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Investigating Noise Exposure And Awareness Among Bakery's Workers Within The Gaza Strip

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--*ABSTRACT*--

Working in bakeries means that workers are exposed to several hazards, physical hazrds, ergonomic hazards, and chemical hazards. Those hazards have the potential for causing injury or illness, therefore they should be eliminated or at least a reduction of their effect should be reached. Noise is one of those hazards and numerous researchers have been discussing this topic. Occupational exposure to extreme noise has been recognized as a very marked hazard encountered in diverse industrial sectors. For example steel factories, stone production plants, and many others all over the world. The current study investigates noise levels and perception among the workers in eleven bakeries in the Gaza Strip, Palestinian Territories. Noise levels were measured using dosi meter. A survey was also used to evaluate the noise perception of workers. 58 workers were involved in the study. The results show that about 70.5 % of the workers are exposed jeopardized to daily noise level higher than the allowed level of 85 dB (A) and 44.83 % of them had never used any earmuffs or earplugs. Only 7 % of the workers were having a training about occupational health and safety. About 50% of the workers experienced a moderate to high degree of noise and were informed about the health effects of noise and ways of avoidance respectively.

It can be concluded the workers within most bakeries are at high risk of evolving permanent hearing loss or additional related diseases due to extreme occupational exposure to noise, and non-use of earmuffs or earplugs. Therefor it is essential to devlop a hearing conservation program in all bakeries. One of its main components is education and training to promote awareness of workers about noise hazards and ways of prevention.

KEYWORDS*: noise levels, bakeries, awareness and practice, occupational health*

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I. INTRODUCTION

Noise is a prominent characteristic of our environment and excessive noise exposure is experienced in a wide variety of occupational settings: mining, heavy and light industry, farming, blue-collar work and nightlife establishments. Noise is one of the most common hazards threatening occupational health and safety. Exposure to excessive noise can result in permanent hearing loss. With the development of industry and mechanization undesired and unavoidable high noise levels were generated in plants. Since the industrial revolution noise has become a constant threat and risk factor. Continuous exposure to permanent high noise levels may lead to enduring hearing loss, which often goes unrecognized because the process is gradual and non-visible. Additional health effects of noise include annoyance, speech interference, sleep disturbance, hypertension and cardiovascular disease, and impairment of cognitive performance [1-10].

Generally, developing countries have not introduced their own guidelines and conventions on occupational health and safety but have adopted these from industrilised countries. However, the exposure limits of industrilised countries are not entirely germane because the working hours, i.e. duration of exposure, in the majourity of the plants and factories in developing countries are 8 - 10 hours a day, six days a week, which is around 25% higher than working hours in industrilised countries [11]. The current study focuses on bakeries in the Gaza Strip. There are around 130 - 150 bakeries within the Gaza Strip. Smaller bakeries employ between four and eight workers while larger bakeries employ more than 40 workers. A total number of between 1200 - 1500 workers are employed.

II. OBJECTIVES OF THE STUDY

The study aims to investigate the noise levels in bakeries, and to evaluate annoyance, awareness and practice among bakery workers in the Gaza Strip, Palestinian Territories. A further goal is to assess the use of Hearing Protection Devicess (HPD) when noise levels are higher than the recommended standard.

III. LITERATURE REVIEW

Numerous studies have been undertaken and published on noise exposure in different occupational environments, that show the negative impact of noise on health, hearing as well as non-auditory effects [1 -13]. While these studies apply to conditions in both developed and developing countries this is the first study to be undertaken in the Gaza Strip.

IV. METHODS, STUDY DESIGN, AND HYPOTHESIS

The study was accompanied in eleven bakeries in the Gaza Strip. The study comprises two parts, measurement of noise levels and a questionnaire.

