Research Article

Assessing Noise Exposure and Hearing Loss among Bakers in Tehran

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Abstract

Introduction: Occupational hearing loss is considered as one of the most important occupational diseases that affects many people every year. So far, many studies have been conducted in this field in various industries, but the issue of occupational hearing loss among bakers has not been considered and the main goal. This study investigates occupational noise in bakeries and possible hearing loss in this occupation. It should be noted that this study was conducted in Tehran.

Method: In this cross-sectional study, 12 bakeries with a variety of 4 types of traditional bread were selected in the city of Tehran and 51 workers working in these bakeries were selected. The method of measuring noise in the workplace was using a regular network method and a device with a Svantek analyzer and in order to investigate possible hearing loss, occupational medicine records and direct evaluation of audiometric results were used.

Results: Considering the working hours of more than 40 hours per week and reducing the exposure standard to 82 dB , the results showed that in all 12 bakeries, the exposure equivalent level varies between 69 and 79 dB, which is lower than the standard and Therefore, none of the 51 bakery workers were exposed to noise above the permissible limit. Despite this level of exposure, the results of audiometry showed that the prevalence of hearing loss was 16%. Also, there was a significant relationship between age, work experience and hearing loss was obtained.

Conclusion: The results of this study showed that the equivalent level of exposure in bakeries is much lower than the standard exposure level, but the people working in the bakery suffer from hearing loss despite not being exposed to noise exceeding the standard limit and therefore, it should be reduced hearing in this job, more studies should be done and other possible factors such as heat stress that can have an indirect effect on the hearing system should be given more attention.

Keywords: Hearing loss; Bakery; Heat stress; Noise; Decibels (dB)

Introduction

Due to the importance and frequency of using bread as the main food ingredient, there are many bakeries in the country that employ several thousand people. According to statistics, bread is baked in the country by more than 82 thousand bakeries. In total, 200 thousand people are working in bakeries in the country. Due to the importance of the issue and in order to check the health of employees in bakeries, many studies have investigated the harmful factors of the working environment in bakeries [1-5].

In the studies conducted by various researchers, important harmful factors such as physical factors and possible chemical factors have been investigated. In the physical harmful factors section, most of the studies consider the thermal stress factor caused by the presence of the oven and water vapor during cooking as the main cause of damage. so that in most of the studies, the role of thermal stress has been the main harmful factor and the main complaint of the workers [6-9].

It has been determined in various studies that the heat stress in bakeries is higher than the permissible limit. Also, the working hours of many bakeries are beyond the limit of 8 hours a day, which causes these people to face more heat stress [10,11].

Considering that the raw material used in bakeries is wheat flour, therefore, in the section of harmful chemical factors, the most important factor that has been considered in studies has been the issue of suspended particles in bakeries, which has been investigated in studies [12,13]. In the field of occupational ergonomics of bakers, there have been studies that mostly focus on the improper ergonomics of the work station and lifting loads. For example, the work station is designed inappropriately or the person has an inappropriate posture when lifting loads [14-16].The review of studies conducted in scientific sources shows that despite the high number of studies conducted on the bakery job, almost all studies have included heat stress and few studies related to ergonomics and dust particles in the bakery.

Therefore, so far, no study has been conducted regarding the exposure of bakers to noise and its possible effects and possible hearing loss in these workers. In most of the studies, the measurements and interventions are in the field of heat stress. However, interviewing the workers working in the bakery and paying attention to some complaints about hearing loss by some bakers forced the researchers of this study to investigate

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the issue noise and hearing loss. By reviewing several studies that have been conducted in the field of identifying the harmful factors of bakeries, the researchers realized that according to the measurements and the available documents, the level of exposure of people in the field of noise, both in the form of network and It has been reported in the form of dosimeter at a level lower than the permissible limit (85 dB) and according to this, the researchers have not done any special follow-up in this field, inferring that the permissible limits are met with noise and this is the reason why it is of interest to the researchers. It was not in previous studies.

