PART- 8

SECTION- I: BIBLIOGRAPHY
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87) Devereux JJ, Vlachonikolis IG, Buckle PW (2002) Epidemiological study to investigate potential interaction between physical and psychosocial factors at work that may increase the risk of symptoms of musculoskeletal disorder of the neck and upper limb. Occupational and Environmental Medicine 59(4), 269-277.


150) Yaglou CP (1927) Temperature, humidity and air movement in industries; the effective temperature index. Journal of Industrial Hygiene 9, 297-307.
157) ACGIH (1996): Threshold limit values for chemical substances and physical agents in the work environment. American Conference of Governmental Industrial Hygienists, Cincinnati.


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SECTION- II: LIST OF PUBLICATIONS
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1) Somnath Gangopadhyay, Goutam Ghoshal, Tamal Das and Shyamalendu Dutta

2) Somnath Gangopadhyay, Goutam Ghoshal and Tamal Das

3) Jayita Chakraborty, Goutam Ghoshal, Tamal Das and Somnath Gangopadhyay

4) Somnath Gangopadhyay, Goutam Ghoshal and Tamal Das

5) Somnath Gangopadhyay, Goutam Ghoshal, and Tamal Das
A Study on Upper Extremity Cumulative Trauma Disorder in Different Unorganized Sectors of West Bengal, India. *Journal of Occupational Health (Japan)*, 2003: 45 (6), pp 351-357.

7) Somnath Gangopadhyay, Tamal Das, Goutam Ghoshal and Banibrata Das

8) Jayita Chakraborty, Goutam Ghoshal, Tamal Das and Somnath Gangopadhyay

9) Somnath Gangopadhyay, Banibrata Das, Tamal Das and Goutam Ghoshal

10) Somnath Gangopadhyay, Palash Biswas, Tamal Das and Goutam Ghoshal

11) Somnath Gangopadhyay, Tamal Das, Goutam Ghoshal and Palash Biswas
12) Somnath Gangopadhyay, Banibrata Das, Tamal Das and Goutam Ghoshal

13) Somnath Gangopadhyay, Abhishek Bharadwaj, Tamal Das and Goutam Ghoshal

14) Tamal Das and Somnath Gangopadhyay

15) Tamal Das and Somnath Gangopadhyay

16) J. Basu, S. Gangopadhyay, T. Ghosh, G. Ghoshal and Tamal Das
17) Tamal Das and Somnath Gangopadhyay

18) J. Basu, S. Gangopadhyay, T. Ghosh, G. Ghoshal and Tamal Das

19) Somnath Gangopadhyay, Tamal Das, Goutam Ghoshal and Tirthankar Ghosh

20) Somnath Gangopadhyay, Goutam Ghoshal and Tamal Das

21) Somnath Gangopadhyay, Banibrata Das, Tamal Das and Goutam Ghoshal
The Prevalence of Musculoskeletal Disorders among Pre-adolescent Agricultural Workers of West Bengal, India. Ergonomics SA (South Africa), 2006, 18(1), pp14-21.
22) B. Das, G. Ghoshal, Tamal Das, T. Ara, S. Dev and S. Gangopadhyay


24) Somnath Gangopadhyay, Tirthankar Ghosh, Tamal Das, Goutam Ghoshal and B.Das
The Prevalence of Upper Limb Musculo Skeletal Disorders Among the Brass Metal Workers in West Bengal, India. Industrial Health (Japan), 2007:45(2), pp 365-370.

25) Somnath Gangopadhyay, Tirthankar Ghosh, Tamal Das, Goutam Ghoshal and B.Das
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APPENDIX: PHOTOCOPIES OF THE PUBLICATIONS
Impact of injuries on work performance among the surgical blacksmiths of West Bengal

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The manufacture of surgical instruments is one of the leading small-scale industrial sectors in West Bengal, India. The present study was undertaken to assess the rate, type and cause of injury incidents among surgical blacksmiths and whether these incidents affected the work performance of the blacksmiths. A cluster of 216 skilled and 225 unskilled blacksmiths (male), engaged in the manufacture of surgical instruments, was selected from Baruipur subdivision as study subjects. The study included: 1) completion of a questionnaire; 2) measurement of physical parameters; 3) incident records; 4) statistical analysis of the data. The present study revealed that the blacksmiths suffered very frequently from work-related injuries. The number of injuries that occurred during 2004-2005 for skilled and unskilled blacksmiths was 1413 and 1610 respectively. Unskilled blacksmiths were disproportionately affected. These injuries resulted in a high rate of lost workdays, i.e. 517 and 742 workdays for skilled and unskilled workers respectively. The study thus indicated that surgical blacksmiths are highly prone to injuries in their occupation, mostly affecting the fingers (23% and 23%) and back region (21.7% and 22%) in both groups, which consequently affected their health, productivity and work performance.

Keywords: Blacksmith; Injury; Workdays lost; Work performance

1. Introduction

Occupational injuries are defined as: "any damage inflicted on the body by transference of energy during work or when commuting that involves a short duration between exposure and identifiable effects after the event or circumstance" (Hagberg et al. 1997). Occupational injuries are one of the most important preventable health problems throughout the world. They are potentially fatal or disabling and affect mainly individuals in their productive years, causing major economic and social impact (Santana and Loomis 2004). In the unregulated informal sector of the economy in Zimbabwe, precarious job contracts prevail and illegal small enterprises are commonly involved in rudimentary operational processes in which safety is not carefully controlled, contributing to a high occurrence of work-related injuries and diseases (Loewenson 1998). The impact of work-related injury is therefore substantial for employers, employees and the health sector (Wadsworth et al. 2003). Occupational injury rates vary geographically, seasonally (Davies and Elias 2000), by industry sector (Schelp and Svanstrom 1986) and by job type (Di Lorenzo et al. 1998). In addition, men have higher injury rates than women (Blasi and Caccavari 1988, Firth and Herbison 1990, Health and Safety Commission 2001, Akerstedt et al. 2002). The relationship between injury rates and age is

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more complex. Some studies suggest an increased risk associated with younger workers (Harker et al. 1991, McKnight and Elias 1998, Lindqvist et al. 1999).