Sound intensity was measured in dB (A) using a sound level meter, AEMC CA832, (35 dB to 130 dB), conformance to EU Standard. It assesses sound ambiences or annoyances in accordance with international safety and quality standards. The sound level meter was calibrated using a calibration devices C.A. 833. Measures used the dB (A) scale, which approximates reception characteristics of the human ear [13]. The sound level meter was calibrated anew each time a new bakery was visited. The noise levels were measured simultaneously at zero distance (close to the ear of the workers) and at 3 meters from the workers. Table 1 contains the arithmetic mean of five measurements taken at the four different workstations respectively.

A questionnaire was created (Arabic language) to assess workers beliefs and attitudes regarding the risk of hearing loss. The data collection was based strictly on the questionnaire. Oral interviews were not conducted among the workers with the assumption that none of the workers were illiterate. The questionnaire was developed based on the United Kingdom Health and Safety Executive (HSE) with consideration of OSHA standards and criteria (USDOL-OSHA, 2004-2011) and after reviewing questionnaires from previous studies. [14, 15]. The questionnaire design was appraised by experts (language and psychology). The questionnaire comprised two parts, the first containing five descriptive questions and the second nine multiple-choice questions.

In the first section, general information about province, education level, age, and work experience were gathered. Age is categorized in five levels: < 20 to ≥ 50 with three 10 year age ranges between these upper and lower scales. Work experience is categorized in five levels: < 2 years to ≥ 20 years with the three $2 - < 5$, $5 - < 10$ and $10 - < 20$ scales between. Education level has four ordinal categories based on the Gaza Strip education system. The second part of the questionnaire is designed to ascertain subjective occupational risk perception and the use of hearing protection tools (HPT) like earmuffs or ear plugs. This part comprised two sections. The first section attempts to ascertain knowledge of noise exposure with four designed questions (questions 1, 7, 8 and 9) where the responders were requested to express their agreement with statements relating to the workplace in terms of lighting, ventilation, temperature, and difficulty in oral communication. The second section of multi-choice statements assesses the use of hearing protection devicess (HPD) with five designed questions (questions 2, 3, 4, 5 and 6) where the responders were questioned to express their level of agreement with statements regarding: i. personal protective equipment (PPE) is provided, ii. Training and exercise in the correct use of PPE is given, iii. I choose to use PPE because it protects me and gives me a feeling of security, iv. Owner/manager provides workers with periodic medical examination including hearing screening, v. wearing PPE enables me to perform better. Responses were ranked on a 5 point Likert's scale from strongly agree to strongly disagree.

V. METHOD OF DATA ANALYSIS

All collected data were transmitted to an electronic spreadsheet and into the Statistical Package for Social Scientists (SPSS) version 18 and the Microsoft Excel 2010 program for analysis. In order to find any meaningful and statistically significant relationship between variables, different statistical tests were performed.

Hypotheses of the study (Null hypothesis)

1. There is a statistically significant difference at the significance level 0.05 in the opinion of the sample about suffering from noise exposure versus the factor work experience.
2. There is no statistically significant difference at significance level 0.05 in the opinion of the sample about using hearing protection versus the factor work experience.
3. There is no statistically significant difference at significance level 0.05 in the opinion of the sample about suffering from noise exposure versus the factor age.
4. There is no statistically significant difference at significance level 0.05 in the opinion of the sample about using hearing protection versus the factor age.
5. There is no statistically significant difference at significance level 0.05 in the opinion of the sample about using hearing protection versus the factor educational level.

VI. RESULTS

Table 1: **Average of the maximum noise level values (for zero distance and 3 meters away from the workers) at the selected four workstations**

