reliability of this questionnaire was evaluated by

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Cronbach's alpha coefficient, and the total reliability of the questionnaire was 0.77, physical aggression, 0.79, verbal aggression, 0.80, anger, 0.78, and hostility was 0.81.

Weinstein Sound Sensitivity Questionnaire (WNSS)

Weinstein's sound sensitivity questionnaire has 21 items with six-choice each. They are scored on a Likert scale from completely agree (zero) to completely disagree (five). The maximum total score of the test is 105 and a higher score indicates greater sensitivity to sound. This questionnaire is used to determine sound sensitivity, and its validity and reliability have been confirmed by Alimohammadi et al. (Cronbach's alpha coefficient of this questionnaire was 0.78).[26]

Statistical analysis

Data were statistically analyzed using SPSS version 24 and R software version 4.0.2. First, descriptive statistics were used, and then, the normality of the data was checked through the Kolmogorov-Smirnov test. One-way ANOVA, Pearson correlation coefficient and linear regression were also used (Significance level was 5%).

Results

All the participants in this study were housewives in Yazd city who had no hearing problems. Their average age was 34.56 with a standard deviation of 6.86. The Kolmogorov-Smirnov test showed that the data related to aggression and sensitivity to sound followed a normal distribution (P value > 0.5).

Figure 2 shows the marital status and education level of the housewives participating in this study, as well as their residency in terms of traffic.

As shown in part a, 44.7% had a bachelor's degree, 26.7% were illiterate or without a high school diploma, 16.3% had a high school diploma, and 12.3% had a master's degree or PhD; In part b, the marital status of the participants is displayed, according to this figure, 85% live with their spouses, in 7.7% cases, spouses are dead, and 7.3% separated from their spouses. In part c, the situation of the place of residence is shown in terms of traffic load and distance from the main streets. According to this figure, all three areas with low, medium and high traffic are in equal proportion, that is, 33.33% of each area (100 people) is included in the study.

Table 1 compares the average score of aggression among different groups participating in this study. It includes the place of residence (with low, medium, and high traffic), marital status, and education level. Table 1 shows that people who live in high traffic areas have a higher aggression score than those who live in low and medium traffic areas (P value=0.009).

On the other hand, there was no significant difference in the noise sensitivity score among people who live in areas with low, medium and high traffic (P value=0.071). The statistical test did not show a significant difference regarding the score of aggression and sensitivity to sound among different groups in terms of marriage (P value >0.05).

Although no significant difference was observed among the illiterate and those without a high school diploma, with a high school diploma, bachelor's degree, master's degree and doctoral groups in terms of aggression score, a significant difference was observed between literacy level and noise sensitivity (P value=0.001).

Figure 3 shows the correlation coefficients between sensitivity to sound, total aggression score, four dimensions of aggression and age. As can be seen, there is a direct and significant relationship between aggression and sensitivity to sound (r=0.28 and P value<0.001).

Moreover, there is a direct and significant relationship between all dimensions of aggression and sensitivity to sound, except for the anger

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Dimension, which has no significant relationship (r=0.098 and P value=0.090).

Age has no significant relationship with aggression and noise sensitivity (P value>0.05).

Table 2 shows the variables which are entered into the linear regression model. This regression was done by stepwise regression method. The confidence level was 95%. Only two variables of sound sensitivity and place of residence in terms of traffic load were entered into the model whose impact was significant (P value<0.05). The coefficient of determination (R Square) is equal to 0.096, which indicates the contribution of 9.6 percent of the model in expressing the dispersion of the dependent variable (total aggression score).

Table 1. Comparison of the Average Total Score of Aggression and Noise Sensitivity among Different Groups

Traffic Status		N	Mean	Std. Deviation	P-Value*
Total Aggression Score	Low	100	69.37	12.18	.009
	Medium	100	70.26	11.77	
	High	100	74.05	10.17	
Noise Sensitivity	Low	100	59.21	11.06	.071
	Medium	100	59.44	8.55	
	High	100	61.96	8.14	
Marital Status		N	Mean	Std. Deviation	P-Value*
Total Aggression Score	Married	255	70.79	11.57	.303
	divorced	22	73.85	13.27	
	Widow	23	73.52	9.10	
Noise Sensitivity	Married	255	60.61	10.04	.178
	divorced	22	57.18	2.59	
	Widow	23	58.56	3.76	
Educational Status		N	Mean	Std. Deviation	P-Value*
Total Aggression Score	illiterate and below diploma	80	72.85	13.81	.281
	Diploma	49	69.30	7.35	
	Bachelor's degree	134	70.59	11.86	
	Master's degree and PhD	37	72.56	9.10	
Noise Sensitivity	illiterate and below diploma	80	65.21	9.29	.001
	Diploma	49	60.00	10.77	
	Bachelor's degree	134	59.21	8.67	
	Master's degree and PhD	37	53.21	1.15	

