

Industrial Noise Pollution and its Impacts on Workers in the Textile Based Cottage Industries: An Empirical Study

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ABSTRACT

This study includes the research work which was carried out to investigate the range of difficulties faced by the workers and its effects on them while working in textile based cottage industries along with their causes. This research provides necessary tip-offs to solve those problems in a systematic way. Therefore, it was considered to know the number of machines (looms) operated by one worker, number of machines in one unit and number of operators in one unit.

The minimum and maximum noise levels were recorded by using digital sound level meter to compute average noise level/ unit. To identify the health problems like respiratory, hearing/listening, irritation, heart/BP, annoyance and headache faced by the workers, the survey was conducted.

In present research work the minimum noise recorded was 101.6dB (A) and maximum as 109.8dB (A), which was compared with OSHA and WHO (World Health Organization) standards. Result of this study shows that due to high intensity of noise generated by looms and dusts at work places, workers were facing the mental and physical problems.

Key Words: Industrial Noise Pollution, Impacts, Workers, Textile, Cottage Industries.

1. INTRODUCTION

Human being is considered as a hungry of needs and demands, if one need is fulfilled another is developed. Needs and demands can be ignored, but necessity can never be ignored in any corner of the world. Necessities are basic needs of human being (i.e. Food, shelter and health). World seems to be fighting with each other for their needs and rights, but it is generally ignored in their own countries. At one side medical sciences spending lot of time and efforts to cure health problems, whereas health is becoming major issue because

today with increasing number of industries and vehicles in the world the noise problem has been increased. Particularly in the urban areas throughout the world, this problem is increasing day by day due to urbanization of heavy industries, construction, huge traffic, recreational centers etc; becomes the major source of noise generation. Developed countries in particular and developing countries in general have established their noise control standards, which are followed and implemented to protect their people from the adverse effects/impacts of noise.

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1.1 Nuisance of Noise

Industrial noise is one of the most wide spread source of noise nuisance in the industrial areas of Pakistan. The noise annoyance among the workers of textile industries due to noise exposure is common to all workers, there should be industrial noise exposure criteria based on annoyance rather than hearing damage criteria [1]. The noise control measures adopted in textile industries ranges from 100-110 dB (A) and pointed out that very few noise control measures are adopted in these industries [2]. The occupational noise exposure of workers in textile industries in Tanzania, more than 30% of workers were exposed to noise exceeding permissible noise exposure i.e. 90 dB (A) [3]. The various aspects of noise pollution in textile industries in India, there were high noise levels in different sections of textile industries ranging from 90-106 dB (A), which was harmful to the workers [4]. Research in two textile industries located in India with specific reference to noise exposure and its effects on workers exposed to different levels of occupational noise, the noise level was more than the permissible limits of noise i.e. 90 dB (A) for 08 hours allowed by OSHA [5]. No survey has so far been undertaken by any public or private sector agencies of Pakistan to collect data about the noise levels in the production departments of the textile industries [6].

1.2 Effects of Noise Pollution

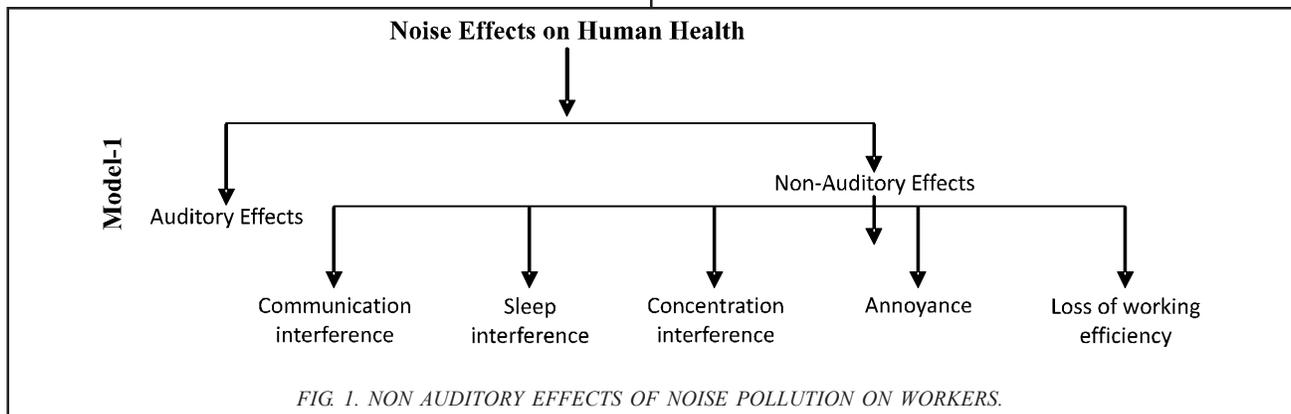
Noise is one of the major pollutants in the urban areas of Pakistan. Depending upon the level, quality and exposure of noise duration, it may adversely affect on the health