Area	Bakery (X1)		Bakery (X2)		Bakery (X3)		Bakery (X4)		Bakery (X5)		Bakery (X6)	
	Average Noise Level of (dB)		Average Noise Level of (dB)		Average Noise Level of (dB)		Average Noise Level of (dB)		Average Noise Level of (dB)		Average Noise Level of (dB)	
	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings
Mixing	89.92	86.6	85.26	86.38	83.36	82.84	91.84	90.88	85.36	84.88	86.3	92.76
Dividing	88.44	86.34	84.06	85.94	79.54	80.28	86.46	87.84	90.74	86.7	93.76	98.22
Slicing	86.54	86.14	86.86	85.32	80.9	84.12	86.54	88.14	84.68	84.22	86.42	91.66
Baking	86.22	86.44	82.98	82.86	80.84	80.92	87.86	84.56	81.66	81.8	90.06	91.06
Area	Bakery (X7)		Bakery (X8)		Bakery (X9)		Bakery (X10)		Bakery (X11)			
	Average Noise Level of (dB)		Average Noise Level of (dB)		Average Noise Level of (dB)		Average Noise Level of (dB)		Average Noise Level of (dB)			
	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings	Zero distance readings	3 meters distance readings		
Mixing	90.14	87.64	85.46	85.3	80.26	80.86	85.88	83.18	91.16	84.54		
Dividing	88.88	89.56	87.66	83.64	85.16	86.02	84.76	82.54	85.5	83.94		
Slicing	90.78	88.96	85.98	82.42	84.42	83.08	85.66	82.96	87.9	83.36		
Baking	93.94	89.36	82.82	83.66	82.04	83.14	83.12	81.72	86.04	84.92		

Table 1 shows the average of the maximum noise level values (for zero distance and 3 meters away from the workers) at different workstations. Examining the measurements recorded in Table 1 indicate that noise levels exceed the recommended level of 85 dB (A) as an 8-hr TWA at zero distance as well as at 3 m distance in all bakeries except in bakeries (X3) and (X9). In some bakeries, particular measures are below the recommended standard whereas in others noise levels exceed the 90 dB (A) limit at zero and at 3 m distance.

Table 2: Demographics and Characteristics of Study Population

Characteristic	Frequency
Age	
< 20	7
20 – < 30	30
30 – < 40	13
40 – <50	6
≥ 50	2
Educational Level	
Literate	21
Primary and/or Preparatory	21
Diploma	12
University	4
Work Experience	
< 2	11
2 – < 5	16
5 – < 10	19
10 – < 20	7
≥ 20	5

Table 2 shows the demographic aspects of the study population. The age of workers ranges from 18 to 52 years. The majority, 64% (37 workers), of the study population are younger than 30 years and only 14% (8 workers) are older than 40 years. Seven workers are younger than 20 years and 13 workers are between 30 - 40 years old. Regarding their education, the workers are distributed as follows: 36% primary and/or preparatory, 36% secondary, 21% diploma and 7% degree. The majority of workers, 79%, have a current duration of work experience less than 10 years; only 5 workers, 6.82%, have work experience of 20 years or more.

Table 3: Frequencies of reasons for not using PPE

Reason for not using PPE	Frequency	Percentages
Uncomfortable	15	26.0
Not available	24	41.0
Hinders work	19	33.0
Total	58	100

Table 3 displays that 26 % of the workers doesn't wear a PPE because it's uncomfortable, and 41 % of the workers doesn't wear PPE because it's not available, and 33 % of the workers doesn't wear PPE because it's hinder the work.

Statistical Validity of the Questionnaire

To insure the validity of the questionnaire a Pearson Test (Criterion-related validity test) was applied. The test measures the correlation coefficient between each item in the field and the whole field. The Criterion Related Validity test measures the internal consistency of the questionnaire by calculating the correlation coefficients between each paragraph in one field and the whole field. Table 4 below shows the correlation coefficient and p-value for each field item. As presented in the table the p-values are less than the standard $\alpha = 0.05$ cutoff or 0.01, so the correlation coefficients of this field are significant at $\alpha = 0.01$ and $\alpha = 0.05$, so it can be assumed that the paragraphs of this field are consistent and valid and measure what they were assigned to do.

