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OCCUPATIONAL HEARING LOSS IN INDIAN FORGING UNIT DUE TO IMPACT OF IMPULSIVE NOISE: A CASE STUDY

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Abstract

Employee working near power press and drop forging are exposed to higher level of noise produced due to impulsive noise. These high levels of noise affect temporarily threshold for those workers who are working for less than one year and permanent threshold shift for those workers which are working more than five years. In research paper, levels of noise were measured by dosimeter at Samrat forging unit manufacturing different steel components for tractor industry. Twelve different employees were selected for conduct of experiment from different departments of Samrat forging industry. Observations presented in this research paper have been collected through questionnaire, the Noise level varies from 100 db to 140 db for different power press were measured by dosimeter. The levels of noise is too high above than OSHO limit recommend for labour. The results show that 90 percent employees are affected by permanent threshold shift (PTS).

Keywords---- FG, HAV, WBV, PTS

1. INTRODUCTION

India is fastest developing countries, the total population of India involved in industries 20% and they contributed to 28.9% in GDP. The forging industries in which more than 45 lakhs labour are involved directly and get employment (Singh et al). Traditionally labour oriented industry changed towards mechanization and automation towards the general awareness about occupational safety, noise pollution. The forging units is part of occupation in India where poor working condition, the labour employees have accepted the job with lower wages in compromising health and safety condition. The labour employees are exposed to vibration, temperature, heat stress, noise and other chemicals like fumes, steams and dust. Different health related problems exposed by to which labours are stress, depression, heat stroke, finger skin temperature, low back problems, gastrointestinal problems, hearing loss. In this study need to investigate to prevent noise induced hearing loss and recognize the relation between health, safety and workplace.

Singh, P, L et al. (2016) indicated that the workers of the Indian steel industry are highly exposed to occupational noise. The majority of workers were not protected from noise induced hearing loss. There was a need to provide special ear protectors for workers engaged in forging. A complete hearing protection program, including training, audiometer, job rotation, and the use of hearing protection devices, needs to be introduced. The result show that more than 90% of the workers sampled showed significant hearing loss at medium and high frequencies. The analyses revealed a higher prevalence of significant hearing loss among the forging workers compared with the workers associated with the other activities. Singh, I et al. (2016) studied that the result of experimental investigations which were conducted to assess the subjective response of seated human subjects under vertical harmonic vibrations. 12 human males were subjected to amplitudes of excitation and frequencies of 5, 8, 2, 16 and 20 Hz. The responses from all the subjects' form of vibrations being felt by them at different body segments, their severity and significance and comfort level were recorded in

subjective form. At high frequency excitations the lower portion of the body, which is close to the point of excitation responds significantly. The response at excitation of frequency closer to natural frequencies of different body segments is clearly evidenced in the form of vibratory effect on those segments. By and large with the increase in inclination of back rest, comfort level increases along with the shift of responding segments in certain cases. Zhou and Griffin (2014) conducted experiment that whole body vibration discomfort when the subject seated with inclined back rest. The RMS were assess at foot rest and back conditions. During the setup frequencies ranges from 5 to 6.3 Hz. The results showed that the frequencies above than 8 Hz produced the discomfort in back rest when angle of inclination 30, 60 and 90 degrees. Pao Chiang Chao et al (2013) studied the combine effect of noise, temperature and vibration. The conducted the experiment on 12 different employees and used to Taughi experiment used to stimulate different exposure conditions caused by physiological parameters. The result showed that the mean artery pressure and skin temperature and exposure time influential factors. Noise was founded major factor responsible for hearing loss and temperature has no effect found at all. During the experiment the temperature ranges from 5 C to 25° C. Basri and Griffin (2013) conducted that the seat vibration for prediction of whole body vertical vibration discomfort when sitting with an inclined back rest by developing an experimental setup. Vertical RMS acceleration levels were evaluated at seat, back and foot rest conditions. The results revealed that discomfort has been influenced by the vibration of inclined backrest at overestimate vibration frequencies around 5 to 6.3 Hz and underestimate at frequencies greater than 8 Hz. In conclusion, frequencies greater than 8 Hz found to be a cause of increased vibration discomfort at back rest, especially when inclined to 30, 60 or 90 degree and much discomfort at head or neck. F. Koussa et al (2013) estimated the acoustic performance of conventional and low height gabions noise barriers. Situ and scale model measurements at a scale of 1:10 had been carried out to assess the basic acoustic properties of a 3 m high gabions barrier. There was a good agreement between these two measurements which results that noise gabions protections can