The manufacture of surgical instruments is one of the leading small-scale industrial sectors in West Bengal, India with an enormous export potential. Manufacturers are now supplying surgical instruments to big dealers and exporters in Delhi, Mumbai, Jalandhar and often directly to overseas clients. Manual forging in the local blacksmith units is the first step in the production chain. Blacksmiths forge the stainless steel components from rolled rounds, which are supplied by the instrument manufacturers. About 7200 persons are directly or indirectly involved in forging of surgical products in the Baruipur subdivision (Roy 2003).

The present study was undertaken to assess the rate, type and cause of the injuries prevalent among surgical blacksmiths and whether these injuries affected the work performance of the blacksmiths. This study was performed in the year 2004 to 2005.

2. Methods

2.1. Selection of subjects

A cluster of blacksmiths (216 skilled and 225 unskilled) were randomly selected from Baruipur subdivision, where blacksmiths were engaged in making surgical instruments. The subjects were all male as no females were employed as blacksmiths.

2.2. Assessment of physical parameters

The height and weight of study subjects were recorded using an anthropometer and a weighing machine (see table 1).

2.3. Incident records and analysis

1. To minimize bias, respondents were asked: ‘have you ever had an accident of any type in your life?’ followed by other questions concerning the study reference period, the last 12 months before the interview. When the answer was positive, the respondent was invited to provide a description of how and when the incident happened, which was recorded as a written narrative. The injury was classified as ‘typical’ occupational (meaning at the place of work) or when commuting. Severe injuries were defined as injuries that forced the worker to take three or more days off work. When an occupational injury was reported, a questionnaire was administered to solicit detailed information on the incident, the nature of the injury, part of body affected, source of injury, event or exposure and day and time of injury.

2. Definition of injury: all types of injuries, such as minor, medium and major, are categorized or measured by a 5-point scale (not at all; rarely; occasionally; quite frequently; very frequently) (di Lorenzo et al. 1998). Minor injuries did not require medical attention, medium injuries required first aid and needed some time to recover and major injuries caused serious impact on the work and health of the workers.

3. Occupational history was also recorded, considering simultaneous jobs, a common feature in this area. A detailed description of the main job, defined as that involving the longest work time or highest remuneration, was recorded. For each job, daily work hours and workdays per week were also recorded to allow estimation of the total hours of work for each person.

4. Other occupational variables were type of workplace, shift work/night work, perception of the job as dangerous, occupational training and subcontracting, all coded as yes/no.

5. Also the injury records of the surgical blacksmiths were collected from the ‘Surgical Instrument Service Center’ at Piali near Baruipur established in 1957.

6. Incident rate was calculated by the formula per 1000 workers as days active:

\[
I = \frac{E}{T}
\]

where \(E\) = event or incidence, \(T\) = time/days active (Duffey and Saull 2000).

2.4. Statistical analysis

For the statistical analysis of the quantitative variable results, under normal data distribution, Student’s t-test was
used to identify whether there is any significant difference, viz., between occurrence of total incident among the skilled and unskilled surgical blacksmiths. Whereas for ANOVA the F ratio was computed to find out the significant difference between occurrence of incidents and the affected body parts. To identify the relationship between the total number of incidents with the years of experience of the blacksmiths, the multiple comparisons between groups Bonferroni t-test was used. Omega square ($\omega^2$) was computed for finding the strength of association. Linear correlation, Spearman rank order correlation and regressions were performed to explore the magnitude and direction of association between two variables, viz., the total incidents and total workdays lost in the surgical blacksmiths in a year. In this way, it can be observed whether there is any relationship between these two variables. Statistical analysis was performed using the statistical package PRIMER OF BIOSTATISTICS (Primer of Biostatistics S.O.msi, Msi Version 1.20.1827.0, Primer for Windows, McGraw-Hill).

3. Results

During the period under study (2004 to 2005), 1413 incidents involving the skilled blacksmiths and 1610 incidents involving the unskilled blacksmiths were recorded, resulting in 517 and 742 lost workdays, respectively. A statistically significant difference ($p < 0.05$) was observed between the injury rate by the skilled blacksmiths when compared to the unskilled blacksmiths and a significant correlation was observed between the total number of incidents and total workdays lost in both groups. The annual incident rate (table 2) among the skilled surgical blacksmiths was 21.1 per 1000 workers and the rate observed in the unskilled surgical blacksmiths was 23.9 per 1000 workers.

The daily work schedule including the mean duration of work and rest as well as the number of working days in a week are described in table 3.

The recording of accidents that had occurred in different months of 2004 involving both the skilled and unskilled workgroups was tabulated (table 4).

Different body parts of the surgical blacksmiths were affected due to injury-causing events. In the case of both skilled and unskilled blacksmiths, the hand (20.7% and 19.9% respectively), wrist (13.9% and 13.1% respectively), finger (23.0% in each case), eye (4.9% and 6.3% respectively), face (7.1% and 7% respectively), leg (8.6% and 8.7% respectively) and back (21.7% and 22% respectively) were injured. The finger (23.0%) was the most affected region. By ANOVA (different body parts affected), it was found that there is a significant difference ($p < 0.05$) of occurrence of injuries in the different body parts of all the blacksmiths (table 5). Thus, ANOVA revealed that there is a significant difference between occurrence of injuries and affected body parts of both the skilled and unskilled blacksmiths.

The predominant types of injuries among the blacksmiths were burns or scalds (25.6% in cases of skilled and 25.8% in cases of unskilled workers) and scratches or abrasions (23.2% in cases of skilled and 24.2% in cases of unskilled workers). Apart from these types, there are several other types of injuries such as sprains/strains/tears, contusion or bruise, inflammation/irritation of joints.