On the other hand, in the past years, the main priority in the measurements were only the sound sources and the sound caused by them and therefore, much attention has not been paid to the effects of hearing damage in bakery workers. It is the cause of people's hearing loss and this matter caused the attention of the researchers of this study, why did hearing loss happen in these people despite not being exposed to noise above the permissible limit? Therefore, the main goal of the current study is to investigate the hearing health status of employees in bakeries.

Materials and Methods

According to the announced statistics, there are about 82,000 bakeries in Iran and there are 7,000 active bakeries in Tehran province and in total, more than 20,000 people are employed in this number of bakeries in Tehran province.

According to the accessibility, the number of bakeries and people working in the bakeries of Tehran city, in the present study, using a statistical consultant, statistical formula and available facilities, a total of 12 bakeries were selected and in these 12 bakeries, 51 people were selected as the study sample.

The study was carried out in three parts. The first part of the study was the measurement of the head and noise in the bakery using a network method. This step was performed by Svantek Svan 971 sound meter with analyzer. This sound meter is one of the most reliable and high quality analyzer sound meters. The measurement method was regular network method according to the working conditions and dimensions of the bakeries and the placement conditions of the devices and the number of 9 stations in each bakery was measured [17].

This measurement method is one of the best methods in places where the noise of the devices is not so high and there are no noisy devices and the noise level in different stations of the work environment is almost the same. The results obtained In this part of the study, it was recorded by the recording device and then written in the relevant tables. The important issue in these measurements is the correct recording of the level of exposure of people and the time of exposure to each of the measurements. Considering the activities of bakeries, the sound Productivity was measured separately in two parts during preparation and during cooking.

In the second and important stage of the study, occupational medicine files of the workers were reviewed and audiometry examinations were performed by an audiometric specialist [18].

One of the important points in the examination of the occupational medicine files that was noticed was the absence of audiometry results in the periodical occupational medicine files of the workers and in the annual examinations, unfortunately, the occupational medicine companies, due to having an intellectual background related to the bakery and the false assurance of the absence of head Based on previous measurements in this environment, removed audiometry from periodical examinations and therefore audiometry of the samples was performed again by an audiometric specialist according to related standards and previous studies [19].

In the third stage, the issue of thermal stress in bakeries and the level of this stress was examined by the digital Wet Bulb Globe Temperature (WBGT) device. This device is one of the best tools and the most accurate devices for measuring thermal stress in the workplace, which is used in many studies.

The features of this device are the ease of use, the speed of recording the results and the validity and reliability of the results. According to the previous studies, it was already assumed that the thermal stress is higher than the permissible limit, but in order to ensure the real and current situation, thermal stress was also measured again [20].

The last and final part of the study was to examine the results of the first, second and third parts of the study so that the possible relationship between the results can be evaluated by experts.

Results

On 15 July, 2024, a total of 12 bakeries and 51 people were measured by using the statistical formula and consultation. All of these people were male and between the ages of 19 and 59. One of the interesting features of the people working in the bakery is the stability of their jobs and lack of employment in other professions, so that all the people in this study have a continuous work experience in the bakery profession. In order to better investigate and increase the accuracy and quality of the study, four types of famous traditional bakeries including Sengak, Berberi, Lavash and Tafton were selected.

The average work experience of the people in the study was 11.4 years, the minimum experience was 3 years and the maximum experience was 29 years.

The level of education of the people was different from cycle to bachelor's degree, but 84% of the selected employees had diploma and cycle and only 8 people had university education, including 2 bachelor's and 6 postgraduates.

The results related to demographic characteristics are shown in Table 1.

The next part of the study was to measure the noise level of the work environment that the employees in the bakery faced during their work shift. As mentioned, the network method was used to measure the noise level. Including the equivalent level of exposure, the lowest and the highest level of exposure are shown in Table 2 and in Figure 1, the graph of people's exposure to noise level in different bakeries is displayed.