Table 4: The correlation coefficient between each paragraph in the field and whole field

	Pearson Correlation Coefficient	p-value
Work environment		
Q1	0.448	0.01
Q2	0.708	0.002
Q3	0.792	0.005
Q4	0.780	0.000
Q5	0.371	0.000
Q6	0.733	0.000

Cronbach's Coefficient Alpha

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values means a higher degree of internal consistency. As shown in Table 5, the Cronbach's coefficient alpha was computed for the first field of the causes of claims, the second field of common procedures and the third field of the particular claims. The results were in the range from 0.746 and 0.837 and the general reliability for all items equal 0.801. This range is high; that proves the reliability of the questionnaire.

Table 5: Reliability Cronbach's Alpha

Number	Section	Cronbach's Alpha
1	**Q1**	0.813
2	**Q2**	0.768
3	**Q3**	0.746
4	**Q4**	0.757
5	**Q5**	0.837
6	**Q6**	0.763
	Total	0.801

One Sample K-S Test

One Sample K-S test was used to identify whether the data follow a normal distribution or not. This test is essential in case testing hypotheses as most parametric tests stipulate data to be normality distributed. This test is applied when the sample size is greater than 50. The results shown in Table 6 clarify that the computed p-value is higher than the significant level of 0.05 (p-value > 0.05). This indicates that the data are normaly distribution and so parametric tests must be used.

Table 6: One Sample K-S

Number	Section	Statistic	P-value
	Work Environment	0.671	0.759

One Sample T-Test

In the following tables one sample t-test was used to test whether the opinion of the respondent to the content of the sentences is positive (weighted mean greater than "60%" and the p-value less than 0.05) or whether the opinion of the respondent to the content of the sentences is neutral (p-value is greater than 0.05) or whether the opinion of the respondent to the content of the sentences is negative (weighted mean less than "60%" and the p-value less than 0.05).

The results presented in Table 7 show that the average mean for all items equals 3.13 and the weighted mean equals 62.64%, i.e. greater than "60%". The value of t-test equals 1.83 and the p-value equals 0.04, i.e. less than 0.05, which means that the work environment had a statistically significant effect on the workers.

Table 7: One Sample T-Test

Items	Mean	Standard Deviation	Weighted mean %	Ranking	t-value	p-value
Q1	3.40	0.99	67.93	3	3.05	0.00
Q2	3.31	1.16	66.21	4	2.04	0.02
Q3	2.72	1.21	54.48	8	1.73-	0.04
Q4	2.81	1.47	56.21	7	0.98-	0.16
Q5	3.79	1.17	75.86	1	5.18	0.00
Q6	2.57	1.24	51.38	9	2.64-	0.01
Q7	3.59	1.03	71.72	2	4.35	0.00
Q8	2.98	1.33	59.66	6	0.10-	0.46
Q9	3.02	1.18	60.34	5	0.11	0.46
Average	3.13	0.55	62.64		1.83	0.04

a. **There is a statistically significant difference at the significance level 0.05 in the opinion of the sample about suffering from noise exposure versus the factor work experience.**

Table 8 displays the relationship between work experience and suffering from noise exposure. It proves further that the longer is the workexperiece, the higher is the percentage of workers, who are suffering from noise. To test the hypothesis, there is a need to use the one-way-analysis of variance (ANOVA). The results illustrated in Table 9 show the p-value equal to 0.003, i.e. less than 0.05, and the value of F test equal to 4.702, which means there is a statistically significant difference at significanclevel 0.05 in the opinion of the sample about-facing noise exposure versus the factor experience. This result demonstrates that the workers with longer noise exposure (due to longer work experience) are suffering from noise more than workers, who have not alonge work experience.

Table 9: Analysis of noise exposure versus work experience (One -Way ANOVA Test)

Field	Source	Sum of Squares	Mean Square	F value	Sig. (P-Value)
The opinion of the sample about facing noise exposure versus the factor work experience	Between Groups	6.172	1.543	4.702	0.003
	Within Groups	17.390	0.328		
	Total	23.561			

Significance level 0.05

Table 8: Percentage with in suffering of noise exposure versus the factor (work experience).