### Table 3. Mean duration of work and rest per day with average number of working days in a week.

<table>
<thead>
<tr>
<th>Workers</th>
<th>Duration of work per day (hours)</th>
<th>Duration of rest per day (hours)</th>
<th>Number of working days per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>10 (±2.38)</td>
<td>1.5 (±0.24)</td>
<td>6</td>
</tr>
<tr>
<td>Unskilled</td>
<td>10 (±2.14)</td>
<td>1.5 (±0.11)</td>
<td>6</td>
</tr>
</tbody>
</table>

### Table 4. Incident distribution among surgical blacksmiths by month (2004).

<table>
<thead>
<tr>
<th>Workers</th>
<th>Injury type</th>
<th>December to March</th>
<th>April to July</th>
<th>August to November</th>
<th>Total</th>
<th>t test*</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled</td>
<td>Minor</td>
<td>294 (20.8%)</td>
<td>366 (25.9%)</td>
<td>328 (22.3%)</td>
<td>1413 (100%)</td>
<td>t = 2.157</td>
<td>Significant ($p &lt; 0.05$)</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>101 (7.1%)</td>
<td>126 (8.9%)</td>
<td>113 (8.0%)</td>
<td>337 (24%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Major</td>
<td>25 (1.8%)</td>
<td>31 (2.2%)</td>
<td>28 (2.0%)</td>
<td>84 (6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unskilled</td>
<td>Minor</td>
<td>333 (20.7%)</td>
<td>436 (27.1%)</td>
<td>357 (22.2%)</td>
<td>1610 (100%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>115 (7.1%)</td>
<td>150 (9.3%)</td>
<td>123 (7.8%)</td>
<td>437 (30%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Major</td>
<td>28 (1.7%)</td>
<td>37 (2.3%)</td>
<td>31 (2.0%)</td>
<td>96 (6%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* t test between total accident occurred among the skilled and unskilled surgical blacksmiths.
tendons or muscles, surface wounds and cuts or lacerations. From the Spearman rank order correlation it was found that the effects of some types of accidents are significantly correlated with one another (in the case of skilled blacksmiths, burns or scalds vs. contusions or bruises; cuts or lacerations vs. sprains/strains/tears; sprains/strains/tears vs. inflammation/irritation of joints, tendons or muscles and in the case of unskilled blacksmiths, scratches/abrasions vs. sprains/strains/tears; cut or laceration vs. inflammation/irritation of joints, tendons or muscles; sprains/strains/tears vs. inflammation/irritation of joints, tendons or muscles) (tables 6 and 7).

Figure 1 shows that there are different types of incidents accountable for injuries in skilled and unskilled surgical blacksmiths. Missing the target while hammering was the most common type of incident among skilled (25.8%) and unskilled (25.5%) blacksmiths. The other causes of accidents are slip of hammer from hand, burn injury on contact with a red hot iron, rubbed or abraded by iron splinters, splashing of blazing coal and cut by sharp tools.

Moreover a significant correlation was obtained on comparing the two regressions shown in figure 2. It has been observed that a linear relationship exists between the total number of incidents and the workdays lost in both the

---

**Table 5. Different body parts affected due to injuries in surgical blacksmiths.**

<table>
<thead>
<tr>
<th>Body parts affected</th>
<th>Surgical blacksmiths</th>
<th>(ANOVA) F ratio and remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hand</td>
<td>Wrist</td>
</tr>
<tr>
<td>Skilled</td>
<td>292  (20.7%)</td>
<td>197  (13.9%)</td>
</tr>
<tr>
<td>Unskilled</td>
<td>320  (19.9%)</td>
<td>211  (13.1%)</td>
</tr>
</tbody>
</table>

---

**Table 6. Type of injury in skilled and unskilled surgical blacksmiths.**

<table>
<thead>
<tr>
<th>Type of injury</th>
<th>Surgical blacksmiths</th>
<th>Skilled</th>
<th>Unskilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratches/abrasions</td>
<td>328 (23.2%)</td>
<td>360 (25.6%)</td>
<td>416 (25.8%)</td>
</tr>
<tr>
<td>Burns or scalds (heat)</td>
<td>360 (25.6%)</td>
<td>226 (16.0%)</td>
<td>235 (14.6%)</td>
</tr>
<tr>
<td>Contusion or bruise</td>
<td>226 (16.0%)</td>
<td>10 (0.7%)</td>
<td>14 (0.9%)</td>
</tr>
<tr>
<td>Cut or laceration</td>
<td>10 (0.7%)</td>
<td>40 (2.8%)</td>
<td>52 (3.2%)</td>
</tr>
<tr>
<td>Sprains/strains/tears</td>
<td>40 (2.8%)</td>
<td>270 (19.1%)</td>
<td>291 (18.2%)</td>
</tr>
<tr>
<td>Inflammation/irritation of joints, tendons or muscles</td>
<td>270 (19.1%)</td>
<td>179 (12.7%)</td>
<td>211 (13.1%)</td>
</tr>
</tbody>
</table>

---

**Table 7. Correlation between different types of injury among the surgical blacksmiths.**

<table>
<thead>
<tr>
<th>Type of accident</th>
<th>Skilled</th>
<th>Unskilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burns or scalds vs. contusion or bruise</td>
<td>r_s = 0.540, Significant (p &lt; 0.05)</td>
<td>r_u = 0.512, Significant (p &lt; 0.05)</td>
</tr>
<tr>
<td>Cut or laceration vs. sprains/strains/tears</td>
<td>r_s = 0.727, Significant (p &lt; 0.05)</td>
<td>r_u = 0.605, Significant (p &lt; 0.05)</td>
</tr>
<tr>
<td>Sprains/strains/tears vs. inflammation/irritation of joints, tendons or muscles</td>
<td>r_s = 0.605, Significant (p &lt; 0.05)</td>
<td>r_u = 0.537, Significant (p &lt; 0.05)</td>
</tr>
</tbody>
</table>
Injuries on the performance of surgical blacksmiths

Both groups of blacksmiths were classified according to their work experience in three categories (0 to 5 years; 6 to 10 years; more than 10 years). Furthermore, the number of incidents and their relation with work experience were observed. From ANOVA it was found that there is a significant difference between the number of incidents and years of work experience in both skilled and unskilled blacksmiths. The multiple comparisons (Bonferroni t-test) also yielded significant differences in the occurrence of incidents between the three categories of both skilled and unskilled blacksmiths (Tables 9 and 10). Skilled and unskilled blacksmiths with more work experience are at significantly less risk of being injured than blacksmiths with less than 5 years of experience. Thus, the workers with the least experience are more likely to be injured.

