PHYSIOLOGICAL AND PSYCHOLOGICAL IMPACTS OF NOISE POLLUTION ON THE WORKERS; A CASE STUDY IN TEXTILE MILLS OF MULTAN, PAKISTAN

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ABSTRACT: Exposure to workplace noise pollution is becoming a serious concern especially in developing countries. The present study is aimed at the occupational noise exposure in the textile mills and evaluating the noise exposure and its detrimental consequences on the health of the workers in particular physiological, and psychological impacts. Two textile mills in Multan, Punjab were carefully chosen for that purpose. The chief objective was to assess the intensity of noise in the different units of the selected textile mills and its impacts on employee's health. Data was collected through a cross-sectional survey of workers conducted via questionnaire and interviews. A DT-8850 digital sound level meter was used for the measurement of the intensity of noise in the various sections of the textile mills. The maximum, minimum, and average value of noise in the mill I was 103.5dBA, 101.5dBA, and 102.5dBA, while in mill II the values were 104.2dBA, 102.5dBA, and 103.3dBA. The results showed that the occupational noise pollution is having an impact on physiological and psychological health of the industrial workers. Survey results showed the lack of awareness and practicing of safety equipment. 62.5% of the respondents complained about the noise in the workplace as a problem while a significant percentage of the respondents experienced disturbed sleep patterns, poor communication, frequent headaches, respiratory problems along with escalating blood pressure and ultimately upsetting of their overall performance. The results draw attention to the serious concern that is required in this matter of safe workplace environment in developing countries like Pakistan.

Keywords: Occupational Safety, Noise pollution, Textile mills, Workers, Industries, Hearing loss.

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INTRODUCTION

Noise can be termed as undesirable sound it is known as an environmental stressor and nuisance. Inside and outside the workplace noise is considered as hazard(Smith and Broadbent, 1992).Development of industries and invention of modern mechanized machines have noticeably abridged the load of work on employees furthermore it has amplified the productivity of industries. One of the greatest undesirables and inevitable by-products of these machines and operations is noise pollution (Bedi, 2006). Noise may cause psychological and physiological effects on workers depending upon its quality,level, and duration of exposure (Bedi, 2006).

Hearing loss is the major impact arising from noise pollution and varies from person to person in terms of level, frequency, pitch, and duration of the noise different.Noise is the major cause of hearing disability in Pakistan, and industry is the key source of hearing impairment(WHO,1997).Noise hearing loss is identified as the 3rd epidemic as it can induce physiological and psychological disruption in the world (Yuen, 2014).There are different types of hearing loss, such as acute, chronic, and acoustic hearing loss. In industrial sectors, the heavy machineries generate high level of noise and disturbs the performance of the workers and affects the health. Sometimes accidents occur due to the high level of noise. Occupational noise is the main hurdle among the people because the occupational noise disturbs the good communication (Zhao *et al*, 1991).According to the statistical report,600 million employees are subjected to occupational noise worldwide(HSME magazine, 2012).

Noise exposure trigger offnumeral physiological reactions mediated by autonomic nervous system on short-term basis. Exposure to noise leads physiological activation which includes increase in heart rate, blood pressure, and peripheral vasoconstriction. There is abrupt habituation to short-term noise exposure but habituation to long-term noise exposure is less certain (Vallet et al., 1983). The powerful evidence for effect of noise on cardiovascular system originates studies of blood pressure in occupational settings (Thompson, 1996). Many occupational studies have recommended that individuals which are persistently exposed to constant noise at levels of 85 dBA tend to have high blood pressure than others who are not subjected to noise pollution (Lang et al., 1992).