Work experience	Suffering Noise Annoyance					N	Total
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly disag-ree**		
Less than 2	0%	0%	18.18%	54.54%	27.27%	11	19%
2- Less than 5	0%	25%	31.25%	43.75%	0%	16	27.6%
5- Less than 10	15.79%	57.89%	10.52%	15.79%	0%	19	32.8%
10- Less than 20	14.29%	71.43%	14.29%	0%	0%	7	12.1%
Above 20	60%	40%	0%	0%	0%	5	8.6%
N	7	22	10	16	3	58	100%
Total	12.1%	37.93%	17.24%	27.6%	5.17%	100%	

b. There is no statistically significant difference at significance level 0.05 in the opinion of the sample about using hearing protection versus the factor work experience.

To test the hypothesis there is a need to use the one-way analysis of variance (ANOVA). The results illustrated in Table 10 show the p-value equal to 0.029, i.e. less than 0.05, and that the value of F test equals 2.942. This means, the null hypothesis should be rejected and thatthere is a statistically significant difference at significance level 0.05 in the opinion of the sample about the use of hearing protection versus the factor experience. In other words, this proves that workers with longer work experience are using hearing protection tools or dvices like earplugs or ear-muffs and workers with less work experience are not using the protection tools.

Table 10: Analysis of the use of hearing protection versus the factor work experience (ANOVA Test)

Field	Source	Sum of Squares	Mean Square	F value	Sig.(P-Value)
The opinion of the sample about the use of hearing protection versus the factor work experience	Between Groups	12.948	3.237	2.942	0.029
	Within Groups	58.316	1.1		
	Total	71.264			

Significance level 0.05

c. There is no statistically significant difference at significance level 0.05 in the opinion of the sample about suffering from noise exposure versus the factor age.

To test the hypothesis there is a need to use the one-way analysis of variance (ANOVA). The results illustrated in Table 11 show that the p-value equals 0.326, i.e. greater than 0.05, and that the value of F test equals 1.190. This means there is no statistically significant difference at significance level 0.05 in the opinion of the sample about facing noise exposure versus the factor age. The results confirmed the null hypothesis and give evidene that noise exposure is not related to the factor age.

Table 11: Analysis of noise exposure versus the factor age (One-way ANOVA Test)

Field	Source	Sum of Squares	Mean Square	F value	Sig. (P-Value)
The opinion of the sample about facing noise exposure versus the factor age	Between Groups	2.032	0.508	1.190	0.326
	Within Groups	22.627	0.427		
	Total	24.659			

Significance level 0.05

d. There is no statistically significant difference at significance level 0.05 in the opinion of the sample about using hearing protection tools versus the factor age.

To test the hypothesis there is a need to use the one-way analysis of variance (ANOVA). The results illustrated in Table 12 show that the p-value equals 0.643, i.e. greater than 0.05, and that the value of F test equals 0.631. This means there is no statistically significant difference at significance level 0.05 in the opinion of the sample about the use of hearing protection versus the factor age. It means that workers tend not to wear hearing protection tools, no matter how old they are.

Table 12: Analysis of the use of hearing protection versus the factor age variance (One-way ANOVA Test)

Field	Source	Sum of Squares	Mean Square	F value	Sig.(P-Value)
The opinion of the sample about the use of hearing protection versus the factor age	Between Groups	3.238	0.809	0.631	0.643
	Within Groups	68.027	1.284		
	Total	71.264			

Significance level 0.05

e. There is no statistically significant difference at significance level 0.05 in the opinion of the sample about using hearing protection versus the factor educational level.

To test the hypothesis there is a need to use the one-way analysis of variance (ANOVA). The results illustrated in Table 13 show that the p-value equals 0.400, i.e. greater than 0.05, and the value of F test equals 0.99. This means there is no statistically significant difference at significance level 0.05 in the opinion of the sample about the use of hearing protection versus the factor educational level. This results show that higher educational level does not nesseerly mean, being awre rregarding safety issues and wearing of hearing protection tools (earmuffs).