4. Discussion

It can be observed from the present study that work-related incidents affect different body parts of the blacksmiths. This has also led to a high rate of workday loss. This finding corroborates with the work of Basu et al. (2005), wherein it was found that blacksmiths incur high rates of cut and burn injuries due to unsafe workstations, as evident from the results of the study of Gangopadhyay (1994) among the construction workers of a steel plant in India where injuries occurred due to poor workstation design. This study found that there is a significant difference in the total number of injuries occurring between the skilled and unskilled surgical blacksmiths. Thus, it can be said that the unskilled blacksmiths are more affected than the skilled ones. Among them, incidents are very predominant, the unskilled ones involved in the highest number of incidents.

The finger is the most affected portion of the body, followed by the hand, wrist, eye, face, leg and back. In both skilled and unskilled blacksmiths, the primary types of injuries are burns or scalds and scratches or abrasions. These types of injuries may have occurred while working with hot steel blanks, blazing coal and constant use of the hammer. The causation of injuries can be attributed to a number of factors. The blacksmiths perform repetitive hammering jobs that give shape to the surgical instruments. This type of job not only requires skill but is also time-consuming. Hammering jobs are responsible for most of the incidents. The significant correlation between the total number of incidents and total workdays lost in a year is an indicator of the fact that frequent incidents result in lost workdays. Similarly, Katsuyama et al. (1999) found absenteeism from work due to injury between 1986 and 1995 at a shipbuilding company. Strong and Zimmerman (2005) also found an occupational health risk; the number of workdays missed or absence from work is influenced by injury. Previously, it has been observed that unskilled blacksmiths fail to keep their commitments because of absenteeism (Basu et al. 2005). In the case of unskilled blacksmiths the added disadvantage is low control over the task in an unhygienic working environment (Basu et al. 2005).

The demand-control model of Karasek (1979) suggests that persons involved in highly skilled occupations, such as assembly fitters or call operators, can handle this type of situation. Difficulties in withstanding this kind of physical...
Linear Regression between Total Incident and Days Lost of the Skilled Surgical workers

Linear Regression between Total Incident and Days Lost of the Unskilled Surgical workers

Comparison of Two Regressions between Total Incidents and Days Lost in Surgical workers

Figure 2. Total accident vs. workdays lost in the surgical blacksmiths in a year.

Table 8. Linear correlation between the total number of incidents and lost workdays in the surgical blacksmiths.

<table>
<thead>
<tr>
<th>Surgical blacksmiths</th>
<th>Total accident</th>
<th>Workdays lost</th>
<th>Linear correlation and regression</th>
<th>Comparison between two regressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skilled (Group 1)</td>
<td>1413</td>
<td>517</td>
<td>r: 0.7645*</td>
<td>t: 3.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DF: 10</td>
</tr>
<tr>
<td>Unskilled (Group 2)</td>
<td>1610</td>
<td>742</td>
<td>r: 0.8481*</td>
<td>t: 3.061</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DF: 10</td>
</tr>
</tbody>
</table>

*Significant correlation (p < 0.05).

and mental strain may be the cause of uncontrollable absenteeism. A significant difference between the number of incidents and the years of experience has been observed between skilled and unskilled surgical blacksmiths. The multiple comparisons (Bonferroni t-test) also reveal significant difference in occurrence of incidents between the three age groups in both blacksmiths groups. With the increase in work experience, there is a gradual decrement in the number of incidents. This result is in conformity with the study conducted by Gangopadhyay and Arora (2000) in the steel plants of India, wherein they found that less experienced persons had a larger number of incidents. Because of the above reasons, the blacksmiths need periodic training to develop the skills required for these types of jobs.
Injuries on the performance of surgical blacksmiths

Table 9. ANOVA with multiple comparisons (Bonferroni t-test) between number of incidents and years of experience of the skilled surgical blacksmiths.

<table>
<thead>
<tr>
<th>Experience</th>
<th>Skilled surgical blacksmiths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-5 years (Group 1)</td>
</tr>
<tr>
<td>No. of subjects</td>
<td>28</td>
</tr>
<tr>
<td>No. of incidents (ANOVA)</td>
<td>365 (±3.717)</td>
</tr>
<tr>
<td>F ratio and remarks</td>
<td>F ratio = 231.26, DF = 2,213</td>
</tr>
<tr>
<td>Multiple comparisons</td>
<td>Comparison</td>
</tr>
<tr>
<td>(Bonferroni t-test)</td>
<td>Group 1 vs. Group 2</td>
</tr>
<tr>
<td>t value</td>
<td>t value = 10.809</td>
</tr>
<tr>
<td>Significant</td>
<td>Significant (p &lt; 0.05)</td>
</tr>
<tr>
<td>Strength of association</td>
<td>omega square (ω²)</td>
</tr>
</tbody>
</table>

Table 10. ANOVA with multiple comparisons (Bonferroni t-test) between number of incidents and years of experience of the unskilled surgical blacksmiths.

<table>
<thead>
<tr>
<th>Experience</th>
<th>Unskilled surgical blacksmiths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-5 years (Group 1)</td>
</tr>
<tr>
<td>No. of subjects</td>
<td>72</td>
</tr>
<tr>
<td>No. of accidents (ANOVA)</td>
<td>752 (±3.39)</td>
</tr>
<tr>
<td>F ratio and remarks</td>
<td>F ratio = 48.08, DF = 2,222</td>
</tr>
<tr>
<td>Multiple comparisons</td>
<td>Comparison</td>
</tr>
<tr>
<td>(Bonferroni t-test)</td>
<td>Group 1 vs. Group 2</td>
</tr>
<tr>
<td>t value</td>
<td>t value = 9.244</td>
</tr>
<tr>
<td>Significant</td>
<td>Significant (p &lt; 0.05)</td>
</tr>
<tr>
<td>Strength of association</td>
<td>omega square (ω²)</td>
</tr>
</tbody>
</table>

5. Conclusion
The present investigation reveals that surgical blacksmiths are highly prone to injuries. As a consequence, they suffer from injuries affecting different body parts. Furthermore, these injuries contribute to a high rate of lost workdays. Thus, it can be concluded that the blacksmiths are highly stressed in their occupation due to the predominance of accidents, which also affects their health, productivity and overall work performance.