be significant for environmental noise reduction. Low height gabions noise barriers was effective only for receivers of limited height and the insertion loss values can reach 8 dB (A) behind the barrier. Natural gabions noise barriers can be useful in reducing transportation noise in urban area. The implementation and maintenance of gabions is very easy.

Beers et al (2008) studied that energy expenditure for 24 men and 24 women clerical work. The energy expenditure was measured in two postures while sitting and standing in office chair posture. The result showed that while standing posture consume more energy during clerical work.

Mansfield et al (2006) measured apparent masses of 15 subjects whilst exposed to single-axis and tri-axial whole body vibration. Each subject was exposed to 28 vibration conditions comprising every combination of single-axis and tri-axial vibration with magnitudes of 0.4 and 0.8 ms⁻² rms in each direction, once with backrest contact and once without backrest contact. Results showed that increasing the magnitude of vibration in directions orthogonal to that being measured affected the apparent mass, causing a reduction in the resonance frequency as the total magnitude of vibration increased. It was demonstrated that the apparent mass resonance frequency was a function of the total vibration magnitude in all axes rather than a function of the vibration magnitude in the direction being measured. It was concluded that more complex biomechanical models were required in order to simulate human response to multi-axis vibration.

Eric L Lynch et al (2005) studied that noise induced hearing loss occurs in drop forging and age is major parameter contributed for hearing loss. The ear muff was become unsuitable when the noise level exceed 140 db. The result showed that 90 percent of the recorded impulsive exceed the L_{peak}.

Griffin et al (2003) studied the 12 male different subjects for whole body vibration. The ranges of vibration varies from 0.25 to 20 Hz. The subjects seating with different thighs contact and affected the thighs area. The result showed that the effect of vibration on back rest was large.

Devereux et al (2002) conducted a study on 891 computers operators and 1514 technicians at workplace. The result showed that the workers highly exposed by physical and psychological risk factors at workplace. They reporting the symptoms of upper limbs.

Griffin et al (2002) studied 12 subjects of vibration ranges from 0.25 to 2.5 ms² rms. The vibrations were transmitted to from seat to various part of body, upper and lower abdominal wall. The result showed that with increased vibration transmissibility to lower abdomen was more.

Zain Zera et al (2001) conducted a experiment in drop forging in meure a noise level L_{peak} 110 db to 152 near punch press and machinery shops. The level of noise 10-20% more than permissible level.

Taylor et al (1984) conducted a experiment for drop and press forging operator by considering 716 hammer operators and 293 control subjects. In study noise were measured by dosimeter and the tape recorder were used for recording the noise. The

result showed that longer exposure more than varies from 5 to 10 years they were more affected by noise induced hearing loss.

2. MATERIAL AND METHOD

2.1 Selection of Subjects

Twelve workers were be taken and their effect of different levels of noise, vibration, fatigue and temperature with be studied in table 1. The following points were taken care off for selection of subjects 1) Age from 18 to 30 years 2) Workers of male gender 3) Educational qualification 4) Labour working duration 8 hours.

TABLE 1 PHYSICAL PARAMETERS OF INDIAN WORKERS

Height (MM)	Weight (Kg)	Age (Yr)
1620±70.0	65±10	25±2.0

Twelve different workers participated in study conducted in Samrat forging unit located at dera bassi Distt Mohali, Punjab, India. All worker healthy fitted without any disease of occurs. Before perform the test on workers we have to check all medical test conduct from medical laboratory in local city in which measure the heart related diseases, heat stress, urgonical problems. All workers were asked to fill in the study and signed a written performa the risk related to the study.