High noise levels aren't usually considered a concern in the textile industry. The noise from the jangle of gears, the high-velocity whine of the rotating machines and the strong noise of the looms is known to be the trade's necessary evils. Using old machines is another

explanation. In developing nations, the equipment being used is unchanged from the designs of 20th century. The only thing that has improved is the working pace of the machines which could've increased the noise level; in most of operations it is exceeding 110 dBA. Textile industries normally pays no attention in reducing the noise, despite the fact that weavers and spinners suffer from significant hearing loss as compared with controlled population. The noise levels usually range from 100 to 110 dBA in textile industries and rarely noise control approaches are implemented in these industries (Bedi, 2006). Studies reveal that over 30% of the textile employees are imperiled to noise levels surpassing the 90 dBA (Yhdego, 1991).Exposure to such noise level causes sleep disturbance which is proportional to level of noise to which an individual is exposed(Ohrstrom, 1989).Many other consequences include nausea, headaches, mood swings, argumentativeness, and anxiety. (Thompson, 1996).

The goal and intent of this research is to assess the level of noise and its physiological and psychological effects on the health and work performance of the employees and to explore the understanding of the attitude of workers toward health and safety practicesin selected textile mills in Multan. Two textile mills in Multan region, which are considered as one of the prime producers and exporters of textile merchandises in Pakistan, were carefully identifiedand chosen for the study.

MATERIALS AND METHODS

The aim of the intended study was attained through a carefully designed questionnaire. The questionnaire contained five major sections, 1) personal information (age, sex and name), 2) occupational status (education level, profession, working hours and previous employment), 3) physiological impacts experienced(hearing impairment, blood pressure), 4) psychological impacts experienced (tension, sleep annoyance, irritation), 5) use of personal protective equipment. All sections entailed multiple questions.

Two textile mills in Multan were selected to carry out the research. A combined total of 80 workers out of 200 was selected from all the sections of the mills to ensure the true representativeness of the population. Names of the textile mills were held unspecified as per the ethical consideration by assigning them the name of Mill I and Mill II respectively.Employees were interviewed individually for filling out questionnaires since most workers were illiterate and couldn't fill questionnaire on their own.

The sample size was calculated through following formula

$$\text{Sample size} = n/N \times 100$$

n = Number of workers effected by noise, N = Total number of workers in the mills

Calculation of high level of noise in the textile mill

$$SPL_{average} = SPL_{max} + SPL_{min}/2$$

SPL = Sound pressure level, $SPL_{average}$ = Average sound pressure level,

SPL_{max} = Maximum sound pressure level, SPL_{min} = Minimum sound pressure level

Calibrated DT-8850 digital sound level meter was used to measure the sound levels in different sampling points. All readings were carried out using ASTM E1686 – 16 standard procedures. Readings were recorded by holding the sound level meter at a height of 1.5meter from the floor of the operational area. The DT-8850 digital sound level meter assesses the intensity of noise. The range of the sound level meter is between the 30dBA to 130dBA and is ideal for the measurement of noise.

The collected data from survey, was analyzed statistically using SPSS version__. Final outcome was achieved through the use of descriptive statistics.

Any kind of biasness was avoided during the study, from designing the questionnaire to the final analysis of the statistical data.

RESULTS AND DISCUSSION

The average measurement of intensity of noise through digital sound level meter at Mill I was 102.5dBA, with a minimum and maximum of 101.5dBA and 103.5dBA respectively. The average intensity of noise at Mill II was 103.3dBA, with a minimum and maximum of 102.5dBA and 104.2dBA respectively.All the readings were exceeding the permissible limit of 85dBA.It can be stated that operational atmosphere is deafening atmosphere after the measurement of the noise intensity. A comparison has been plotted between the intensities of the noise. (Figure1).