* One Way ANOVA test

Table 2. Analysis of the Multiple Linear Regression Model

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R Square	Adjusted R Square
	B	Std. Error	Beta				
(Constant)	47.914	4.272		11.217	.000	.096	.090
Noise Sensitivity	.324	.068	.264	4.748	.000		
Traffic	1.891	.785	.134	2.410	.017		

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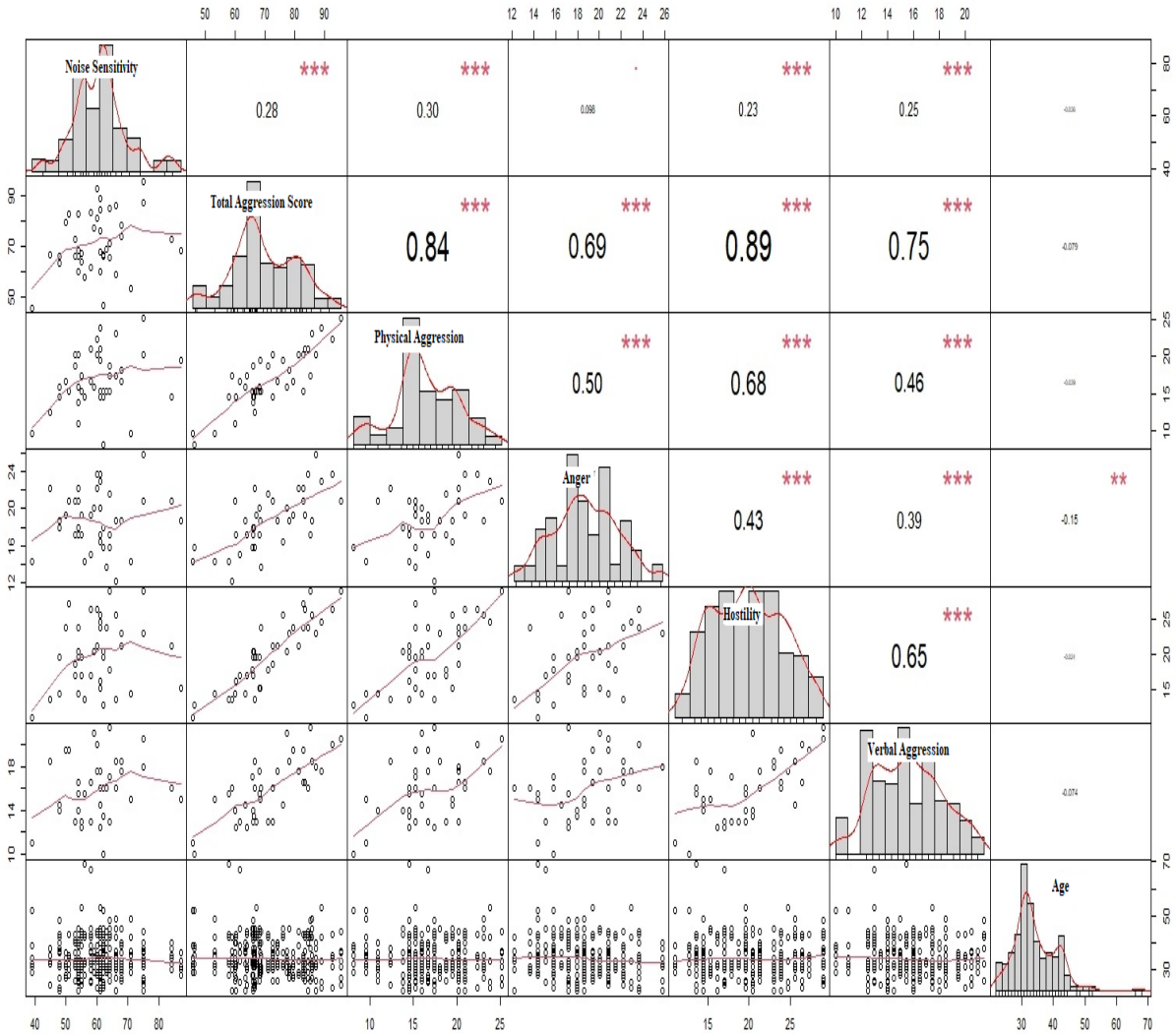

Figure 3: The Relationship between Sensitivity to Sound and Age, and Aggression and Its Dimensions

Significant codes: 0.001 '***' 0.01 '**' 0.05 '*' 0.1 '.'

