

PRELIMINARY SURVEY TO ASSESS THE HEALTH STATUS OF IRON AND STEEL INDUSTRY WORKERS

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ABSTRACT: More than two hundred iron and steel industrial units in and around Lahore were surveyed to assess the general working conditions of these units. Structural layout of the unit, product type, production capacity, number of workers, number and length of shifts, noise level and temperature were used to indicate the severity of the working conditions. Data from more than 300 workers of 18 units was collected to assess health status and hazards involved. Vital signs were measured to calculate BMI as an indicator of health status along with the common diseases and problems encountered by the workers. Analysis of the data revealed that air temperature ranged from 40-49°C, while the noise level exceeded beyond 80dB reaching 110dB at certain points. Body temperature and blood pressure showed lower trends than the average, while BMI showed 6.21% underweight, 65.8% normal, 24.2% overweight and 3.6% obese. Data regarding the diseases reflected 45.96% muscular problems, 25.46% asthma and breathing problems, 14.28% nose and throat problems, 12.11% skin allergies and 9.6% joints problems. Other diseases included eye problems, BP and diabetes. 4.65% cases of hepatitis B and C were found. 2.4% workers were found who had TB with different stages of treatment. All ranges of workplace injuries were found to be in 26.4% workers. The results of this study suggest that strict monitoring is required so as to improve the occupational health of these workers.

Key Words: Vital signs, Body Mass Index, Occupational health.

INTRODUCTION

Millions of people are employed in the industry throughout the world and are directly related to the production. Injured and sick workers are not only a source of morbidity to themselves and their families but also affect the economy as a whole. Despite considerable improvements in work place environment in developed countries businesses spend a significant amount of money on costs associated with work injuries and illnesses (Spiegel and Yassi, 1991).

Statistical estimates of global fatal occupational injuries and accidents revealed that 355,000 people were killed at work in 1994 (Takala, 1998). According to International labour organization (ILO), two out of three workers or some 2 billion workers worldwide are exposed to one or more of thousands of the potential hazards at work place. Although claims are always boosting in industrialized countries but the real situation is much graver as far as workers health and their social benefits are concerned. It is estimated that 2.2 million people die every year due to injuries and illnesses caused by occupational hazards, while 0.35 million lose their lives because of fatal occupational injuries (ILO, 2005). ILO has narrated the differences in developed and developing countries as first category is at a risk of work related diseases while accidental hazards are more prevalent in the second one. Young workers (15-24 years) are more prone to non-fatal occupational injuries than their older fellows. In developing countries like Pakistan, the situation is graver owing to the number of factors like scarce employment, lack of awareness and reliable information and socio- economic status of the workforce. Environmental health standards are much strict than occupational health standards by the guideline values recommended by WHO (UNEP/ILO/WHO, 1993).

Iron and steel industry of the world prospered rapidly to keep pace with the speedy development of industries in the last century. In 1995, the world's raw steel production was 828 million tons, with the majority of production in Asia (about 37%) whereas; Europe estimates 27% (Stellman, 1998). In iron and steel industry, workers are exposed to chemical hazards including vapors and fumes, physical hazards like noise, vibration, temperature, etc. and a heavy load of occupational injuries (William, 1995).

Heat stress is one of the most severe health risks in iron manufacturing and production units (Webb, 1995). Muscular blood flow is reduced leading to ultimate oxygen deficiency due to continuous and strenuous work (Lankatilake and de Fonseka, 1990), heart rate is increased while mean blood pressure tends to decline and cardiac output tends to increase whereas after acclimatization, heart rate is lowered and remains lower

than the normal (Niimi *et. al.* 1997). Heat workers are inclined to subjective fatigue, which increases with the heat exposure levels (Becklake, 1989).

World labour was estimated to encounter various occupational injuries and health effects shown as 37% back pain, 16% hearing loss, 13 % chronic obstructive pulmonary disease (COPD), 11% asthma, 9 % trachea, bronchus or lung cancer, 8% injuries, 2% leukemia (Nelson *et al.*, 2005).

Health status of iron workers is particularly neglected in Pakistan and needs special attention. Comparison between countries is critically important tool to support the creation of nationwide preventive programmes (Michaels *et. al.* 1985).