of humans. These effects can be for the short-term exposure to intense sound or continuous exposure to the less intense of noise levels. The result of exposure of noise can cause reduction in output of work, lack of efficiency, impairment of hearing and feeling of annoyance etc. Studies on human working in noisy environments indicate that there are Heart disease problems, Accidents at work place, Irritation, Speech interference, Headache problems, Respiratory problems, Nervous problems and many physiological and psychological problems [7]. Occupational noise exposure and noise-induced hearing loss both interfere with the safety of industrial daily life. Of particular significance, is the finding that working in places here daily doses of noise exposure exceeds 89 dB (A) is more hazardous even for those suffering from mild noise induced hearing loss [8].

1.3 Auditory Effects

Fig. 1 reveals that any effect of reduction in hearing sensitivity is generally called as "hearing loss". There may be many causes of hearing loss, but the main cause is the result of intense exposure of noise. Personal noise exposure level and higher pre-shift hearing impairment are important causes which affects on the TTS values in the workers [9].

The noise can affect the human ears in mainly three ways. It can deafen or damage the hearing capability instantaneously, it can severally reduce the sensitivity of ear to the sounds of certain frequencies over a period of



time, and it can numb the human ears for a limited period of time and return to the normal position within minutes, days or weeks depending upon the intensity of noise. If the human ear is exposed to high intensity of noise for shorter period of time, a test of sensitivity of ear should be taken immediately after the exposure reveals a small hearing loss known as TTS (Temporary Threshold Shift). The hearing threshold is the lowest sound pressure level, which can be detected by the subject, and this may rise up to 20 dB at certain frequencies even after relatively short exposure. Fortunately, the phenomenon is temporary in nature, the ear recovering its original sensitivity after a relatively short time, any PTS (Permanent Threshold Shift) being too small to measure. However, as the level and exposure duration of noise increases, the TTS and length of time increases to cover from it. In the modern society the noise is the most undesired and unavoidable because of the mechanized operations. It not only creates the hurdles in the communication but depending upon the level, quality and exposure of duration may result in different types of physiological, physical and psychological effects on the human health, like accident at workplace, efficiency with which tasks are performed, impairment of hearing, work interference, cancer and heart diseases etc [10]. Unfortunately a large number of workers work in factories and workshops, where noise levels are very high and when exposure of noise is for 08 hours/day regularly the effects cease temporarily. A permanent hearing loss develops, and by time it becomes severe to make normal conversation very difficult to hear and this leads to chronic disability and damage becomes permanent and irreversible.

1.4 Non-Auditory Effects

The noise has direct and specific effects on human health and indirect disturbance effects on sleep. Fig. 1 shows that due to noise there may be large number of physiological and psychological effects on human health and can act and interact with other stress factors. The level of noise at which the physiological noise effects

begin to occur varies according to the physiological functions but few changes of significance are induced by noise less than 70 dB (A). A damage risk criteria ranging from a level of possible physiological reaction at 60 dB (A) to a possible beginning of injury as 95dB (A) [11]. Non-auditory effects, from a physical point of view may be regarded as occurring in three stages by different physiological mechanism. The most important among these stages is the rapid tensing of muscles at the sudden onset of a noise. This tensing is followed by slight slower effects which are mediated by automatic nervous system producing changes in the heart rate, volume of respiration, blood vessel diameter secretion etc. Non-auditory effects include communication interference, sleep interference, concentration interference, Annoyance and loss of working efficiency.

