IJCOM 2023 July;3(1):3-8

Effects of Occupational Exposure on Health of The Workers of Copper Manufacturing Utensils in Kashmir (India)

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Declaration of Conflict

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Abstract

Purpose: The objective was to investigate the general working conditions of the workers of copper manufacturing Utensils in Kashmir (India) and to assess the health risk factors of the workers working in that industry.
Methods: The study was conducted at 30 workshops manufacturing copper utensils of Kashmir valley situated in India. Temperature, Noise level was also measured in these units by following standard protocols. A formulated questionnaire was circulated among the workers to assess the health risk factors of the workers and observation method was utilized to evaluate the working conditions of theses workshops
Results: The present investigation indicates that the majority of the workers of these factories industry were illiterate. Most of them were suffering from health problems like eye irritation, injuries, back pain, skin injuries, respiratory problems and general weakness.
Conclusions: Our results clearly indicated that the health and working conditions of the workers manufacturing copper utensils in Kashmir (India) were unsatisfactory. Every worker on an average was suffering from three to five health-risk factors. We recommend that personal protective equipments should be provided to the workers to reduce the risk factors.
Keywords: copper utensils, employment, health risk factors, personal protective equipments, Kashmir (India)

Introduction

Kashmir (India) possesses significant resources in men and materials which if tapped and mobilized by sensible planning will result in the expansion of small scale industries which may take up the market both in India and abroad. The people of Kashmir may effortlessly produce complicated goods in a lucrative manner provided they get suitable guidance and necessary facilities[1]. The copper manufacturing industry is already employing 28,000 copper workers, engaged in around 6,000 registered factories. The cottage structure, work force, raw material, tool typology and work style, and above all, the make, size, shape, finish and value of both the decorative and ceremonial copper objects like Kashmiri basins, trays, glasses, soap cases, ornamented plates, containers, cooking pots, cups, tea kettles, eating pots, buckets, vases, jars, boxes, bowls, roasters, incense burners, ink and pencil boxes, lamps, knives, swords etc are distinct for in-home use and out-home wedding and mourning ceremonies.

Purpose of the Study

The workers of the these workshops are exposed to different types of physical and ergonomic hazards, while designing and shaping these copper utensils that may not attract much people to select this industry as their professional carrier. The objective of the present study was to investigate the working conditions of the workers of copper manufacturing industry in Kashmir (India) and to analyse their health problems associated with the manufacturing of these utensils.

Materials and Methods

Study area

The present study was conducted in 30 workshops in Kreeri Baramulla. After Srinagar most of the units of copper making are believed to be situated in Kreeri of District Baramulla.

Site Selection

Kashmir has won a great reputation for its artisans. The chief center of industries in Kashmir is situated in the district, Srinagar, however, other localities are also famous for their special crafts. The selected small scale industries are concentrated in Baramulla districts in Kashmir Valley, therefore, the present study was planned to carry out in Kreeri tehsil of Baramulla as this industry is concentrated relatively in the more area as compared to other tehsils of this district in Kashmir valley.

Data collection

The field survey approach was used to carry out the present study. Altogether 90 workers participated in the present investigation and a control population of 30 participants who were not having any major medical history were also selected for the study. The control population participants who were not exposed to these types of activities and were doing minimal physical labour were only selected. The selection of workers at the workplace was based on random sampling technique. A questionnaire was structured as per the guidelines published earlier with slight modifications.[1] The respondents were interviewed at their workplace and the observations at the site were recorded. The respondents were given a brief orientation on the nature and the purpose of study. All the respondents were assured that their personal details will be kept confidential. However, they consented to publish their photograph as a part of the present study.

Noise level Monitoring

The intensity of noise at the workplace was measured by using Sound Level Meter (SL- 4010 Type 2, Range 0- 130 dB, Cal Right Instruments, California, USA). The intensity of noise was measured at the interval of 20 – 30 seconds within 45 minutes.[1]

Temperature and Humidity

The data for temperature and humidity was collected from Metrological Department Srinagar.

