



DISCOMFORT DUE TO WORK ENVIRONMENT AND SAFETY FACTORS AMONG WORKERS IN FOUNDRY INDUSTRY

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ABSTRACT

The purpose of this paper is to analyse the discomfort owing to work environment and safety factors among workers in foundry industry. Fifty workers aged 18-55 years participated in this study. Discomfort due to work environment factors like lighting, unclean workplace, interpersonal relationship and safety factors like job safety knowledge, training and personal protective equipment were subjectively evaluated by the questionnaire survey. The results indicated that, the highest and lowest percentage of workers were experiencing at least one discomfort, that is 72% and 6% respectively. All the 16 discomfort factors scored above the average discomfort score of 2.5 on scale of 5. According to this study outcomes, more exploration is needed on the relationship among discomfort due to work environment and safety factors and its effect on the workers in foundry environment.

Key words: Work Environment, Safety, Foundry, Discomfort, Workers

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1. INTRODUCTION

In today's manufacturing scenario, the manufacturing companies are continuously striving for improving the effectiveness. One such way of achieving the manufacturing effectiveness is by employing world class manufacturing strategies e.g., lean manufacturing and total productive maintenance. The world class manufacturing strategies focus on the processes involved in manufacturing. However, the effectiveness of the organisation depends not only on the processes involved in the organisation, but also relate to the state of the workforce i.e., more specifically to health and safety of the workers [1-4].

One of the most important sector in the manufacturing is foundry (metal casting) industry. In a foundry environment, the workers are subjected to discomfort due to unhealthy work environment and lack of appropriate safety management methods. The workers are subjected to work in an unfavourable work environment without safety training and education, which give rise to distress in their body and mind [5-9]. Presently, many workers are employed in foundry industry across the globe and this paper is intended to study the level of discomfort experienced by workers due to work environment and safety factors in foundry industry. The aim of this study was to analyse the discomfort due to work environment and safety factors among the foundry workers. The results of this study shall be employed in formulating an action plan to reduce or eliminate work environment and safety factors leading to discomfort and thereby improving the health and safety level of the foundry environment.

2. MATERIALS AND METHODS

2.1. Workers (Subjects)

The study was carried out by utilising the inputs from fifty workers employed in foundry industry. The age of the workers participated in the study was ranging between 18 and 55 years with the average age of workers being 36.18 years and standard deviation of 8.44 years. The mean height of the workers was 165.12 cm with a standard deviation of 7.85 cm and the mean weight of the participating workers was 63.98 kg with a standard deviation of 9.17 kg. The working experience of the workers in the foundry industry was 7.06 ± 5.33 years. The details of the workers involved as subjects in the study is provided in Table 1.

Table 1 Characteristics of the workers (subjects) participated in the study				
S.No.	Parameter of the workers or subjects	Number of workers or subjects	Mean or Average	Standard Deviation
1.	Age	50	36.18 years	8.44 years
2.	Height	50	165.12 cm	7.85 cm
3.	Weight	50	63.98 kg	9.17 kg
4.	Work experience in foundry industry	50	7.06 years	5.33 years

The workers engaged themselves in the present study on their own interest. Before the study, the supervisors and the workers were explained the purpose of this study. In general, the production was planned in one shift of 8 hours. The normal working day of 8 hours was divided with two short 10 minute and one 30 minute breaks.

3. METHODS AND MEASURES

A questionnaire was employed as the data collection instrument in this study to capture the responses from the subjects. The questionnaire consisted of 60 items including a human body diagram to specify the parts of the body. Out of these 60 questions, 9 and 7 questions about discomfort due to work environment and safety factors respectively were present in the questionnaire. The workers indicated their responses on a scale of 1 (no discomfort) to 5 (high discomfort). The scale of 1 to 5 was maintained constant throughout the questionnaire. However, the intensity corresponding to the scale 1 to 5 is not constant throughout the questionnaire. For e.g., for the factor ‘moving around workplace in need of tools’ and ‘workplace is slippery due to improper maintenance’ several times a day is considered as high discomfort and given the rating of five (5) in the scale; whereas for the factor ‘opportunity to acquire sufficient knowledge about the job’ and ‘use personal protective equipment’ rarely or never is considered as high discomfort and given the rating of five (5) in the scale. The responses from the workers were collected at the workplace.