5.1. Recommendations
Considering the socio-economic status of these workers, the following suggestions were made to improve their working conditions at low cost:

(i) The work period should be modified, with short rest pauses in their work schedule, which may improve their efficiency.
(ii) Enough flexibility and adjustability should be incorporated in the workplace.
(iii) Periodic in-house training should be conducted to develop the skills required for these types of jobs.
(iv) Usage of low-cost personal protective devices should be made mandatory.

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References


Roy, S.K., 2003, Diagnostic study report on surgical cluster at Baruipur, 24 Parganas(S) (Kolkata, West Bengal: Small Industries Service Institute).


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Prevalence of Upper Limb Musculo Skeletal Disorders among Brass Metal Workers in West Bengal, India

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Abstract: Brass metal work is one of the oldest cottage industries in West Bengal, India. Workers performing rigorous hand intensive jobs are likely to suffer from MSD affecting the upper limbs. The present investigation was intended to establish the prevalence of upper limb MSD among the brass metal workers and to identify the causative factors behind its development. In this study, 50 male brass metal workers (Experimental Group) and 50 male office workers (Comparison Group) were selected. For the symptom survey, a questionnaire on discomfort symptoms was performed. Repetitiveness of work and Hand Grip Strength of both the groups were measured. It was revealed that upper limb MSD was a major problem among brass metal workers, primarily involving the hand, wrist, fingers and shoulder. Among the workers reporting subjective discomfort, most of them felt pain, followed by tingling and numbness in their hands. Many complained of swelling, warmth and tenderness in their wrists. Their activities were highly repetitive and the handgrip strength of these workers was significantly less than that of the comparison group. Based on these findings, it appears that high repetitiveness, prolonged work activity (10.5 h of work per day with 8.4 h spent on hammering) and decreased handgrip strength may be causative factors in the occurrence of upper limb MSD among brass metal workers in West Bengal, India.

Key words: Musculo skeletal disorders, Upper Limb, Repetitiveness, Grip strength, Brass metal workers.

Introduction

Musculo-skeletal disorders (MSD) may be defined as injuries and disorders of the muscles, nerves, tendons, ligaments, joints, cartilage and spinal disc. This may occur due to improper physical work activities or appalling workplace conditions. MSDs can be caused by heavy physical work, static work postures, frequent bending and twisting, lifting, pushing and pulling, repetitive work, vibration and psychological and psychosocial stress.

Musculoskeletal disorders are the most common self-reported work-related illness. They are the manifestations of ergonomic hazards and are the leading causes of disability among the people during their working years. According to Levy and Wegman, occupational exposures or aggravating MSD rank first among health problems in the frequency with which they affect quality of life. Workers performing rigorous hand intensive jobs are likely to suffer from MSD affecting the upper limbs. Occupational exposures involving highly repetitive jobs with grasping of the hands, repetitive bending of the wrist, vibration and localized mechanical pressure are considered to be contributing factors towards the occurrence of this disorder. Crouch suggested that handgrip strength is a useful diagnostic tool to determine work-related upper extremity musculoskeletal disorders such as Carpal Tunnel Syndrome. Decreased grip strength may make it difficult to form a fist, grasp small objects, or perform other manual tasks. The existence of MSD in upper...
limbs can be detected by examining pain, numbness and tingling in the hands and tenderness, swelling and warmth in the wrists. An association of MSD with various industrial work has been found in UK. This study revealed that upper limb disorder rank second only to back complaints in various work organization in UK. It was also reported that the workers, who were exposed to repetitive work for long time, the occurrence of MSD was found to be very high among them.

Brass metal work is one of the oldest cottage industries in India, particularly in West Bengal. Although these types of work were practiced throughout West Bengal for many years, in recent times they are carried out in the central part of West Bengal in places like Nadaburip and Berhampore. In this job household utensils are prepared in a large scale. At first, a sheet of brass metal is continuously hammered manually for giving shape and then the utensils are designed by engraving with cutters. Finally they are polished and made ready for sale. As hammering is the most predominant activity in the entire work process, a large number of workers are engaged in this activity. Although brass metal work are carried out for so many years, yet no such study on these works has been reported so far. Moreover it has been reported that many workers in the Berhampore region have left their jobs in the last few years primarily due to work-related upper limb MSDs. Thus in the present study, the prevalence of upper limb MSD among these brass metal workers associated with strenuous hand intensive jobs will be evaluated by comparing with office bearers involved in minimally hand intensive jobs.

Materials and Methods

Subjects

The study was performed on 50 male brass metal workers, designated as the experimental group, engaged in rigorous hand intensive jobs including hammering (weight of each hammer on an average is 2.5 kg). Since the number of such workers had undergone a steady decline over the years, out of the existing 150 workers, 50 were chosen for the study. To avoid selection bias, workers were selected randomly from the Berhampore subdivision of West Bengal. The workers were first selected in the age range of 27-42 yr and then 50 workers were selected from them by lottery (Table 1). This subdivision was specifically chosen because brass metal works are predominantly carried out in this subdivision and are done by only male workers. Another 50 male office bearers, who are not involved in constant hand intensive jobs, were selected as a comparison group for this study.

The office bearers are responsible for the arrangement of files, distribution of documents in different sections of the office and serving tea, water, foodstuffs to staff members on request. Both the experimental and the comparison groups belong to the same socioeconomic status. The entire study was conducted in the year 2004-2005.

Questionnaire

A modified Nordic questionnaire was applied which included a number of questions emphasizing individual details, type of work, upper extremity MSD symptoms, affected body parts etc. to investigate the discomfort at work. After explaining the aim of the study in a layman’s term, each subject was approached and the questionnaire was performed individually and collected on the spot during the same day. For the symptom survey, the subjects were enquired whether they suffered from tenderness, swelling and warmth in the wrist and from pain, numbness and tingling in the hands.