Evaluation of work conditions

The checklist was used to cover ergonomic problems that exist in these industries. In the checklist, issues of general working conditions (GWC), workstation design (WD), working posture (WP), and hand tools (HT) were assessed. The general working conditions, thermal

conditions, air quality, workstation analysis, working posture were determined by the checklists of Choobineh *et al*, with slight modification (Appendix H). The items in the checklist were observed at the different industries selected in the present study. The ergonomic index was calculated as a percentage of all provided items in the checklist. An index was calculated for each part of the checklist to identify the major sources of problems and ergonomic bottlenecks at the workplace.

$$\text{GWC index} = \frac{\text{GWC score}}{\text{Total items provided}} \times 100(\%)$$

$$\text{WD index} = \frac{\text{WD score}}{\text{Total items provided}} \times 100(\%)$$

$$\text{WP index} = \frac{\text{WP score}}{\text{Total items provided}} \times 100(\%)$$

$$\text{HT index} = \frac{\text{HT score}}{\text{Total items provided}} \times 100(\%)$$

$$\text{Ergonomic index} = \frac{\text{Total score}}{\text{Total items provided}} \times 100(\%)$$

Statistical Analysis

The results of all the experiments were analyzed by using one way analysis of variance (ANOVA) with Duncan's multiple range test for comparison of the significance level (P) between the mean values of control and exposed population. A $p< 0.05$ value was considered as significant difference between the values compared.

Results

The workers engaged in the copper manufacturing units in the selected area were in the age group of 20-50 years. They had 3 to 15 years of work experience in these units. All the workers were found to be male. It was observed that the copper manufacturing units were operated for 8 hour per day and for about 320 - 350 days in a year because of the availability of the raw materials in the valley. The physical characteristics of the workers of this industry are given in Table 1.

The mean average temperature in the study area was recorded 14.27 °C with a maximum and minimum of 22.03 °C and 44.96 °C, respectively. The mean relative humidity and total rainfall during the study period was recorded 67.77% and 44.96 mm, respectively (Table 2).

The average noise in dBA was recorded at 4 workshops selected randomly and the noise level was found to be 66.67 dBA, 57.11dBA, 72.97 dBA, 67.33 dBA. The descriptive statical analysis is given in table 3.

The ergonomics of the units revealed that hand tools and work station indices were the major sources of problems at the workplace. The overall average of the hand tools and work posture indices is 83.33, and 83.33%, respectively (Table 4). It was observed that the work conditions in most of the industries were beyond the acceptable limits.

The prevalence of different physical and ergonomic diseases/risks among the workers of the copper manufacturing workers was found to be very high (Table 5). Most of the workers were suffering from respiratory ailments and musculoskeletal disorders. 83.33% of the workers reported shortness of breath when walking fast or slow and 80% reported Chest pain when you breathe deeply. Back pain was reported by 83% of the

Table 1. Physical characteristics of the workers

Parameters	Average
Gender	Males (100%)
Age (years)	30.7
Height (cms)	168
Weight (kg)	59
Educational Qualification	Mostly Illiterate
Monthly Income	7000 INR

Table 2. Temperature and humidity in the study area during the survey period

Month	Average Tempt. (°C)	Max. Temp. (°C)	Min. Temp (°C)	Average relative humidity (%)	Total rainfall (mm)
September	21.1	29.2	15	63.7	36.83
October	14.4	22.8	7.2	62.6	24.13
November	7.3	14.1	2.2	77	73.91
Mean & SE	14.27± 3.98	22.03± 4.38	8.13± 3.72	67.77± 4.63	44.96± 14.93

Source: https://en.tutiempo.net. Assessed. 26/1/2022

Table 3. Noise level(dBA) at the workshops

Descriptive statistics	Station 1	Station 2	Station 3	Station 4
Average	66.67	57.11	72.97	67.33
Standard Deviation	10.70	13.36	7.41	16.17
CI95%	4.47	4.47	4.47	4.47
Skew	-0.387	0.329	0.017	-0.615
zSkew	-0.866	0.736	0.039	-1.375

p< 0.0025

Table 4. Ergonomic indices of copper manufacturing Units

Ergonomics	Overall score
General working conditions	22.82
Work station	50
Working posture	23.3
Hand tools	83.33
Overall ergonomics	45.11

workers and 73% of the workers reported difficulty in moving your head up and down. A significant difference (p< 0.05) in the respiratory problems (p< 0.0090), musculoskeletal problems (p< 0.0009) was observed at the workplace between control and exposed population. However, no significant difference in the health issues was observed at the workplace between exposed and control population (Table 1). Moreover, the subjective complaints of fatigue, general weakness and body pain, irritation and hearing problems related to different psychological and physical stresses were also observed among the workers. Various incidents of injuries were also noticed among the workers. All the health issues were significantly high in the copper manufacturing workers as compared to control population in the study area.