Table 13: Analysis of the use of hearing protection versus the factor educational level (One-way ANOVA Test)

Field	Source	Sum of Squares	Mean Square	F value	Sig. (P-Value)
The opinion of the sample about the use of hearing protection versus the factor educational level	Between Groups	4.833	1.611	0.99	0.400
	Within Groups	87.080	1.613		
	Total	91.914			

Significance level 0.05

VII. Discussion

Occupational exposure to noise is inescapable in bakeries. A reduction of it might be possible through effective engineering solutions, administrative solutions and/or the correct use of suitable hearing protection tools. Nevertheless effective practice of occupational health and safety had not been fully implemented in most of developing countries, while industrial countries have been practicing occupational safety rules effectively.

The results of the noise measurements show that the equivalent sound pressure level in all bakeries ranged between 80 dB (A) and 98 dB (A) (Table 1). The noise levels exceed the 85 dB (A) threshold limit value (TLV) recommended by the American Conference of Governmental Industrial Hygienists (USA-ACGIH) [23] in seven of the eleven bakeries. 70.5% of the study sample is exposed to daily noise levels above the permissible level of exposure, i.e. 85 dB (A). This high noise level in theese bakeries (X1, X2, X4, X5, X6, X7 and X11) is, apart from X4, due to old machinery. The use of new machines in the other three bakeries (X8, X9 and X10) generates less noise. An additional reason why these bakeries are less noisy than the others is the preventive and frequent maintenance of the machines. A further reason causing the high noise level in the prior seven bakeries is their location in densely built-up neighborhoods. The latter three bakeries are detached and at a distance from built-up areas.

The noise levels described in this study [80 - 98 dB (A)] are familiar with levels known in the literature for steel industries [3, 6, 8, 15, and 16]. In the current study around 44.83% of hearing protection tool (HPT) non-users are exposed to everyday noise level likely to cause noise induced hearing loss [everyday noise level above 85 dB (A)]. Nevertheless, the proportion would be even greater if we take the exposure time into account, which is at least 48 hours weekly in these bakeries and not (35 – 40) hours per week as in the USA and European countries where these standards apply.

The findings of this research show that 70.5% of the bakery workers suffer from high or moderate noise annoyance. It was prevalent among the age groups 30 - < 40, 40 - < 50 and > 50 years and the exposure group of > 5 years. Those results are similar to the study done and published in a small-scale hand devicess manufacturing industry in India, which showed that 62% of workers in building units suffered annoyance from noise, and that it was more frequent among the 30 - 34 age group and the exposure group of 3 - 5 years [15]. Bedi reported a low proportion (42%) of textile workers experiencing noise annoyance [17].

Around 57% of workers participated in the recent study suffered from speaking interference, whereas, in other studies 70 - 95% of workers suffered from talking interference [15, 16, 18].

Employee awareness of health effects of occupational exposure to noise plays a vital role in the prevention of auditory and non-auditory effects. In this study, half the workers (50%) claimed awareness about the health effects of noise. In other studies, 29 - 93% of workers were aware of the health effects of noise [4, 15, 16, and 17]. Svensson et al. states that 95% of the Swedish employees were aware that loud noise could hurt their hearing [18]. In a study in Malaysia, the researchers found that 36% of the noise-exposed workers knew the fact, that exposure to extreme noise results in hearing loss [19]. In this study, almost 50% of the workers were aware of the safety measures protecting workers from noise, in comparision with 92% reported by Ologe et al. [16].

The majority of the workers involved in this study, had proper education and short work experience but that the little of them were conscious of the health effects of noise and of the applicable safety measures which supports the assumption of previous researchers that awareness seems to be resulting from the individual experience of working in a noisy environment for many years rather than from educational know-how [16, 20]. In this investigation, the variables i) educated about the job-related hazards, and ii) joining a training course in occupational health and safety were found to be correlated to the awareness of the workers about the health effects of noise and the safety measures. This study and Ologe et al. agree that both noise irritation and awareness are definitely associated with noise exposure [16].