2.2 Questionnaire design

1) Have you any hearing disease?

2) Do you have low back pain?

3) Do you have any drug addict like alcohol or tobacco?

4) Whether you use helmet, Ear plug and Goggle used while working?

5) Have you any accident while working?

6) Do you taking any medicine.

Yes No

7) Do you use shielding equipment at work place?

8) Do you the supervisor recognize the benefit of shielding equipment?

9) Do you have any in sleep disturbance?

This is pattern of the questionnaire in which the author asked the question from the workers and the answer is very, moderately, much and high.

2.3 Data Collection

A weighted sound level meter, Model Bruel & Kjaer-2250 was used to Dose appraisal. The labour employees working near drop forge hammer were participated in this study for data collection. The sound level meter was attached to waist and microphone was attached to the collar of the labour employees. The sound level was recorded for 10 minutes on every working site of drop hammer, two to three reading were recorded at each site.

The noise levels in different departments of drop forging hammer shown in table 1 the levels of noise Lequ varies from 90 to 120 db. This levels of noise is exceed by Indian factory act and OSHA limit for labour employees. Most of labour employees were working overtime was varies from one to four hours in day shift.

Table 2 Measurements Of Noise Levels In Different Departments

S.No	Departments	Capacity Of Forge hammer (TON)	Total no of Labor Employees in sections	Lequ (db)
1	Forge hammer-1	0.5	10	90
2	Forge hammer-2	0.5	9	94
3	Forge hammer-3	1.0	7	97
4	Forge hammer-4	1.5	15	102
5	Forge hammer-5	1.5	6	107
6	Forge hammer-6	2.0	12	118
7	Forge hammer-7	2.0	6	120
8	Forge hammer-7	2.5	9	135

Table 3 Temperature And Humidity Recorded In Month Of June

S.No	Department	Temperature (° C)	Humidity (%)
1	Blank cutting	43	42
2	Drop forging section	41	51
3	Flash Removing	38	54
4	Grinding	36	50
5	Heat Treatment	40	47
6	Diesel and Gas Furnaces	42	42
7	Diesel and Gas Furnaces	42	42
8	Shot blasting	37	48

The data collected of heat stress in different departments in forging unit was shown in table 2 in which the temperature varies from 37 °C to 43 °C during in day time when temperature and humidity reach maximum at 2.00 pm in that day. This was more than permissible limit which was varies from 22 °C to 29 °C recommended by Indian factory act.



Fig. 1. Labour Employees working during grinding operation The fig 1 showed that the workers in contact with noise levels.