Medical investigations have proved that noise can cause physiological stresses like blood pressure and increase heart beat rate. Noise also disturbs sleep and cause speech interference. A sound receiver human ear has to work under a wide range of conditions. Under unfavorable conditions like excessive noise the hearing mechanism of human ear could be damaged permanently or temporarily depending upon the type, intensity and duration of exposure to noise. Noise can adversely affect the performance of any person during his working, problem solving, reading or doing any sort of work, it can even lead to the accidents. Noise intensity above 80 dB (A) may increase the aggressive behavior of human being.

1.5 WHO Guidelines for Environment Quality Standards

The role of WHO about the control of noise pollution is noteworthy. Although WHO is not an authority to prescribe the limits of noise, it recommends some permissible limits of noise, which are just advisory for its member states.

WHO guide line values are given in Table 1 and are organized according to specific environments when multiple adverse health effects are identified for a given environment, the guideline values are set at the level of the lowest adverse health effects. The guideline values represent the sound pressure levels that affect the most exposed receiver in the listed environment WHO recommendations [12].

1.6 Environmental Quality Standards of Pakistan

Industrial operation is one of the most widespread sources of noise pollution in towns/cities of Pakistan but, there is no any legislation regarding noise standards. Public complaints on noise pollution are often received in the federal PEPA (Pakistan Environmental Protection Agency) and provincial SEPA (Sindh Environmental Protection Agency), but in the absence of the national standards of noise, these agencies cannot take any legal action against noise producing sources. PEPA was established in 1997. By exercising its powers under clause (d) of section 6(1) of Pakistan environmental protection Act 1997, the PEPA has established NEQS (National Environmental Quality Standards) for Motor Vehicle Noise only. According to NEQS, maximum limit of vehicular noise is 85 dB (A) at the distance of 7.5m from the source [13].

2. RESEARCH METHODOLOGY

The research methodology employed here was based on data collection through questionnaire and interviews. The objectives of the study were to investigate the different noise levels in different numbers of textile looms by recording of noise level using digital sound level meter AR-824, at the site of the study and to identify its effects on worker's health by comparing the noise levels with WHO and OSHA guidelines. As far as the parameters of the questionnaire were concerned, the number of workers working and number of looms present in the same premises has been taken into consideration during study to know the health hazards. In order to make assessment of prevailing industrial noise pollution of textile based cottage industries located at Kundanpur Mohalla, Tando Adam. There were about 200 textile-based cottage industries having different number of machines (textile looms) installed in the residences/cottages of the people and were operated round the clock. Survey was conducted in 40 units (20%) of different categories of textile looms to record the industrial noise levels and to get the personal opinion of the workers regarding their feelings and difficulties due to high occupational noise levels and its pollution. Finally the mitigation plan/recommendations have been given to solve/reduce the problems.

TABLE 1. WHO GUIDELINES FOR ENVIRONMENTAL QUALITY STANDARDS

Specific Environment	Critical Health Effects	Allowable Noise Level (dB)	Time Duration (Hrs)
Outdoor living area	Serious Annoyance Day time	50	16
Indoor, Inside bed room	Moderate Annoyance	Day time	16
		Night Time	08
Outside bed room	Sleep disturbance, window open	45	08
Class room	Disturbance of information, message communication	35	During class
Hospital ward room	Sleep disturbance	Night time	08
		Day time	16
Industrial, commercial, shopping and traffic areas	Hearing impairment	70	24
Public address indoor and outdoor	Hearing impairment	85	01
Music through head phone	Hearing impairment	85	01

3. RESULTS AND DISCUSSION

It was observed in the surveyed area that there were four categories of textile-based cottage industries as mentioned:

- (1) Category-A: Having 04 looms operated by 01 worker.
- (2) Category-B: Having 08 looms operated by 02 workers.
- (3) Category-C: Having 12 looms operated by 03 workers.
- (4) Category-D: Having 16 looms operated by 04 workers.