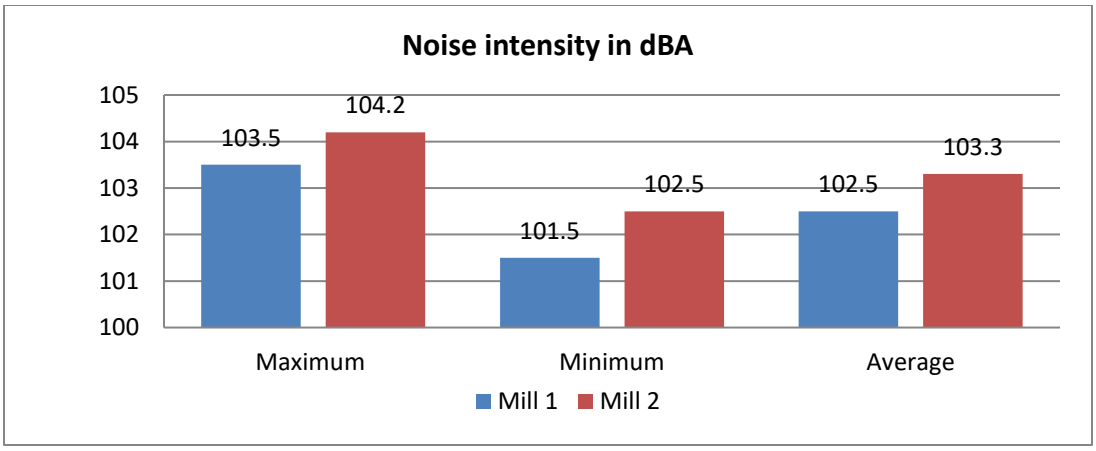

Figure1. Comparisons between the readings of two mills

Noise level in Different Sections: The proposed National Environment Quality Standard for noise in industrial area is 85 dB (A) for 8 hours working period in a workplace.

The data was analyzed through SPSS software by taking mean, median and Std. Deviation, (speech interference, annoyance, headache, sleep annoyance, tension, nervousness, irritation, and depression (Table 2).

Mostly workers were uneducated and were not aware of the use of hearing protection equipment. Statistical analysis of responses to the questionnaires is given (Table 3).

Table1. Noise level in different Sections.

Sr. No	Sections	Reading Observed (dB) Mill I	Reading Observed (dB) Mill II	Required Standard for 8 hours dB(A)	Remarks
1	Blow Room	88.1	89.3	85	High
2	Carding	91.6	90	85	High
3	Drying	91.6	94.5	85	High
4	Simplex Mixture	90.3	98.7	85	High
5	Ring department	99.3	102	85	High
6	Auto-Cone	99.5	100	85	High
7	Winding	95.8	99.3	85	High
8	Packing	88	90	85	High
9	Power Plant	100.8	103.1	85	High

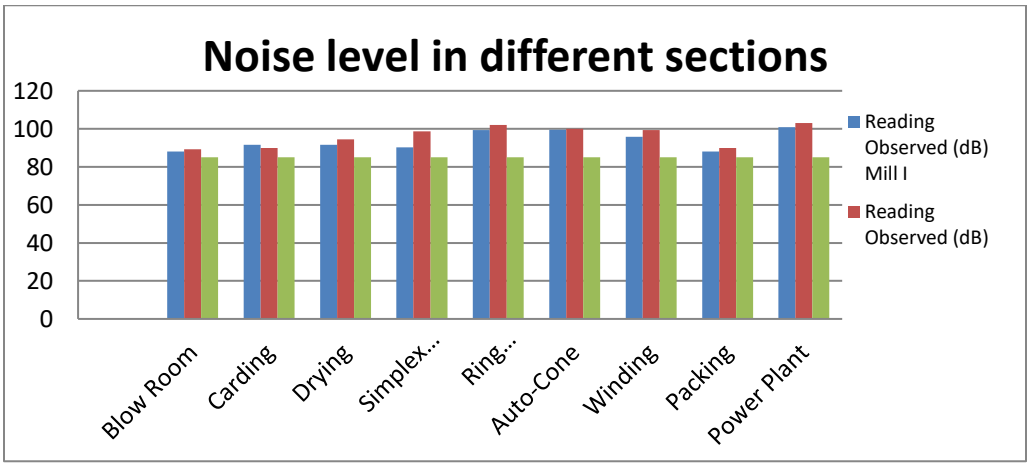

Figure 2. Noise level in different sections

Table 2. Impacts related to the Occupational Noise.