Table 1: Demographic information of the people in the study.

Personal information	Category	Frequency	Percent
Age	18-29	15	0.29
	39-30	17	0.33
	49-40	12	0.24
	50 and above	7	0.14
work experience	Under 5 years	5	0.1
	5 to 10	11	0.22
	10 to 20	24	0.47
	More than 20 years	11	0.22
Education level	Diploma and sub-diploma	43	0.84
	University education	8	0.16

Table 2: Information from noise measurement.

Measuring station	minimum	Maximum	Leq	Description
Bakery number 1	61	83	73	Barbari bread
Bakery number 2	63	80	76	Barbari bread
Bakery number 3	59	81	73	Barbari bread
Bakery number 4	54	78	71	Lavash bread
Bakery number 5	58	75	69	Lavash bread
Bakery number 6	63	87	79	Lavash bread
Bakery number 7	60	77	72	Sangak bread
Bakery number 8	59	79	76	Sangak bread
Bakery number 9	55	84	79	Sangak bread
Bakery number 10	52	81	77	Taafton bread
Bakery number 11	69	86	78	Taafton bread
Bakery number 12	63	89	79	Taafton bread

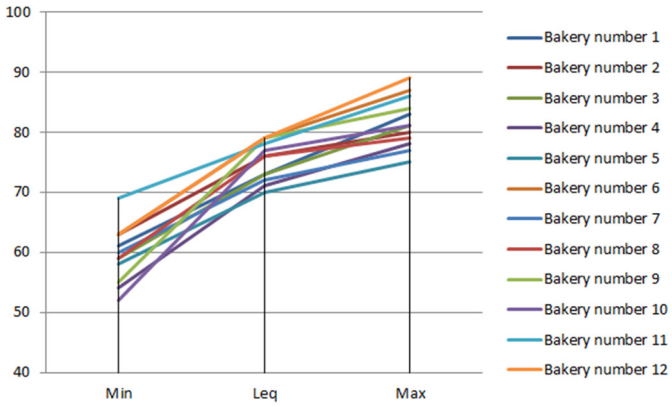

Figure 1. The diagram of the results, measuring the ambient noise of bakeries.

As can be seen in Figure 1, the highest sound level recorded is 89 dB and the lowest sound level is 52 dB and the maximum Leq exposure level is 79 dB. Because the exposure of the people present in the bakery was more than 8 hours. Therefore, the standard limit for exposure is changed to 82 dB instead of 85 dB. However, even so, the average level equivalent to workers' exposure is lower than the permissible limit and it is expected that occupational hearing damage should not occur. In the second part, we examined the hearing status of bakery workers by audiometry and occupational medicine records.

The present study showed that out of a total of 51 people in the present study, 2 people have severe hearing loss and 6 people have mild to moderate hearing loss and the rest of the workers had healthy hearing. The results of hearing loss are shown in Figure 2.

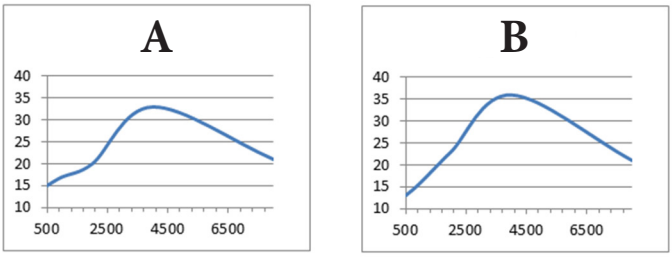

Figure 2. The graph of the average hearing threshold of bakers by frequency. **Note:** A) Left ear, B) Right ear.

In the third part of the study, the measurement of thermal stress in the bakeries was investigated. The measurement showed that in all the bakeries, due to the duration of the shift, the thermal stress is higher than the permissible limit and Sangak and Barbari bakeries had the highest amount of thermal stress. The results of the measurement by digital WBGT device are shown in Table 3. The permissible limit of occupational exposure to heat stress for such jobs is 26.7 °C. Therefore, it can be seen that in the 12 measured bakeries, the average exposure is higher than the standard limit.