A sample of 10 industrial units was considered for study from each category and total of 100 workers were involved in one shift (10 workers in Category-A, 20 workers in Category-B, 30 workers in Category-C, and 40 workers in Category-D). The noise level of studied units has been summarized and statistical technique Mean has been used to work-out the average noise level of all categories of surveyed textile units.

Fig. 2 shows that in Category-A the minimum noise level was recorded as 101.7dB (A), maximum 103.4dB (A) with

an average of 102.45dB (A). In Category-B, the minimum noise level was recorded as 101.6dB (A), maximum 107 dB (A) with an average of 104.1 dB (A). Similarly in Category-C, the minimum noise level was recorded as 106.7 dB (A), maximum 109.3 dB (A) with an average of 108.15 dB (A). In Category-D, the minimum noise level was recorded as 107.6 dB (A), maximum 109.8 dB (A) with an average of 108.78 dB (A).

3.1 Problems Faced by the Workers Due to Noise Pollution

To know the problems faced by the workers due to noise pollution, it was observed during survey of the units and interviewing with the workers that most of the workers were either un-educated or primary educated and very few were matriculate or intermediate. Due to negligible education these peoples were very much reluctant to undertake measures to protect themselves from the consequences of high noise levels. The information which was provided by the workers regarding the problems, they were facing due to excess noises of the machines and other factors is reflected in Fig. 3.

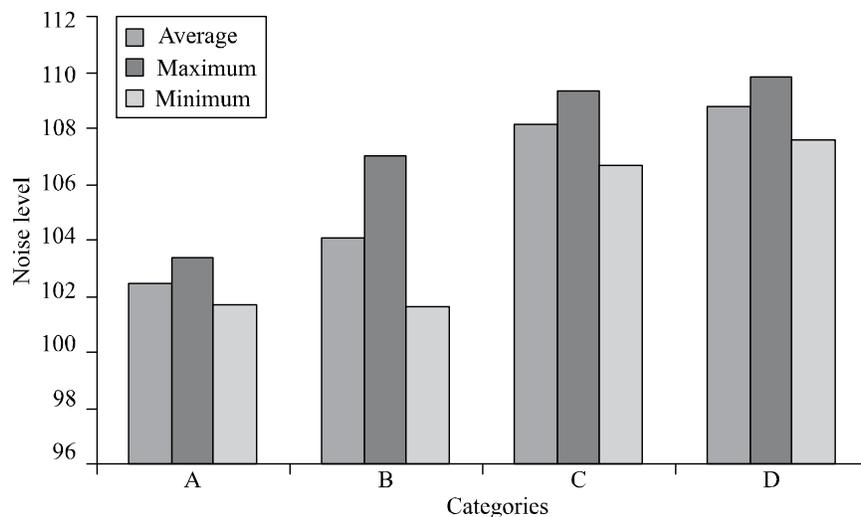


FIG. 2. NOISE LEVEL (dB)

3.2 Speech Interference, Irritation and Hearing problems

Fig. 3 indicates the response of the workers of all categories regarding speech interference, irritation and hearing problems faced by them.

It has been observed that all (100%) workers in all categories were facing problem of speech interference. In Category-A 03 (30%) workers were facing irritation problem and 02 (20%) workers were facing hearing problem. In Category-B, 05 (25%) workers were facing irritation problem and 06 (30%) workers were facing hearing problem.

In Category-C, 10 (33%) workers were facing irritation problem and other 10 (33%) workers were facing hearing problem. In Category-D, 14 (35%) workers were facing irritation problem and other 14 (35%) workers were facing hearing problem.