Response	Speech interference	Annoyance issue	Headache issue	Sleep annoyance	Tension	Nervousness	Irritation	Depression
Mean	1.1250	1.2500	1.1500	1.5000	1.6250	1.5625	1.2500	1.3750
Median	1.0000	1.0000	1.0000	1.5000	2.0000	2.0000	1.0000	1.0000
Std. Deviation	0.33281	0.43574	0.35932	0.50315	0.48718	0.49921	0.48718	0.48718

Table 3. Awareness related to the use of hearing protection equipments.

Response	Do you feel hearing loss	Do you have respiratory issue	Knowledge about the useof hearing protection use	Use for the hearing protection	Monthly checkup of your hearing
Mean	1.7000	1.1875	1.9500	1.9500	1.8750
Median	2.0000	1.0000	2.0000	2.0000	2.0000
Std. Deviation	0.46115	0.39277	0.21932	0.21932	0.33281

Almost all the 80 workers reported some kind of physiological and psychological impacts experienced by them on routine basis. 70out of 80 workers(87.5%) reported difficulty in effective communication with new worker or visitor.60 out of 80 workers (75%) reported irritation as a psychological impact caused by high noise during working hours. 68 workers out of 80 workers(85%) reported frequent spells of headaches caused during working hours. Out of these 80 workers, 50 (62.5%) reported depression issue as the psychological impact affecting their routine life and social interactions. Escalation of blood pressure and respiratory problems was another impact highlighted by the workers. Out of 80 workers, 65 (81.25%) reported increase in blood pressure level since they started working in the selected textile mills.

The major problem of noise pollution; decrease in hearing capacity was reported by 56 (70%) workers while 40 (50%) workers reported about the disturbance of sleep patterns and 45(56.25%) reported nervous problems like sudden anger and mood swings. The results evidently presented that the noise pollution was having a detrimental outcome on the overall work performance of the workers and was negatively affecting their daily lives and social relationships. (Figure3) presents an overview of all the physiological and psychological impacts experienced by the selected sample of the population.