4. STATISTICAL ANALYSES

4.1. Reliability of the Data

The data collected through the questionnaire study was subjected to Cronbach’s alpha test. The Cronbach’s alpha is one of the globally accepted measures for indicating the reliability of the data. Cronbach’s alpha is calculated by correlating the score for each scale item with the total score for each observation (usually individual subjects), and then relating the same to the variance for all individual item scores.

Cronbach’s alpha is given by,

$$\alpha = \left(\frac{k}{k-1} \right) \left(1 - \frac{\sum_{i=1}^k \sigma_{y_i}^2}{\sigma_x^2} \right)$$

where: k refers to the number of scale items

$\sigma_{y_i}^2$ refers to the variance associated with item i

σ_x^2 refers to the variance associated with the observed total scores

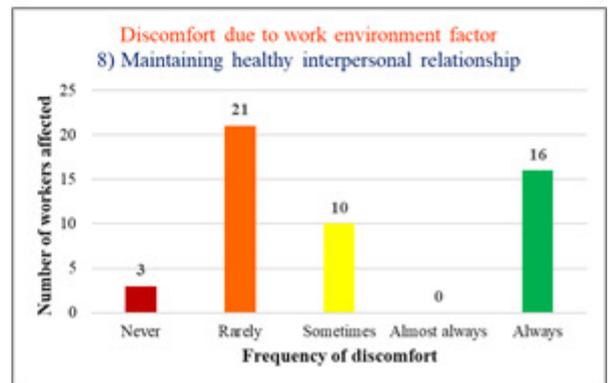
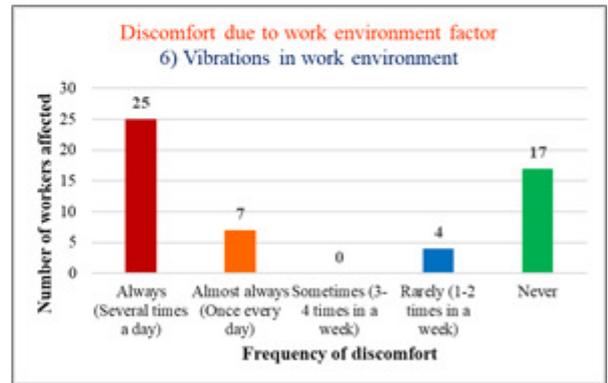
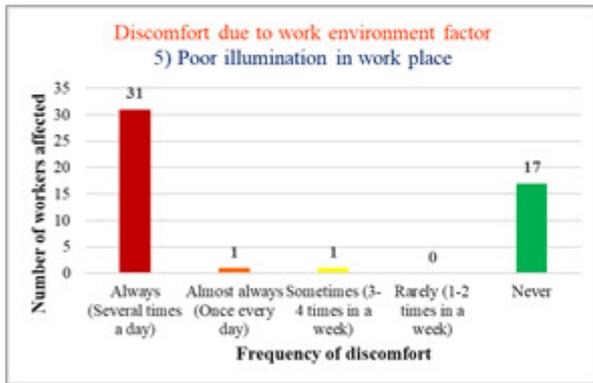
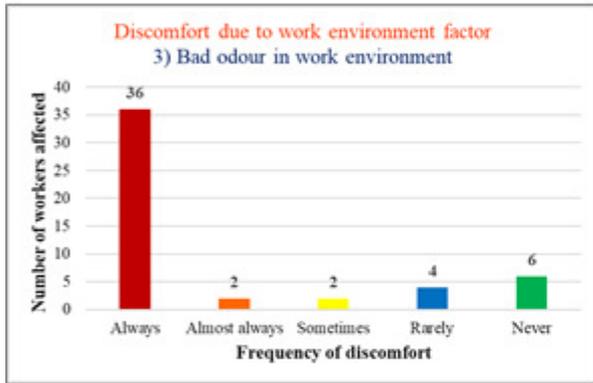
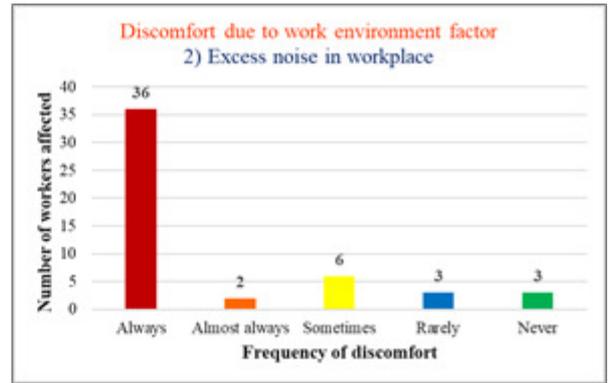
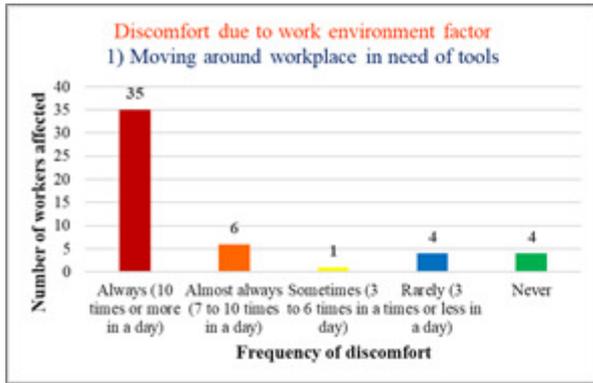
Cronbach’s alpha ranges from 0 to 1 indicating the reliability of the measured data. If Cronbach’s alpha is 0, it means that there exists no relation among the data and Cronbach’s alpha is 1, it means that data are correlated to each other. Generally, Cronbach’s alpha less than 0.5 is highly unacceptable and Cronbach’s alpha between 0.65 and 0.8 or higher is recommended [10].