3.3 Respiratory and Heart/BP Problem

Fig. 4 reflects that in Category-A, 04 (40%) workers were facing the respiratory problem and 02 (20%) workers were facing heart/B.P problem. In Category-B, 08 (40%)

workers were facing the respiratory problem and 05 (25%) workers were facing heart/BP problem. In Category-C, 13 (43%) workers were facing the respiratory problem and 08 (27%) workers were facing heart/BP problem. In Category-D, again 17 (43%) workers were facing the respiratory problem and 11 (27%) workers were facing heart/BP problem.

3.4 Annoyance Problems

Fig. 5 shows the response of the workers of all categories regarding their annoyance problem due to noise pollution faced by them. In Category-A, 03 (30%) workers were very annoyed, 04 (40%) workers were annoyed, where as 03 (30%) workers were not facing the problem of annoyance. In Category-B, 07 (35%) workers were very annoyed, 08 (40%) workers were annoyed, and 05 (25%) workers were not facing the problem of annoyance. In Category-C, 12 (40%) workers were very annoyed, 14 (47%) workers were annoyed, and only 04 (13%) workers were not facing the problem of annoyance. In Category-D, 16 (40%) workers were very annoyed 19 (48%) workers were annoyed, and only 05 (12%) workers were not facing the problem of annoyance.