There are more than 200 registered iron and steel units in and around Lahore (LCCI, 2003). These units are clustered in two or three regions. Most of the foundries and re-rolling units are situated in Badami Bagh, Baghban pura, Township, Daroghawala, and G.T. road towards Sheikhupura. The situation of workers in iron and steel industries is one of the concerning issue in Pakistan. In preliminary surveys made in this regard, it was found that the workers are continuously exposed to very high temperatures. Direct skin burns; heat cramps, fatigues and asthmatic symptoms were common in these workers.

In the present project, main emphasis is on the heat stress on the health status of workers in iron and steel industry.

MATERIALS AND METHODS

Research methodology consisting of two components i.e. sampling and data analysis was used. Preliminary survey of the area was carried out to define the plan of work. A questionnaire was designed on the basis of the operations carried out in these units to gather maximum and useful information. In the first phase of the study, a thorough survey of about 200 iron and steel units was made to obtain data regarding the process type, product type, raw material used, number of shifts, number of workers and fuel type was collected. Information regarding the physical conditions including ambient air temperature, noise level at the work place, relative humidity, etc. of these iron and steel units was also collected. Administrative information like ratio of labour to managerial jobs, production capacity, health facilities for the labour by the administration, financial benefits, etc. was also collected to use as an indicator of the job stress on the worker. This data was used to categorize the workers on the basis of the hazards involved.

Second part of the study was related with the health assessment of the workers involved in jobs under high environmental temperatures. In this phase data from

more than three hundred iron and steel industry workers was collected with the help of a structurally designed questionnaire and their interview. Questionnaire was designed to collect thorough information about the worker's history including age, qualification, family size, monthly income, length of service, nature of job, personal and family disease history, etc. Vital signs were noted to assess the current health status of the heat workers. These included body temperature, blood pressure, height, weight, hip and waist circumference, peak expiratory flow rate (PEFR) of the workers. The collected data was tabulated and was analyzed statistically to assess the occupational hazards present in these units and ultimately affecting the workers.

RESULTS AND DISCUSSION

Iron and steel industry of the world prospered rapidly to keep pace with the speedy development of industries in the last century. Integrated steel production from the initial handling of iron ore to the loading of the finished products present a myriad of health and safety hazards. The data collected showed that 105 units (56%) were working as re-rolling only while 8 units (4%) processed as melting and re-rolling. Seventy five (38%) out of 200 were the forging units making mostly the auto parts, 10 units (5%) were the casting units while only 2 units (1%) were the melting furnaces making billets and other products (Figure:1). The studied units were engaged in making various products ranging from 15-meter girders to fine nuts and bolts.

Total heat load on a worker depends upon the time spent at each workstation, the intensity of work, the clothing worn and immediate workstation environment. The workers spend long hours in very high temperature as the units have long shift durations. Most of the units work in single shift but this may last upto 12 hours with maximum of 2 hours rest at various intervals. The data shows that 81% units work on single shift basis, 18% on double shift basis while only 1% of the units work on 24 hour basis. Nature and quality of the product depends upon of the type of the raw material used. In the studied iron and steel units, both local and imported raw material was used. In the local raw material, various types of scraps and semi- formed products from the same unit or from other units are used. While imported raw materials included bundle scrap, ship plates, billets, etc from different parts of the world.

The studied iron and steel units were categorized on the basis of the number of heat workers. The categories made were: (1) 2-5 heat workers, (2) 5-10 heat workers, (3) 10-20 heat workers, (4) 20-40 heat workers and (5) more than 40 heat workers. The data revealed that category 1 comprised 39 % of the total units studied; category 2 making 13%, category 3 with 30 %, category

4 showing 14% and category 5 had 4% of the total studied units (figure 2).

As the foundries, melting and re-rolling units require a huge supply of heat energy for their working, hence the fuel used is also very important to attain the required temperature. Mostly the natural gas is used to heat the furnaces but the electricity, coal and furnace oil is also used. Among the other types of materials used as fuel; included rubber, plastic, tyres and leather shoes etc. causing immense smoke and suffocation when injected into the furnace. The data showed that 183 units used natural gas only as furnace fuel, 23 units used furnace oil, 17 units used electricity with natural gas, 2 units used coal while 7 units used other types of fuel like rubber, plastic, leather, etc. (Figure 3).