Cronbach’s alpha calculated for the data collected in the present study was calculated using the statistical package available in Microsoft Excel. The Cronbach’s alpha for the data collected from this study was 0.898. This Cronbach’s alpha indicates that the data collected through this study is reliable and shall be subjected to the statistical analyses.

4.2. Responses from the Subjects

The data collected from the subjects are analysed and the total number of responses against each work environment and safety factor along with the rating is presented in Figure 1.

Discomfort Due To Work Environment and Safety Factors Among Workers In Foundry Industry



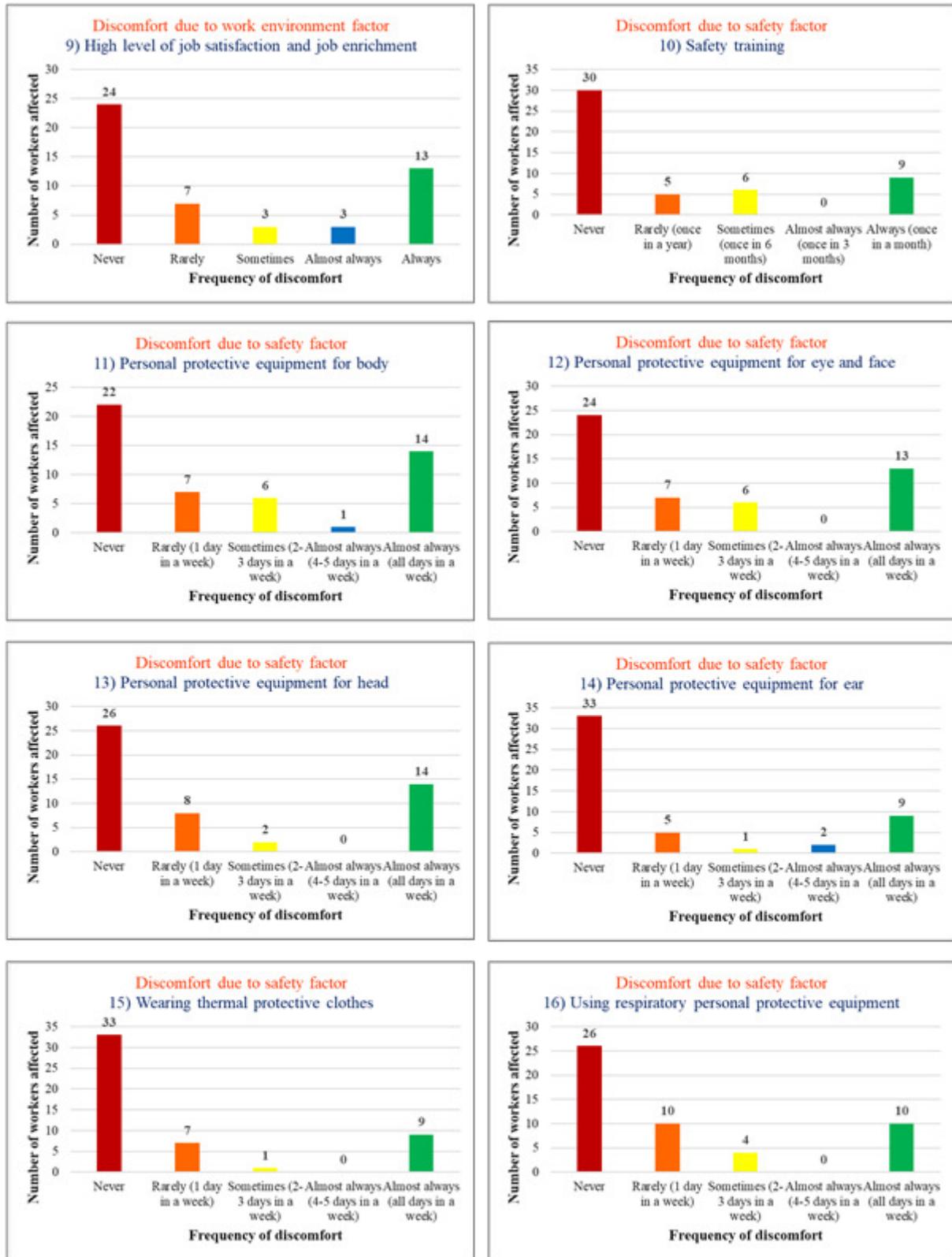


Figure 1. Discomfort due to work environment and safety factors and their frequency among the workers

From Figure 1, the following interpretations were made on the discomfort due to work environment and safety factors in foundry environment. As mentioned earlier, the total number of subjects in the present study was 50. From the data, it is evident that 72% of the workers are 'annoyed or irritated by noise in workplace' and 'bad odour in working environment' and 70% of the workers are affected by 'excessive movement in the workplace in need of tools' in a day. Similarly, the 62% of the workers are experiencing discomfort due to 'poor lighting condition in workplace' several times in a day. The workers are also subjected to discomfort due to 'personal protective equipment'. Almost 66% of the workers are feeling discomfort due to the 'unavailability of personal protective equipment for ear and heat'. About 60% workers have also criticized about that the 'lack of safety training' leading to unsafe working culture. Similarly, other discomfort factors are analysed and it is apparent that workers in foundry environment are experiencing discomfort due to work environment and safety factors almost every day. This lead to the computation of the average discomfort score among the subjects. The average discomfort score for the workers due to work environment and safety factors are provided in the Table 2.

Table 2 Discomfort score of the respondents' due to work environment and safety factors

S.No.	Discomfort due to work environment and safety factors	Discomfort score (on a scale of 5)
1.	Annoyed or irritated by noise in workplace	4.12
2.	Moving around workplace in need of tools	4.04
3.	Wearing thermal protective clothes	3.92
4.	Bad odour in working environment	3.88