Fig. 2. Labour Employees working at drop forge hammer

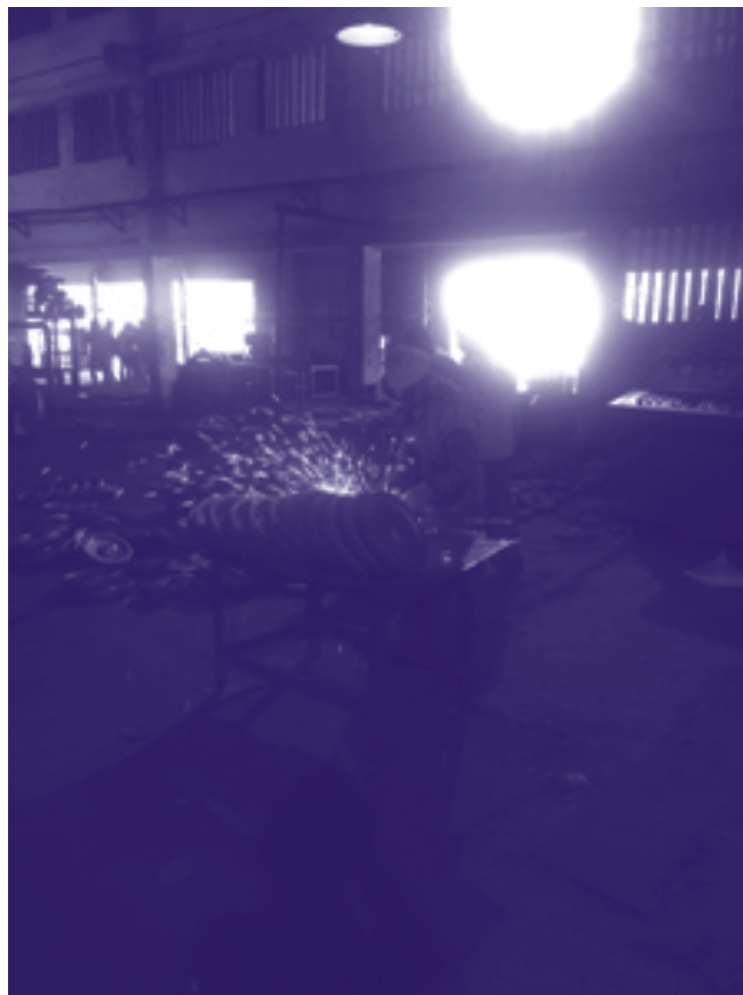


Fig. 3. Labour Employees working during standing

The fig 1, fig 2 and fig 3 shows that workers working near the drop forging power press in Samrat forging unit dera bassi while standing and sitting. The heat exposed from press to workers body and the vibration from power press to transfer to the hand arm. The table 4 shows that total subjective response regarding the heat stress from 5 point scale. The table 4 describe that various health related affect of the heat stress on workers working in smart forging units in India. There was occur when they are working during their normal timing and working in which heat stress occurs due to the high temperature of the furnace working near the furnaces.

Table 4 Heat Stress From Drop Forging And Press Forging

Heat Stress	No of labour	Not at All	Very Small	Modest	Much	Subjective Scale (0-4)
Heat exhaustion	12	0	0	10	2	.38
Heat syncope	12	0	3	5	2	.29
Heat hypervelation	12	5	3	2	2	.25

3. RESULTS AND DISCUSSION

The hearing threshold shift was estimated at different frequencies in audiometric room shown in table 5. There were 12 labour who participated in audiometric test. They were brought to ergonomic laboratory from industry to Sanga hospital Ropar where the test was conducted. The rooms are sound proof and proper ventilated. The audiometer which varies range from 0 to 80 db for all frequencies conducted in the test. In the test conducted the workers participated in hearing clearly Then the range of intensity is increased by frequency

slowly up to that value in which they start respond. Then the response was recorded after four to five time which was presented in table 5. The range was increased both for left and right ear. Start from right ear test was performed and start the reading was taken. The reading of both left and right ear allowed the threshold shift which indicated hearing loss. The hearing loss was measured found on the threshold degree with varying noise levels.

TABLE 5 AUDIOMETRY FOR HEARING THRESHOLD SHIFT

S.No	Frequency (KHz)	Right Ear (db)	Left Ear (db)
1	.5	5	10
2	1	10	15
3	2	15	20
4	3	20	25
5	4	25	5
6	5	30	15
7	6	15	10
8	7	10	15
9	8	15	5
10	9	25	20

In any industry the maximum temperature of work stations recorded at 7 feet above the ground level and proper air movement shall be provided. The temperature in shop floor was recorded shown in Fig 4. The temperature recorded in summer 1 June to 30 June 2016 during the day. The temperature showed that was above the recommend range was recorded in shop floor. The recommend range is 25 ° C and humidity is 35 percent.