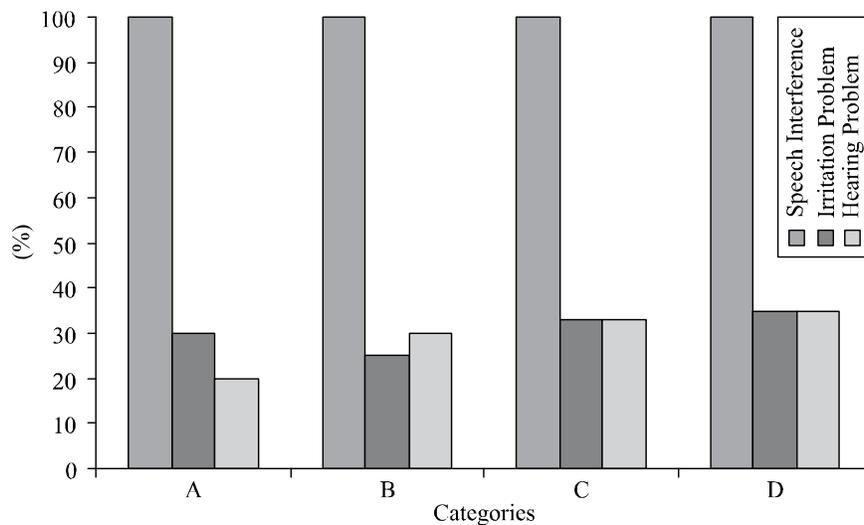
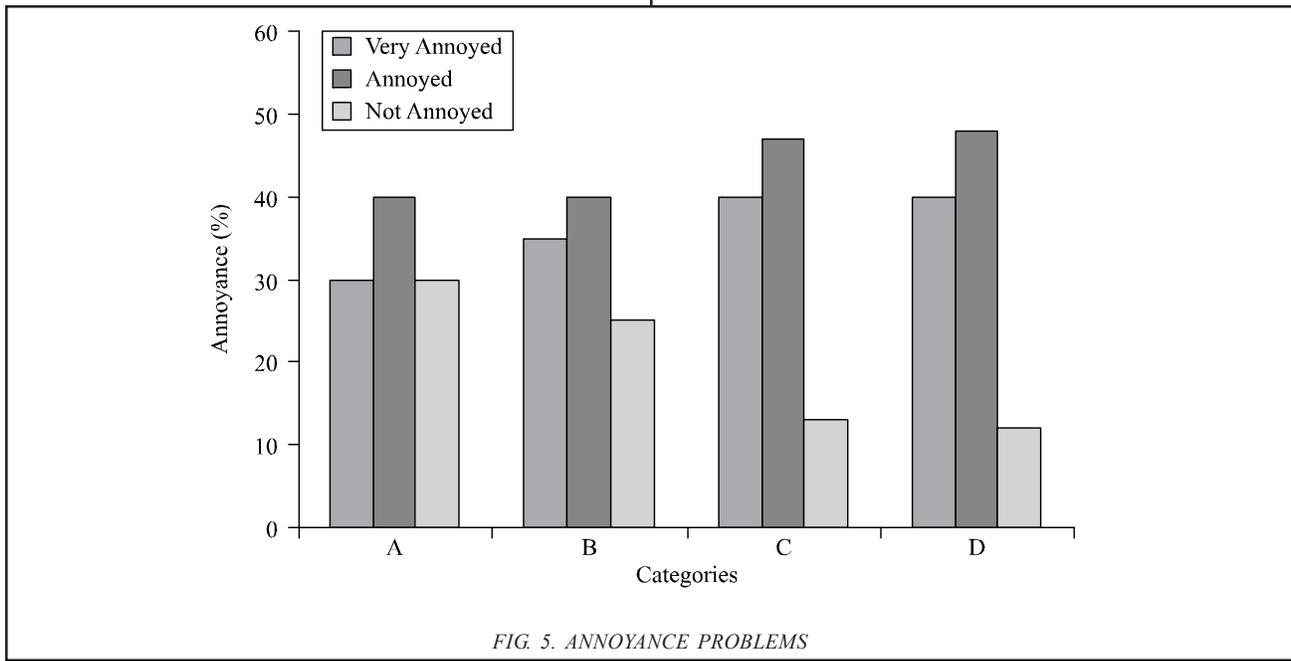
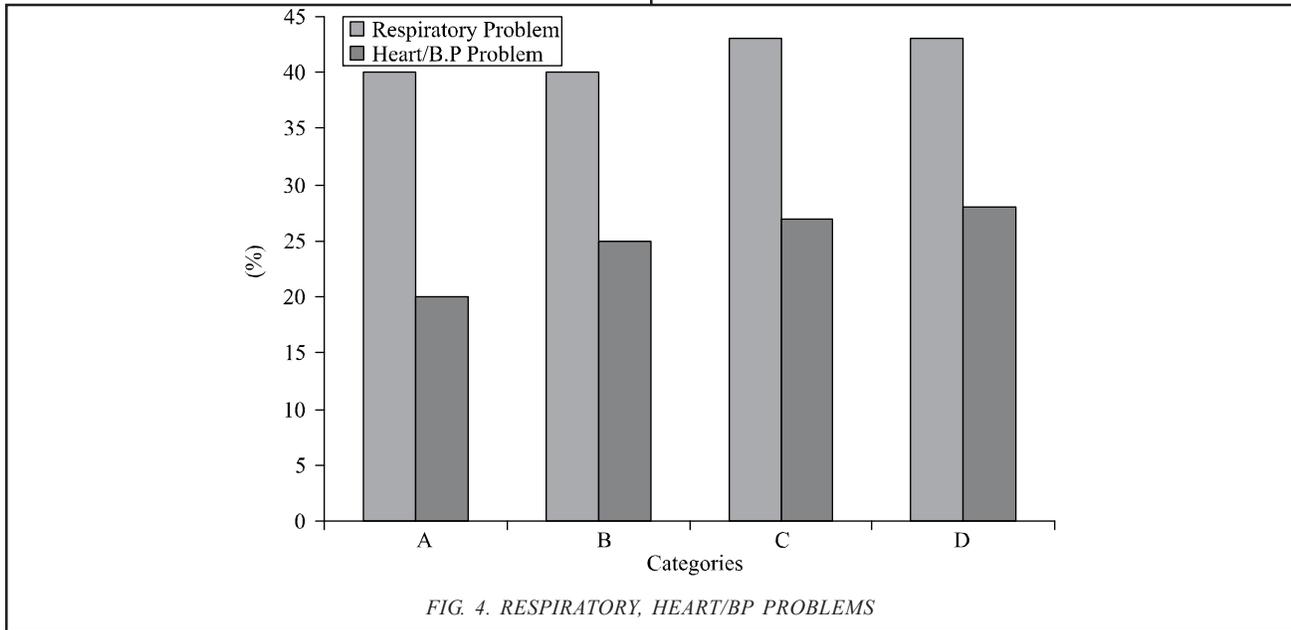