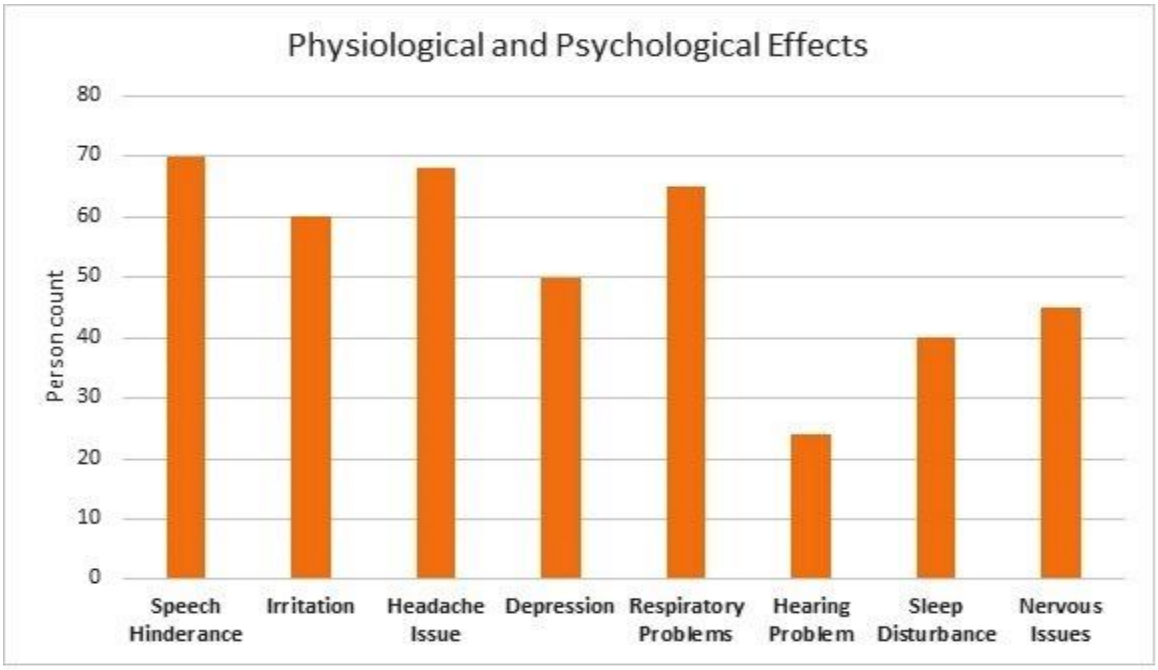

Figure 3. Physiological and psychological impacts experienced by workers

According to the results, Difficulty in the effective communication (87.5%), Irritation (85%) and increase of blood pressure (81.25%) were the dominating impacts reported by the workers. 95% of the workers were not aware about the noise protection equipment. Only 5% workers were aware about the importance of safety equipment and were using the protection against noise. As most of the workers were uneducated, they were unaware of the importance of use of noise protection equipment while some of them refused to use the protection because they did not feel comfortable wearing the protection equipment. This bewildering percentage draws attention to the need of education that is vital for the safety of workers in the workplace.

The impacts of occupational noise pollution in the developed countries are decreasing as the awareness about the protecting equipment is on the rise and becoming an essential part of the industrial sector. On the contrary, as the demand of industrialization is increasing in the developing countries, the impacts of noise pollution in workplace are surging high as there is less importance given to the occupational safety. Noise pollution being the only factor that disrupts the psychological health of the worker is almost always neglected. Previously, researches have been carried out on the effects of occupational noise pollution in Pakistan and across the borders with the similar purpose of identifying health effects of noise in workplace and highlighting the need of awareness about the noise safety practices.

The results of our study; blood pressure increase, irritation, trauma, and fatigue from occupational noise were in accordance with as reported by Buksh *et al.*, 2018.Subramaniam *et al.*, 2019 also pointed out in his study that majority of the workers in the textile industry suffered some kind of hearing impairment at one stage or another. Ahmad *et al.*, 2016 tried to point out the importance of safe and healthy environment in the workplace. His results highlighted that a comparatively safe and quite environment increases the productivity and overall performance of the workers and is preferred by the textile workers. Roozbahani*etal.*, 2009 went a step ahead and pointed out which units of the textile industry caused more hearing loss. He used audiometric test to identify the hearing loss in workers working in different sector. His findings stated that hearing loss predominantly occurred in the labors who were at work in theweaving and spinning units while Abbasi *et al.*, 2010endeavored to categorize the health effects of noise and provide a more applicable strategy to curtail these effects in a prepared way in textile industries of developing countries. His research work suggested that the numeral of looms operated by one worker, integer of machinist in one unit and quantity of technology in one component could minimize the effects.

Conclusions: Occupational noise is a serious health concern and it should be given prime importance in occupational health and safety practices as it can leave the employees with psychological impacts and should be handled accordingly especially in industries like textile where heavy machineries which produce high intensity noise are present and workers have to work in the vicinity of these heavy machineries. The chief purpose of this study was to highlight the attention that is required in occupational practices in countries like Pakistan. Extensive literature and scientific evidence are present which demands the precautionary measures to be put in practice by the industries and monitored by the Government. Industrial noise should be curtailed by engineering methods in the first place along with noise absorbent materials used in the walls of textile mills. Awareness workshops about protective equipment like ear plug and earmuffs should be conducted on regular basis and penalties should be put in place for any violations.

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