Noise is one of the major hazards in iron manufacturing and handling units. In the survey, it was found that noise level at almost every work point was well in excess of the permissible limit of 85 dB, reaching even upto 110 dB at certain cutting points. Noise level was measured with the help of sound level meter. As indicated in figure 4, average noise level at charging points was 89 dB, at loading areas 95 dB and maximum noise level at cutting points was noted as 110 dB. The time-weighted average (TWA) for the noise level is 8-hours TWA at 80 dB and decreases with a ratio of two hours with an increase of 5 B in the noise level .

As far as the working hours are concerned, these ranged from 4-hours to 14-hours with the intermittent rest period of minimum of 0.5 hours to maximum of 1.5 hours in the whole day in the units studied. Data showed the length of working hours as: 4 % workers 4-7 hours/day, 8% workers 8 hours/day, 2% workers 9 hours/day, 42% workers 10 hours/day, 40% workers 12 hours/day and 4% workers 14 hours/day in the heat (Figure 5). Total heat load on a worker depends upon the time spent at each workstation, the intensity of work, the clothing worn and immediate workstation environment. If the heat load is sufficiently severe, effect on health and performance will occur. This ranges from increased concentration of painful cramps, fainting, heat exhaustion and heat stroke (Lankatilake and de Fonseka, 1990).

Workers were categorized into ten groups. It reveals that 21 workers in the group of 14-17 years , 37 in the group 18-20 years of age, 46 workers in the group of 21-24 years, 50 in the group of 25 –28 years, 42 in the group of 29-32 years, 37 in the group of 33-38 years, 47 in the group of 39-45 years, 19 each in the groups of 46-50 and 51-60 years and only 4 in the group of 61-70 years of age. The results clearly indicate that the maximum number of workers fall in the age ranging from 21-45 years indicating the severity of the job nature as workers above 45 years of age make on 16.14 % of the total workers and older people can not perform such hard job.

To assess the health status of the heat workers,

various parameters were used. BMI of the workers is shown in the figure 6. The results indicate that 65.8% of the workers had BMI as normal, 24.2 % workers as over-weight, and 3.7% workers as obese while 6.2% workers were identified as under-weight. The nature and intensity of the job demands healthy workers hence most of the workers were falling in the normal weight category. The over-weight and obese workers were those who had either joined the job recently or had long job duration in the units. Newly joined workers gained weight due to the over exertion of the job while the older obese workers had less active life style due to the fatigue and over exertion during the duty hours. The results need further validation through detailed analysis. The Blood pressure showed a declining trend as average systolic blood pressure 116 ± 8 mm/Hg and diastolic blood pressure as 84.7 ± 6.1 mm/Hg (Figure 7). This is because during the heat stress, heart rate is increased while mean blood

pressure tends to decline (Niimi *et. al.* 1997). Body temperature of the workers under constant external heat tends to decline as shown in figure 8. The average body temperature showed a declining trend with an average of $96.28 \pm 6.11^{\circ}\text{F}$.

As the discomfort increases with increasing temperature and thermoregulatory adjustments are made by the body to counteract the effect of high temperature leading to vasodilation of the skin reducing the blood supply to the inner mainly splenchnic organs (Nose and Takamata, 1997). Peak expiratory flow rate (PEFR) is an indicator of the load on the lungs at that particular time. The data showed that PEFR in almost all the workers was lower than the normal lung capacity (Figure 8).

Apart from the discomfort in the workers, almost every worker had heat related problems. Data regarding the diseases reflected 45.96% muscular

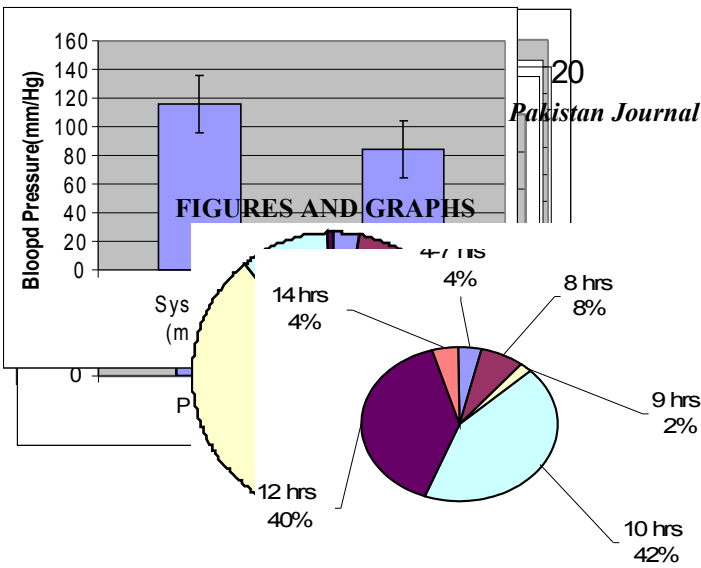


Figure 3. Number of iron and steel Units using various types of fuels.