FIG. 3. SPEECH INTERFERENCE, LIMITATION AND HEARING PROBLEMS

3.5 Headache Problems

Fig. 6 indicates the response of the workers of all categories regarding their problem of headache faced by them. In Category-A, 02 (20%) workers were facing regular headache problem and 04 (40%) workers were facing occasional headache problem. In Category-B, 07 (35%) workers were facing regular headache

problem, whereas 08 (40%) workers were facing occasional headache problem. In Category-C, 12 (40%) workers were, facing regular headache problem, where as other 12 (40%) workers were facing occasional headache problem. In Category-D, 16 (40%) workers were facing regular headache problem, whereas other 17 (43%) workers were facing occasional headache problem.



4. RECOMMENDATION/MITIGATION

- (i) In Pakistan, most of the people do not know about the impacts of industrial pollution, therefore it is recommended that Radio, TV, Newspapers, NGOs and other media should provide wide publicity to keep the people aware about the effects of industrial pollution and their remedial measures.
- (ii) It is recommended that noise protection devices (mufflers/silencers) be provided to the workers during working hours to protect their ears from the effects of high noise intensity.
- (iii) It is recommended that noise-insulating enclosures be provided at the working places to reduce the noise level.

Following measures are very essential to adopt during the operation of machines.

- (i) Reducing the speed of rotating and moving parts of the machines would result the smooth operation and would reduce the noise output.
- (ii) By reducing the friction between rotating parts, sliding or moving parts in the mechanical system obviously results in smooth operation and decreases the noise output. Similarly by reducing

- (iii) flow resistance in fluid distribution systems results less noise produced.
- (iii) Proper alignment of the machines, rotating or moving or contacting parts results in less noise output. Good axial and directional alignment in pulley system, gear trains, shaft couplings, power transmission systems bearings and alignment of axle are the fundamental requirements to control the noise output.
- (iv) The noise levels could be reduced by properly lubricating the different parts of the machines time to time. This would increase the life of the mechanical system and would help to reduce the noise levels.
- (v) There is no real distinction between mufflers and silencers. They are often used interchangeably. They are in fact acoustical filters and are used when noise is required to be reduced.
- (vi) As the light reflects from one source to another, the noise can bounce from one hard surface to another. In noise control system this phenomenon is called reverberation. If a soft, spongy material is placed on the walls, floors and ceilings the reflected sound will be defused and soaked (absorbed) up.