Table 3: Information obtained from thermal stress measurement.

Measuring station	TLV	Measured WBGT	SD	Description	Status
Bakery number 1	26.7	29.5	3.5	Barbari bread	More than allowed
Bakery number 2	26.7	30.1	3.1	Barbari bread	More than allowed
Bakery number 3	26.7	28.9	3.3	Barbari bread	More than allowed
Bakery number 4	26.7	27.3	2.4	Lavash bread	More than allowed
Bakery number 5	26.7	27	2.6	Lavash bread	More than allowed
Bakery number 6	26.7	28.5	3.1	Lavash bread	More than allowed
Bakery number 7	26.7	30.3	4.2	Sangak bread	More than allowed

Bakery number 8	26.7	31	3.5	Sangak bread	More than allowed
Bakery number 9	26.7	29.8	3.5	Sangak bread	More than allowed
Bakery number 10	26.7	27	2.2	Taafton bread	More than allowed
Bakery number 11	26.7	27.9	1.5	Taafton bread	More than allowed
Bakery number 12	26.7	28.2	3.3	Taafton bread	More than allowed

Discussion

The results of this study showed that the equivalent level of exposure in bakeries is much lower than the standard level of exposure, so that the maximum equivalent level of exposure among bakeries is 78 dB, which is again 4 dB less than the revised exposure threshold 82 dB. On the other hand, the audiometric results of the samples working in the bakery, despite not being exposed to noise exceeding the standard, show a hearing loss of 16% of the workers, which indicates a high level of hearing damage. By referring to previous studies, it is clear that in the statistics obtained on the rate of hearing loss in different industries, this percentage of hearing loss is included in the category of industries with high hearing damage and is placed at the level of industries such as steel industries and metal parts assembly industries. While in those industries, the average equivalent level of exposure is usually more than 85 dB and in the range of 87 to 91 dB.

If in the investigated bakeries, the maximum exposure level is 78 dB, which by referring to reliable sources, working in such places does not require any health care and should not cause hearing damage. If the level of noise encountered in bakeries is compared with similar industries, this damage should be in the hearing loss range of 3 to 10%, which in the current study is 5.6% more than similar industries. In fact, 56% of hearing damage It was more than expected.

Dr. Chen and his colleagues conducted a meta-analysis study in 2022 regarding the simultaneous exposure to noise and heat stress and it was observed that no English-language article has been conducted in this regard, but 14 studies were selected among the Chinese studies [21]. It was pointed out by the meta-analysis that the rate of hearing damage was 49% more than expected. By comparing people who were simultaneously exposed to sound and heat stress and those who were only exposed to sound, they concluded that the exposure At the same time, it has caused the aggravation of damage, which the results of the current study also emphasize this point, so that in this study too, 56% of hearing loss is more than expected [21].

According to this study as well as Chen et al., study, which was a summary of 14 studies conducted in connection with the simultaneous exposure to noise and heat stress, one should be more careful in relation to hearing loss in such work environments [21]. A review study conducted by Golmohammadi and his colleague in 2019 also mentioned the effect of heat stress on hearing loss [22].

Conclusion

Considering that the mechanism of the effect of heat stress is to affect the important glands of the body, especially the pituitary gland and hypothalamus, in future studies, special attention should be paid to the effects of separate and combined effects of heat stress and noise on the important hormones of the body, because according to the results The result of this study is that due to the low level of exposure of workers to noise, noise reduction or the use of personal protective equipment such as telephones will not have a special effect and considering the thermal stress in the environment, any use of personal protective equipment will also have problems. Therefore, more studies should be conducted in the field of hearing loss in this job and similar jobs and the effect of indirect factors on the hearing system should be given more attention.

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