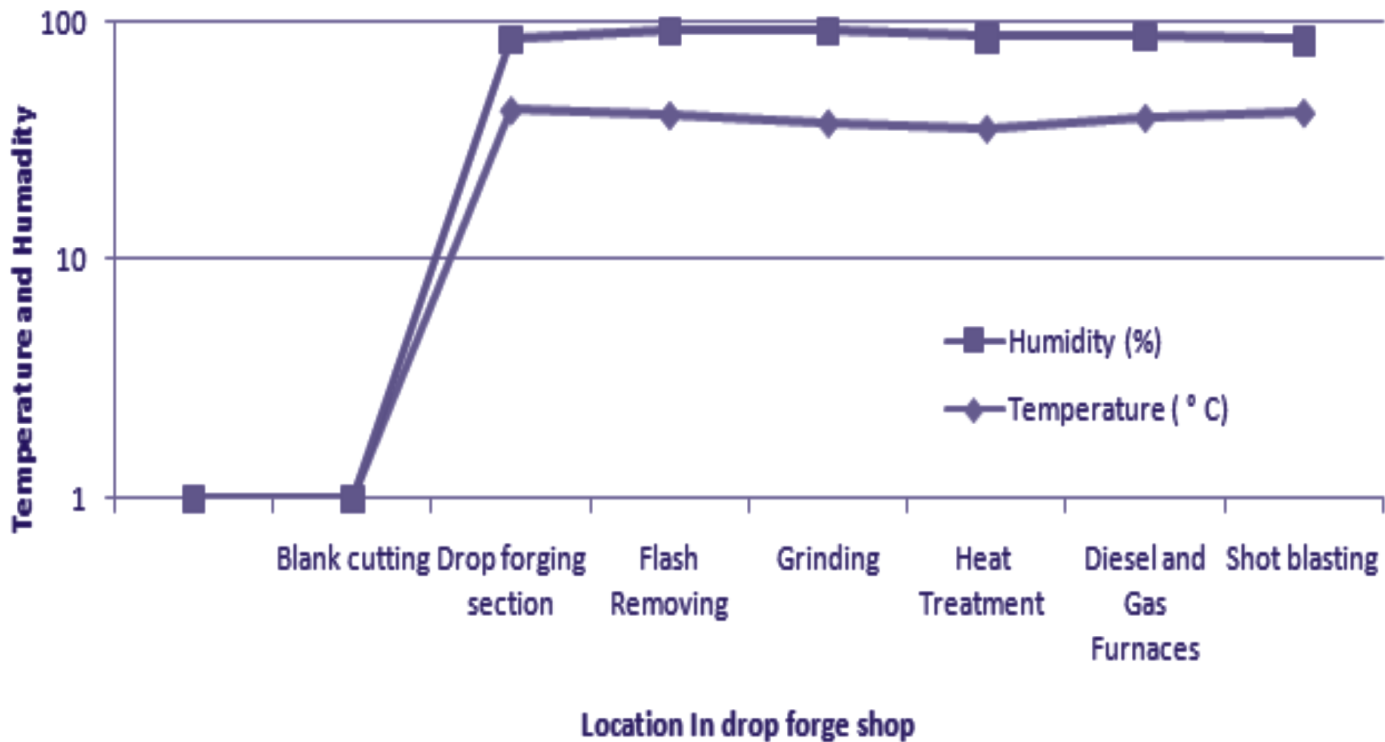


Fig. 4. Temperature recorded in Samrat industry in month of June 2016

4 CONCLUSIONS

In the present research work labour are not protected it was found that noise hazard to regular as well as impetuous noise altitude above 80 (dB) the hearing loss are greater. They work for 2 to 4 hr per days which is varies from 12 to 24 hr per week which is more as per the Indian factory act due lower wages rates provided by Indian industry. The design of ear muff will be better so that workers should be protecting form high impulsive noise. The labour must give induction training time to time so that they can uses shielding equipments while they perform task in shop floor. The hearing loss and sleep depression are associated with occupational noise exposure. Overall consequence of study is that India industry is lag behind in noise control and implementation of use of shielding equipments.

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