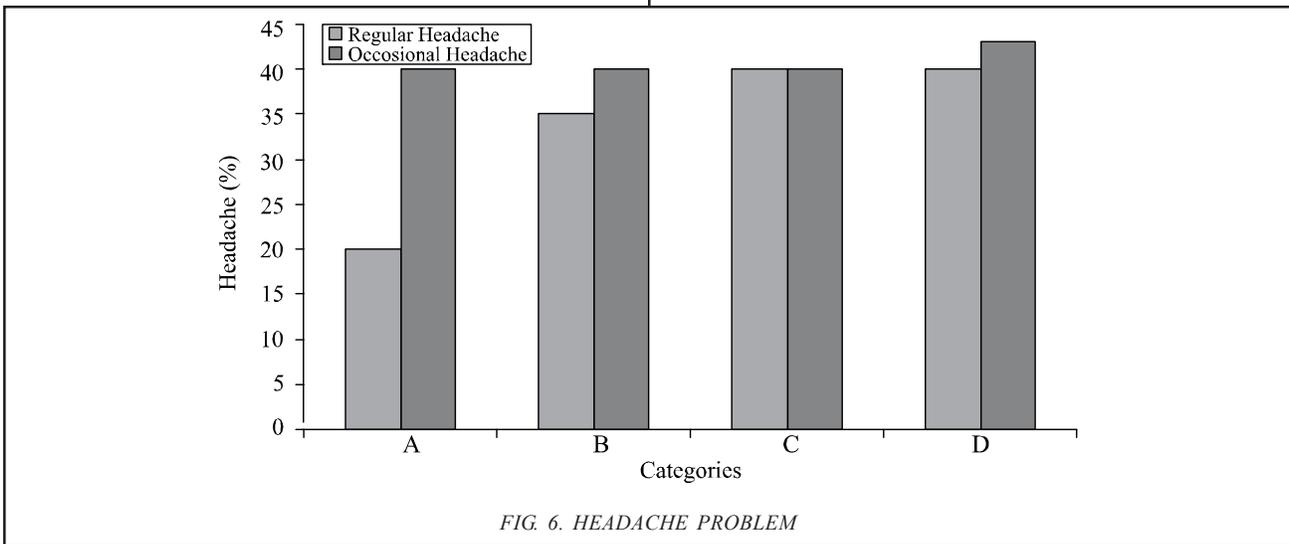


FIG. 6. HEADACHE PROBLEM

- (vii) One of the main sources of machinery noise is structural vibration caused by rotation of poorly balanced parts such as fans, flywheels, pulleys, cams and shafts etc. If the measures would be taken to correct these parts, the result would be achieved in less noise produced.
- (viii) It is recommended that exhaust fans and ventilators be properly arranged at the working places to reduce dust particles and their impacts.
- (ix) It is recommended that Local Government should take measures for legislation of such cottage industries, as they (industries) should get their selves registered with local government and abide the rules and regulation prepared by the authorities from time to time.
- (x) Textile based cottage industries are facing monetary problems, in this regard it is recommended that government should support them by providing loans on low interest rate so that they should replace their old looms with new and advance machines, which would not only help to reduce the noise intensity but will also increase the productivity as well.
- (xii) At present there is no specific legislation to control industrial noise pollution at National level; it is recommended that Government should pass the "Industrial Noise Pollution Control Act" to meet the conditions of Pakistan.
- (xiii) It is recommended that the owners of textile based cottage industries be asked to reduce the working shift from 12 hours to 08 hours duration to reduce the noise exposure time of workers and save their hearing loss.

5. CONCLUSIONS

It was observed that, majority of the workers of sample size were either illiterate or they possessed primary education. Few among them were matriculate or

intermediate. Because of unawareness regarding the impacts of health hazards associated with industrial noise pollution they were not taking appropriate measures for their safety and health.

The average noise level was recorded as 102.45 dB (A) in Category-A, 104.1dB (A) in Category-B, 105.15 dB (A) in Category-C and 108.7 dB (A) in Category-D. However, 100% workers of all categories were facing the problem of speech interference due to high intensity of machine noise.

As for as the irritation problem was concerned, 30% workers from Category-A, 25% from Category-B, 33% from Category-C and 33% workers from Category-D were feeling irritational problem.

Whereas in Category-A 20%, in Category-B 30%, in Category-C 33% and in Category-D 53% workers were facing hearing/ listening problem. In Category-A 40%, in Category-B 40%, in Category-C 43% and in Category-D 43% workers were facing respiratory problem.

The analysis further reveals that 20% workers of Category-A, 25% from Category-B, 27% from Category-C and 28% workers from Category-D were having the heart/BP problem. As for as annoyance is concerned 30% workers from Category-A, 35% from Category-B, 40% from Category-C and 40% from Category-D were very annoyed. Where as 40% workers from A, other 40% workers from B, 47% workers from C and 48% workers from D category were annoyed.

However, 30% workers in Category-A, 25% from Category-B, 13% from Category-C and 12% from Category-D were of the opinion that the noise level was moderate and they were not annoyed because of machine noises. The major problem for the workers had been the headache of all the categories. According to the analysis 20% workers in A, 35% workers in B, 40% workers in C and other 40% workers of Category-D, were facing regular headache during working hours of their duty. Where as 40% workers in A, 40% in B, 40% in C and 43% workers in D category were feeling occasionally headache during working hours.

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