Repetitiveness of work

A study on repetitiveness was performed through the analysis of time and motion of work in both groups. The total time period for a particular job was recorded by video photography. Different activities constituting that particular job and the time taken for the completion of each activity were recorded with a stopwatch by viewing the video clips. Repetitive activity was considered to be that which occupied more than 50% of the total time period for that particular job. The result will confirm the repetitiveness of the work.

Grip strength

A physical examination was performed by handgrip dynamometer (Make: Rolex, India) to measure the handgrip strength of the experimental group and the comparison group. The handgrip strength was measured following the standard method where in the handle of the dynamometer is adjusted at which the second joint of the index finger is bent at nearly right angles. The body must be straight without side bending; both feet and arms in natural positions and the dynamometer should be gripped with full force. The dynamometer should not come in contact with the body or clothing and should not be swung around. The measurement was done three times (morning, noon and evening) per day among workers at 90° elbow flexion and 180° elbow extension, as it has been observed that the highest and lowest values of grip strength vary in accordance with the elbow positions.
### Table 1. Worker Demographics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Experimental Group</th>
<th>Comparison Group</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>40.6 (± 6.4)</td>
<td>39.3 (± 4.1)</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>168.2 (± 11.2)</td>
<td>167.0 (± 9.7)</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>59.9 (± 9.9)</td>
<td>58.2 (± 8.1)</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Years of Experience</td>
<td>16.3 (± 8.1)</td>
<td>15.8 (± 7.2)</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Duration of work per day (h)</td>
<td>10.5 (± 2.1)</td>
<td>8.0 (± 1.3)</td>
<td>Significant</td>
</tr>
<tr>
<td>Duration of rest per day (h)</td>
<td>1.5 (± 1.0)</td>
<td>1.0 (± 0)</td>
<td>-</td>
</tr>
<tr>
<td>Number of working days per week</td>
<td>6</td>
<td>6</td>
<td>-</td>
</tr>
</tbody>
</table>

### Statistical analysis

Students $t$ test was performed to find out whether there was any significant difference in between the parameters of the groups. A two-tail chi square test of independence was applied to determine whether there is any significant association between the parameters measured. The computed $\chi^2$ was next compared with the critical $\chi^2$ value for the chosen level of significance ($p<0.05$).

### Results

The mean values of age, physical parameters (height and weight) and the average years of experience of the subjects in the Experimental group and Comparison group are shown in Table 1. The workers of the experimental group had an average working experience of more than 16 yr, while the other group worked for more than 15 yr.

The daily work schedule including the mean duration of work and rest as well as the number of working days in a week is also represented in Table 1. It was observed that the subjects of both the groups work six days in a week. But the subjects of the experimental group worked 10.5 ± 2.1 h per day and got 1.5 ± 1.0 h of rest per day, whereas the subjects of the comparison group worked 8 ± 1.3 h and got rest for 1 h in a day.

In the experimental group, the repetitiveness of the main activity, i.e., hammering is observed. During a single work cycle of 90.5 ± 0.3 s, 72.5 ± 0.4 s is spent in the main activity (hammering) and the mean frequency of hammering in 72.5 s is found to be 121 times. The total hammering activity is performed for 8.4 h each day. On the other hand the main activities performed by the comparison group is less than 50% of the work cycle. This indicates that the comparison group performs non-repetitive activities in their daily work schedule.

Table 2 shows the association between discomfort and no discomfort among the subjects of the experimental and comparison groups. Discomfort of upper limb was significantly higher in the experimental group than in the comparison group.

In the Experimental group, 35 (70%) subjects felt discomfort in the hand, 31 (62%) suffered from discomfort in the wrist and 30 (60%) from discomfort in the fingers. The extreme part of the upper extremities that is the hand is found to be an effective zone for the Experimental group. Moreover 20 (40%) workers also suffered from discomfort in the shoulder region.

On the other hand the workers of the comparison group suffered negligibly from such discomfort (Table 3).

### Discussion

The results of this study revealed that the brass metal workers (experimental group) are engaged in rigorous hand intensive jobs for many years, whereas the office bearers...
Table 2. Associations of upper limb discomfort between the experimental group and the comparison group

<table>
<thead>
<tr>
<th>Study Groups</th>
<th>Discomfort</th>
<th>No Discomfort</th>
<th>(X^2) Values</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group</td>
<td>40</td>
<td>10</td>
<td>43.7</td>
<td>Significant (p&lt;0.001)</td>
</tr>
<tr>
<td>Comparison Group</td>
<td>7</td>
<td>43</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Symptoms of upper limb MSD in the experimental group and the comparison group

<table>
<thead>
<tr>
<th>Discomfort at the Upper Limb</th>
<th>Study Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental Group</td>
</tr>
<tr>
<td>Body Parts</td>
<td></td>
</tr>
<tr>
<td>Shoulder</td>
<td>20 (40%)</td>
</tr>
<tr>
<td>Hand</td>
<td>35 (70%)</td>
</tr>
<tr>
<td>Wrist</td>
<td>31 (62%)</td>
</tr>
<tr>
<td>Fingers</td>
<td>36 (60%)</td>
</tr>
<tr>
<td>Type of Discomfort</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>40 (80%)</td>
</tr>
<tr>
<td>Tingling</td>
<td>20 (40%)</td>
</tr>
<tr>
<td>Numbness</td>
<td>14 (28%)</td>
</tr>
<tr>
<td>Type of Discomfort</td>
<td></td>
</tr>
<tr>
<td>Swelling</td>
<td>30 (60%)</td>
</tr>
<tr>
<td>Warmth</td>
<td>24 (48%)</td>
</tr>
<tr>
<td>Tenderness</td>
<td>12 (24%)</td>
</tr>
</tbody>
</table>

Table 4. Relationships between handgrip strength (in kg) of the subjects in the experimental and comparison groups

<table>
<thead>
<tr>
<th>Handgrip Strength</th>
<th>Experimental Group</th>
<th>Comparison Group</th>
<th>(t) value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 90° elbow flexion Morning</td>
<td>42 (± 2.8)</td>
<td>46 (± 2.8)</td>
<td>4.8</td>
<td>Significant (p&lt;0.001)</td>
</tr>
<tr>
<td>Noon</td>
<td>41 (± 3.0)</td>
<td>43 (± 2.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening</td>
<td>40 (± 2.4)</td>
<td>42 (± 3.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 180° elbow extension Morning</td>
<td>39 (± 3.1)</td>
<td>42 (± 2.4)</td>
<td>8.8</td>
<td>Significant (p&lt;0.001)</td>
</tr>
<tr>
<td>Noon</td>
<td>38 (± 2.4)</td>
<td>41 (± 2.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening</td>
<td>37 (± 2.8)</td>
<td>40 (± 2.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(comparison group) are not involved in such type of work. There was no significant difference in the physical parameters (height and weight) measured between the groups. Apart from these there was also no significant difference in the other parameters as mentioned in Table 1, except duration of work per day.