Discussion

This study was conducted with the aim of evaluating the relationship between living in different traffic areas and noise sensitivity and aggression in housewives of Yazd city from 2019 to 2020. The results of investigating the level of aggression in the community demonstrated that people who live in areas with high traffic had a higher score of aggression than those who live in areas with low and medium traffic. A study conducted by Dzhambov et al. showed that those who heard sounds above the normal threshold showed a higher aggression score .This is in line with the results of the current study.[27] Noise is one of the factors that can increase the level of aggression in noisy workplaces.[28] The psychological effects of noise on people are different in different spatial and temporal conditions. In environments with noise pollution, speech disorders are increased and brain activity and physical work are decreased. The results of this study are in line with the results of several studies regarding the effect of noise on aggression. [29, 30] A research in Germany showed that the noise level of more than 55 decibels is considered psychological

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stress and may cause irritability and aggression in people.[31] the results of this study showed that noise and aggression have a direct relationship, which is in line with the results of other studies. Noise in high and low frequencies is considered an important mental and psychological stimulus for brain activities and causes an increase in human errors. It also brings about a decrease in accuracy and an increase in psychological responses such as aggression.[32] it has been shown that the greatest behavioral stress caused by noise occurs between the ages of 30 to 49, and the life quality of people exposed to noise decreases [33, 34]. However, in this study, there is no relationship between age and aggression and noise sensitivity which is in line with the results of Denson's study [35] but is not consistent with the results of Dzhambov's study[27] which is probably due to the fact that the area examined in Dzhambov's study was located near a cemetery which can have a greater psychological impact on the evaluated structures of aggression and noise sensitivity in women. The results of Alimohammadi et al.'s study revealed that the increase in job tenure and age has a direct relationship with mental status and aggression. It is contrary to the results of this study. But, the group exposed to loud noise showed more aggression, which is consistent with the results of this study.[32] the correlation between the effects of noise and psychological stress has been mentioned in other studies as well.[36] The current study suggested that sound sensitivity has no significant relationship with the living place of the people under study. The ratio of sound sensitive people is equal in three areas with low, medium and high traffic.

Although in this study, authors observed no significant difference in the score of aggression and sensitivity to sound among different groups in terms of marriage, this result cannot be generalized to other studies. This is because in this study, the marriage criterion was not the same in different groups. About 85% of the participants were married people. On the other hand, the score of aggression among different groups was the same in terms of literacy, while a significant difference was observed between the level of literacy and sensitivity to sound. In fact, findings indicated that people who had less sensitivity to sound were able to achieve higher academic degrees.

Regression analysis showed that only two factors of living place and noise sensitivity have a significant effect on the level of aggression. The regression model can explain 9.6% of the changes in the dependent variable (total aggression score). This shows that other factors also play a role in the occurrence of aggression. For example, there are some social and personality disturbing factors, the combination of which increases the level of aggression.[37] Environmental pollutants, including carbon monoxide, have an interfering role regarding the effects of sound on aggression and psychological stress. [38,39] Attitudinal factors, including the level of sound perception, are well expressed among all the factors affecting the level of annoyance. The effect of each of the demographic variables on the level of aggression caused by noise should not be ignored, because factors other than noise play a role in the level of annoyance and aggression.[28] The results of this study showed that the quality of the place of living in terms of noise caused by heavy traffic has a direct relationship with aggression, and on the other hand, those who were able to get a higher level of education had less sensitivity to noise.

Limitations of the study

One of the limitations of this research was non-examination of the effects of other factors on aggression caused by noise, which should be further investigated in future studies. The self-reporting of aggression and sound sensitivity measurement tools are other limitations of this study. By evaluating the reactions of citizens to different urban environments, better measures can be taken to improve the infrastructure of neighborhoods at risk.

It is also possible to plan using effective and

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efficient programs with the help of health experts to deal with behavioral and psychological tensions.

Conclusion

The results of this study, which was conducted for the first time in Yazd, showed that one of the effective factors in aggression among the participants is the traffic load in their place of residence. More traffic load causes more aggression. Also, the sound sensitivity factor had a direct and significant relationship with the aggression score.

Finally, the authors suggest that those who are sensitive to sound or experience more aggression should use different sound insulations and barriers such as double-glazed doors and windows, unolite, etc. in the building where they live; and, if possible, move to areas with low traffic.

Ethical considerations

At the time of data collection, politeness and respect were observed in dealing with the target group, and the participants were assured that all their information would remain confidential. Therefore, it was not necessary for them to write their names and surnames. Also, before completing questionnaires, the necessary information was given and the consent form was obtained from the participants.

Conflict of interest

Authors declared no conflict of interest.

Acknowledgment

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Authors Contribution

Research design: M.Z.S and A.S

Data collection: M.J

Data analysis: H.M and F.S.Z

Writing and editing the article: F.S.Z

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