5.	Safety training	3.76
6.	Personal protective equipment for ear	3.76
7.	Using respiratory personal protective equipment	3.64
8.	Opportunity to acquire sufficient knowledge about job	3.38
9.	Personal protective equipment for head	3.36
10.	Personal protective equipment for eye and face	3.32
11.	Poor lighting condition in workplace	3.24
12.	High level of job satisfaction and job enrichment	3.14
13.	Personal protective equipment for body	3.12
14.	Vibrations in work environment	3.06
15.	Workplace is slippery due to improper maintenance	2.92
16.	Maintaining healthy interpersonal relationship	2.58

From Table 3, it is noted that, all 16 factors, discomfort score due to work environment and safety factors is greater than the average score i.e. 2.5 (discomfort score was recorded on a scale of 1 to 5). This indicates a condition where the workers are experiencing discomfort almost every day. Also, the workers are not only subjected to one discomfort at a time but many. This analysis indicates that, discomfort due to work environment and safety factors is highly prevalent among the workers in the foundry environment.

5. CONCLUSION

The study reported in this paper was carried out to analyse the existence of discomfort due to work environment and safety factors among the workers in foundry environment. A questionnaire was developed to acquire the data from the subjects (workers). The questionnaire contained questions to capture the subjects' responses on the discomfort due to work environment and safety factors. The data was collected from 50 employees working in foundry environment. The reliability of the collected data was tested using Cronbach's alpha reliability test. The data were analysed and the following conclusion were derived out of this study. The

study results indicated that, as many as 72% of the workers were experiencing discomfort due to 'noise in workplace' and 'bad odour in working environment'. The lowest percentage of workers i.e. 6% of the workers do not 'maintain healthy interpersonal relationship' leading to discomfort. On an average 75.1% of the workers in the present study were subjected to discomfort due to 16 work environment and safety factors in a foundry environment. Thus, this study indicates the existence of discomfort due to work environment and safety factors among the foundry workers and the level of discomfort experienced by these workers were significant.

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