A further result of this research shows that 55.2% of workers used hearing protection devices (HPD) but only about 31% used them consistently, which is similar to a study conducted among textile industry workers of a weaving unit in Karachi, Pakistan where 55% used hearing protection devicess of whom only 25% used them regularly [4]. However, other authors found that only 5% of workers consistently used hearing protection devices [16, 21]. Ahmed et al. and Samuel et al. respectively report 7% and 24% of workers exposed to noise used hearing protection devices during working hours [5, 22]. A study in a steel rolling mill in Nigeria reported that only 28% of the workers used hearing protection devicess [16], and another study in Malaysia found that only 5% of the workers consistently used hearing protection devices [19].

This study shows that 93% of workers who use hearing protection devices (consistently or periodically) are exposed to noise levels higher than 85 dB (A), and similar results were found in other studies [16, 22]. Surprisingly, in this study around 29.5% of workers exposed to a noise level of 85 dB (A) or less use hearing protection devices. Samuel et al. reports a lower percentage (19%) [22].

This study and Samuel et al. [22] are in accordance that the use of HPD is positively related with noise level but in contrast to Samuel et al. [22] the use of HPD was not interrelated with level of education or age.

The greatest causes given for not wearing hearing protection devices in this study were unavailability or discomfort. Other studies report discomfort, unavailability and carelessness as obstacles for not using hearing protection devices.

The results of the recent study that the use of HPD and noise annoyance are dependent and there is a positive relation between noise annoyance and usage of HPD among workers exposed to high noise levels is consistent with that reported by Samuel et al. [22], and supports their recommendation that the factor noise annoyance should be combined into all future studies regarding the use of hearing protection devices. In contrast to Samuel et al. [22] no relation was found between noise annoyance and hearing protection devices usage among employees exposed to a noise level at or lower 85 dB (A).

When workers are aware of the hazardous effects of noise exposure they can actively develop coping strategies. A dialogue with management is one possibility. However, individual strategies are limited. Trade unions can play an important part.

Specification / Characteristic of Sampling Sites and limitation of the study

Based on the current study observations, all bakeries have an over-crowded layout of machines in a confined indoor area, and the production processes are carried out adjacent to each other without barriers between the noise source and the workers. Generally, in each bakery different sorts of machine work simultaneously. The number of workers in the small bakeries varies between four and eight, whereas in the larger bakeries the number of workers varies between 30 and 50 per shift. They work more than 48 hours weekly. Some bakeries have old machinery which generates high noise levels. A few bakeries are modern and have relatively new and quieter machines.

VIII. CONCLUSION

The results of this study undoubtedly reveal that the workers in most of the bakeries are at high risk of developing noise induced hearing loss (NIHL), noise irritation, and other allied illnesses due to extreme occupational exposure to noise, and the non-use of hearing protection devices (HPD). Greater number of the workforce is unaware about the health effects of noise and ways of avoiding them and only some employees wear hearing protection devices.

Awareness was definitely connected with noise exposure, and there was a relationship between noise annoyance and noise level, which could have negative effects on the workforce, if they do not use hearing protection devices.