According to Silverstein et al., an activity is said to be repetitive if 50% of the work cycle involves similar motion patterns. This criterion of repetitiveness was satisfied in this study wherein the hammering activity covers 72.5 s, which is 80.1% of the work cycle of 90.5 s. Thus high repetitiveness may be regarded as a causative factor for the development of MSD in upper limbs.

It is found that all the workers (Experimental group) had some sort of discomfort feeling in the upper limbs of their body as depicted in Fig. 1. The figure also showed that although the workers of the experimental group felt discomfort throughout the day, a greater percentage suffered more during work than during rest. Thus it can be assumed that the job done by the brass metal workers is extremely intense and as a consequence the feeling of discomfort not only prevails during their work but also persists during their rest periods. On the contrary the workers of the comparison group hardly suffered from any such problems. This result
suggests that highly strenuous hand intensive jobs for prolonged period (10.5 h a day) may have lead to the development of musculo skeletal disorders among the brass metal workers as indicated from the reported discomfort feeling.

From the statistical analysis it is evident that there is a significant association between positive and negative responses of discomfort feeling among the experimental and comparison groups. This suggests that the brass metal workers engaged in hand intensive activities have to perform strenuous tasks repeatedly throughout the day, suffered the most, where as the workers of control group performed comparatively less strenuous activity and suffered less.

It is also evident from the results that the subjects of the experimental group suffered from discomfort in the upper extremities, primarily involving the hand (70%), wrist (62%), fingers (60%) and shoulder (40%). As the workers mostly perform the hammering activity below their shoulder level, so the shoulder region may have been least affected. This finding further establishes the fact that the tasks performed by the brass metal workers involve repetitive acceleration of hands with a heavy hammer over sustained period of time.

On the other hand the workers of the comparison group suffered negligibly from such discomfort feeling suggesting that they perform minimum hand intensive jobs.

It has already been reported that by examining pain, numbness and tingling in the hands and tenderness, swelling and warmth in the wrists, the prevalence of MSD can be detected. A similar result is also obtained in this study wherein most of the brass metal workers (80%) felt pain in the hands, followed by tingling sensation (40%) and numbness (28%) in the hands. These workers also reported of swelling (60%), warmth (48%) and tenderness (24%) in their wrists. Thus it can be said that many of the workers of the experimental group may be suffering from MSD. But the workers of the comparison group hardly suffer from any of these problems. Therefore it is evident that the office bearers may suffer from MSD affecting different body parts but are less likely to suffer from upper limb MSD.

The handgrip strength of the workers of both groups was measured at 90° elbow flexion and 180° elbow extension. A significant difference in handgrip strength at both positions was observed between the subjects of both the groups. The comparison group had significantly higher handgrip strength than the experimental group. This result corroborates with the work of Aiperovitch-Najenson et al. and suggests that the brass metal workers, constantly engaged in hand intensive jobs, are likely to suffer from upper limb MSD. Therefore the results when aggregated together provide a fairly clear indication of the fact that the brass metal workers are liable to suffer from MSD of the upper limb.

From this study it can be concluded that brass metal workers are constantly engaged in highly repetitive hand intensive jobs and by performing such strenuous jobs for several years, they suffer from discomfort feeling at the upper extremities like the hands, wrists, fingers and shoulder region. The feeling is aggravated with prolonged work, followed by a decrease in the handgrip strength and inability in grasping objects. All these factors consequently may lead to the development of MSD at the upper limbs of the brass metal workers.

With a progressive decline in the number of brass metal workers, there has been a significant shrinkage in the geographical area where these works are practiced. Thus, after considering the situation, the authors were compelled to perform this study among limited number of people. Had
this study been possible a few years back, then the number of workers abandoning the job could have been restricted.

Acknowledgements

The authors express their sincere gratitude to the brass metal workers and the office bearers who rendered immense co-operation during the completion of this study.

References

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(150 years Celebration of University of Calcutta)
January 8-10, 2007

SOUVENIR & ABSTRACTS

Organised by:
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ASSESSMENT OF OCCUPATION RELATED HEALTH DISORDERS AMONG STONE CUTTERS OF WEST BENGAL, INDIA

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'Ergonomics Laboratory, Department of Physiology
University College of Science and Technology
University of Calcutta

Stone cutting and setting is an important task in urban construction sites in India. Present study was conducted to assess the occupation related health disorder among these stonecutters.

For this study 60 male stonecutters were randomly selected from urban sector of West Bengal. A detailed posture analysis was performed among stonecutters by OWAS method and the causation of discomfort feeling related with these postures was analyzed.

It was observed from the study that workers work continuously in awkward postures during stone cutting and setting activity suffer from discomfort feeling at different parts of their bodies mainly lower back, knee and shoulder. Discomfort feeling was maximally recorded among the age group of 41-50.

Stonecutters are also exposed to dust in the construction site. From the testing of Peak Expiratory Flow Rate (PEFR) it was observed that stonecutters of 18-30 years of age have higher PEFR than the stonecutters of 41-50 years of age.