Discussions

The present investigation reveals that almost every worker suffered from 3-5 diseases and also the reported events of accidents were common in these units. However, no preventive measures have been taken so far to minimize such incidents. The use of personal protective equipments was found to be almost negligible. Moreover, the workers were not exposed to proper training and awareness programmes in the related area. It has been found that all the workers were males and most of them were without primary education even.

The use of chemicals, workstation dust, and copper particles may cause various types of respiratory problems and allergic reactions among the workers.[4-9] The prevalence of eye irritation was very high among the workers due to the observed excessive amount of dust. Suffering from hearing problem was found to be significant in the analyzed subjects. This may be due to the continuous exposure of the workers for eight hours each day to the noise generated by beating of copper to make utensils. The exposure of workers with such noise level may cause permanent hearing impairment and may even result in deafness.[11-15] The prevalence of skin injuries can be attributed to use of different tools without proper personal protective equipment's, and it is to mention that this work was conducted during winter and due to drop in temperature these workers may not handle the tools properly resulting in skin problems and other injuries among these workers. It should be noted that a decrease of 1 ^{0}C in core temperature may markedly impair performances and could increase the risk of occupational injuries and accidents.[16] In terms of climatic conditions, the acceptable ambient temperature of comfort would be slightly higher in the summer than in the winter, being 23-27 ^{0}C and 25-25^{0}C, respectively.[17] It has been observed during the present investigation that the workers adopted different awkward postures to manufacture copper utensils during working hours that resulted in different injuries[18] to them and other musculoskeletal problems. There is an immediate need of legal mechanisms to provide opportunity of growth and safety at the workplace in this industry. The management should also provide a minimum working system and suitable environmental conditions which may not only help in improving the health conditions of the workers but also may help in increasing the effectiveness of the working conditions

Table 5. Prevalence of different symptoms/conditions in workers of copper units

Disease	Workers percentage	Control percentage	P value
Hearing Issues			
Hearing Problems	53	3	p< 0.0213
Wearing a hearing aid	40	0	
Vision Problems			
Eye irritation	23.3	12	p< 0.1269
Wear contact glasses	40	2	
Respiratory Conditions			
Trouble smelling odor	13.3	0	
Asthma	3.33	0	
Chronic bronchitis:	6.66	0	
Shortness of breath	90	13.3	
Emphysema	3.33	3.3	p< 0.0090*
Shortness of breath when walking fast or slow	83.33	13.3	
Coughing that produces phlegm	50	12	
Coughing that wakes you early in the morning	80	10	
Chest pain when you breathe deeply	80	10	
Allergic/Skin Issues			
Allergic reactions	20	0	p< 0.0655
Skin Injuries	68.68	3	
Skin allergies and rashes	30	3.3	p< 0.1395
Musculoskeletal disorders			
Back pain	83	13.33	
Back Injury	26	0	
Difficulty in fully moving your arms and legs	76	2	
Pain when you lean forward	63	5	p< 0.0009*
Difficulty in moving your head up and down	73	16.6	
Swelling in legs and feet	26	10	
Other related health issues			
Anxiety	70	66.6	
General weakness and fatigue	60	50	
Weakness in any of your arms	80	70	p< 0.5471
Heart problems (Heart beating Irregularly)	36.6	10	
Diabetes	66.6	73.3	
High blood pressure	83	46.6	

leading to quality performance of the workers. The exposure to continuous fire and hot objects may cause eye irritations and eye related problems among the workers. Personal protective equipments (viz mask, gloves, ear muffs and goggles etc.) and heating arrangements in winter should be provided to the workers in order to reduce the risk factors.

Acknowledgements

We are thankful to the workers and owners of the industries for their kind cooperation, where the present investigation was carried out. We are highly thankful to principal, Government Degree College Thindim Kreeri for her technical, administrative and moral support.

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