Figure 4. Percentage of studied iron and involved in making of various types of products.

Figure 5. Percentage of heat workers in iron and steel units on the basis of working hours/day

Figure 7: Average systolic and diastolic blood pressure of heat workers of the studied iron and steel units.

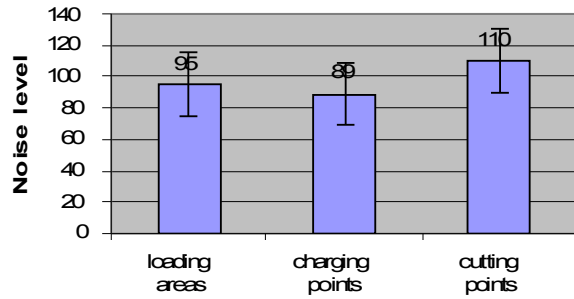
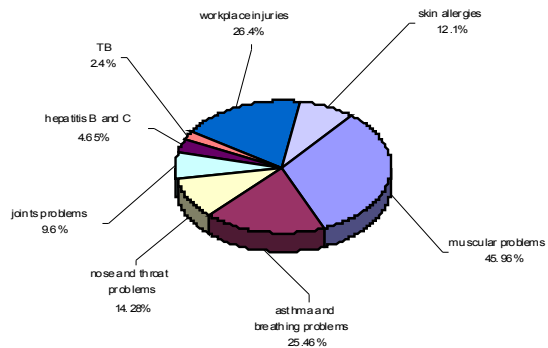


Figure 6: Percentage of the studied heat workers on the basis of Body mass index.

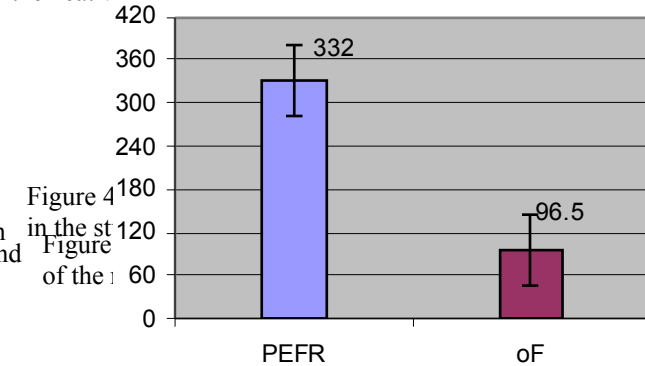


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Figure 9: Percentage of heat workers some common diseases in the studied iron and steel units.

problems ranging from body cramps to severe pain and numbness, 25.46% asthma and breathing problems, 14.28% nose and throat problems, 12.11% skin allergies and 9.6% joints problems. Other diseases included eye problems, BP and diabetes. 4.65% cases of hepatitis B and C were found. 2.4% workers were found who had TB with different stages of treatment. All ranges of workplace injuries were found to be in 26.4% workers (Figure 9).

As far as the socio-economic status of the workers is concerned, it showed a very poor picture. Most of the workers had large family to support with limited earning adding burden to their lives. The level of their education reveals the reasons of their low socio-economic status. Data indicates that 48% of the workers from the studied group were illiterate, 27 % had primary level of education, 24 % had acquired education from middle to secondary level while only 1% of the total workers got higher secondary level of education. The total monthly income of the worker showed a mixed picture with income starting from a minimum of 2.5 thousand rupees /month to a maximum of 40 thousand rupees/month, with maximum number of workers in the categories having monthly income of 4-16 thousand rupees/month.

Conclusion: It is concluded from the present study that:

- Working conditions of the iron and steel units are very poor and pose multitude of occupational hazards to the workers.
- Workers of the studied group have deprived socio-economic status.
- Health status of the workers is pitiable and needs special attention.
- The study provides the basis for the determination of long term biochemical changes in blood of these workers.

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