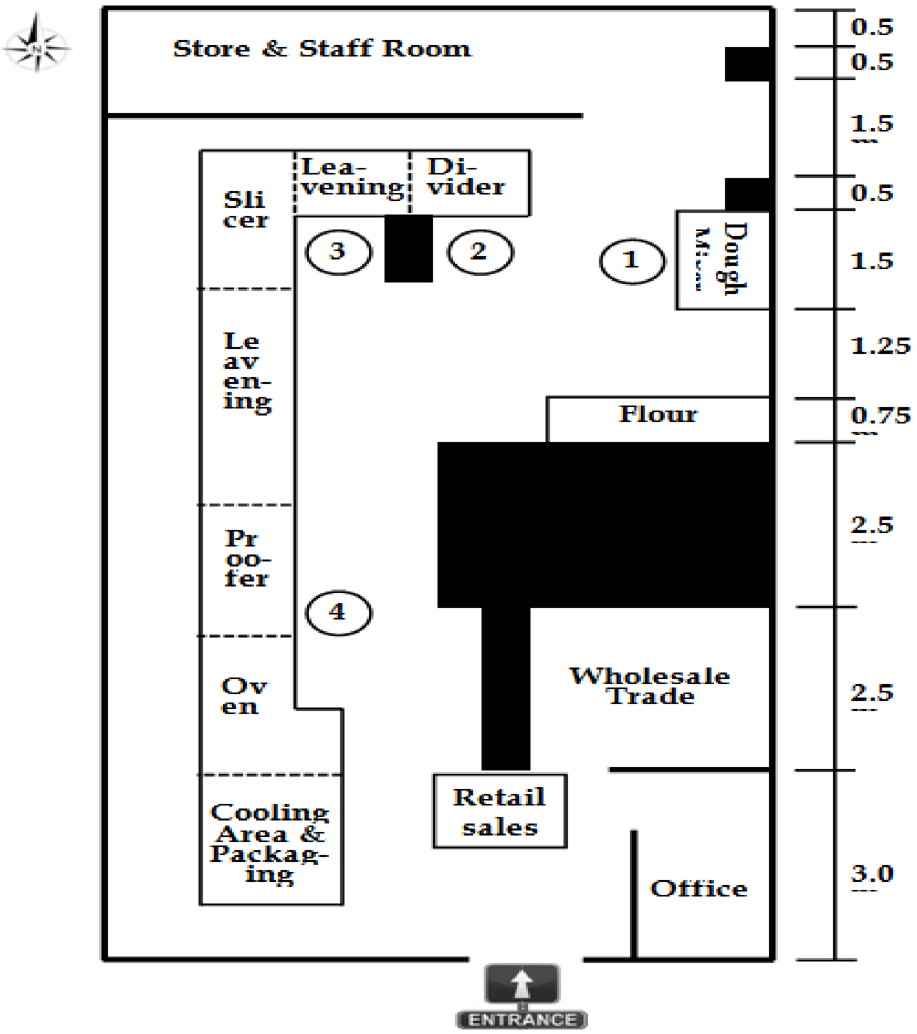
To avoid occupational injury due to extreme noise exposure, noise levels should be controlled and reduced to a tolerable level. The ideal way of controlling noise level is to decrease the noise level at source, but where the technology cannot adequately control the problem or when cost is too high, administrative solutions such as separating quiet areas from noisy areas and job rotation, or personal hearing protection such as earmuffs or ear-plugs are an alternative [22].

RECOMMENDATIONS

Depending on the results of the recent study, the following recommendations could be taken into account to overcome the current situation:

1. Identifying and quantifying the noise exposure experienced by workers, should be determined. It must be made clear that the risk of hearing loss does not only depend on the noise levels themselves but also on duration of exposure. If the noise dose (the measured Sound Exposure Level normalized to an 8-hour working day) is greater than 85 dB (A), noise control / reduction measures should be applied.
2. Engineering control should be the first line of defense against hazardous industrial noise exposure, such as substituting or changing noisy machines, better fitting and maintenance of machines, and where required, enclosing and/or separating all noise sources.
3. The developing of a noise map where lines can be sketched connecting points of equal noise level, i.e. a graphic representation of the sound level distribution existing within a bakery, identifying hazardous areas.
4. If difficulties to reduce noise are faced, it is imprtant to ensure the protection of workers exposed to hazardous noise is guaranteed.
5. It is very important to test the hearing capacity of the workers occasionally as this is the best way to be sure that the implementation of any industrial hearing conservation program will be successful.
6. Enact legislation to ensure that at the recommended level of 85 dB (A) hearing protection devices would be be worn and suitable training and supervision is to be provided for their use.

Diagram 1: Simple layout scheme representing machine layout in most bakeries



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