Key words: Stonecutters, Postures, OWAS, Discomfort feeling, and PEFR.
A STUDY ON INDIAN SCHOOL BUSES AND DRIVERS
CONCEPT OF SAFETY IN SCHOOL BUS OF KOLKATA

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Tamal Das, Tarannum Ara, Somnath Gangopadhyay

Ergonomics Laboratory, Department of Physiology
University College of Science and Technology
University of Calcutta

School bus is one of the most important and plays a significant role in the transportation of students to and from the school in Kolkata and throughout the world. This study is performed to find out the condition of school buses, concept of safety among the school buses drivers regarding the school bus design as well as the problems facing by them while driving the school bus to minimize the occurrence of accidents.

For this study questionnaires were formulated and performed among 60 students, 20 parents and 20 bus drivers of four different schools of Kolkata. The anthropometric measurements of school students were also taken.

From this study it was found that condition of Indian school buses is not good and from the analysis of questionnaire it was revealed that school bus drivers were not much aware about the school bus safety and they facing many problems while driving school bus. Finally, it was suggested to formulate a detailed training program for school bus drivers and some changes must be done according to the Ergonomics design concept towards the establishment of a safe environment in the school buses of Kolkata.

Keywords: School bus, Kolkata, Concept of Safety, School bus drivers

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[ 96 ]
FUNCTIONAL CAPACITY
- Mental and Physical -
THE PREVALENCE OF MUSCULOSKELETAL DISORDERS AMONG PRE-ADOLESCENT AGRICULTURAL WORKERS OF WEST BENGAL, INDIA.

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ABSTRACT
In India, particularly in West Bengal, pre-adolescents are primarily associated with agricultural works in rural areas mostly due to their socio-economic disadvantage. They are compelled to carry out a considerable amount of manual, rigorous tasks in the agricultural field. For this they have to adopt some undesirable postures that may lead to musculoskeletal disorder (MSD) in the near future. The main aim of the present investigation was to assess the prevalence of MSD among the pre-adolescent agricultural workers (both male and female) of West Bengal. For this study three groups of subjects, an experimental group engaged in hand intensive jobs, control group-I performing lessor amount of hand intensive job and control group-II pursuing only education were selected. A modified Nordic questionnaire was used for all groups. It is evident from this study that these very young agricultural workers who are required to constantly bend and twist during work will experience transient fatigue, pain and eventually MSDs.

INTRODUCTION
In contrast to developed countries, agriculture is of paramount importance in most industrially developing countries (IDC) because of the large proportion of the population involved and the need to maintain national food production. Collins and Roberts (1988) suggested that there is a critical relationship between productivity and health, and this is of particular relevance to IDC because many agricultural tasks in these regions entail high levels of strenuous activity. In fact it has been reported that human effort provides more than 70% of the energy required for crop production tasks in developing countries (FAO, 1987).

In India, specially in West Bengal, pre-adolescents are predominately involved in agricultural works in rural areas due to their socio-economic disadvantage. They are required to perform a fair amount of manual, rigorous tasks in the agricultural field, and are particularly involved in land preparation for crop production. The basic activities include – harrowing, ladderimg, mowing, ridging, weeding, spading and planting of crops. The harrow used is essentially a frame with spike teeth protruding from it, which is dragged across the soil surface, and harrowing is carried out by either animal-drawn or tractor-drawn equipment, or by the farmer himself. This is heavy work and may lead to MSD. After harrowing, spading the soil is another rigorous process done using two different types of spade (short and long handled). Certain crops, such as potatoes are grown on ridges of soil in some farming system, and these ridges can be formed with hand tools such as a shovel or hoe. It is a repetitive process which results in the farmers suffering from pain in different parts of the body.
Many sub-optimal working postures, specially severe flexion or lateral twist and bending have been found to be significantly related to low back pain (Punnett et al., 1991). Associated with these awkward postures is the location and weight of the load which affect the moment of force applied in the lumbar region, and which in turn affects muscle loading and compressive forces on the internal vertebral disc (Chaffin and Anderson, 1984; McGill and Norman, 1985). Thus low back problems appear to be associated with the types of postures requiring back flexion, carrying and lifting of heavy loads, together with exposure to whole body vibration (Pentinnen, 1987). In India many physically demanding agricultural jobs require poor working postures and use-of force by farmers working in the fields; of particular concern is the number of young children involved in this work. Low back pain has been associated with pre-adolescent agricultural workers due to lifting of heavy materials involving awkward postures (Garg, 1989).

The main aim of the present investigation was to assess the prevalence of musculoskeletal disorder (MSD) among the pre-adolescent agricultural workers (both male and female) of West Bengal.

MATERIALS AND METHODS

For the study 50 male and 50 female pre-adolescent (10 to 14 years) agricultural workers were selected from the village Chowtara and Gopinagar near Tarakeswar of West Bengal as Experimental group, and two Control groups, I and II, were used to compare with Experimental group. In Control group-I, 50 male and 50 female subjects of the same age group (10 to 14 years) and of the same socio-economic status residing in the same village were selected. These 100 child workers were engaged in domestic work involving minimum amount of hard intensive job. In Control group-II another 50 male and 50 female subjects from the same areas and of the same age and same socio-economic status were selected randomly. All subjects in this group were fully involved in study, without doing any domestic work.

The pre-adolescent agricultural workers perform various types of activities such as weeding, harrowing, ridging and planting of crops on a daily basis in the field. Preparing this land for cultivation can require considerable time and energy, especially in the marginal areas where resource-poor farmers have to survive. Nevertheless land preparation is essential to provide good conditions for seed germination and plant growth.

A detailed study based on modified Nordic Musculo-Skeletal-Disorder Questionnaire (Dickinson et al., 1992) was performed on both the Experimental and Control groups. The questionnaire constitutes a series of objective questions with multiple choice responses. The questions were grouped into the following major sections dealing with:

- Physical parameters of the workers which included measurement of height, weight, BSA and BMI.
- Subjective symptoms of the musculoskeletal system.
- Detailed questions on work-related pain to investigate the feeling of discomfort.
- Temporal intervals related to discomfort.

Subjective Symptoms about the Musculo-skeletal System

In this part of the questionnaire the participants were interviewed to identify any kind of discomfort experienced in the body, such as in the neck, shoulder, elbow, hand, wrist, upper back, lower back and lower extremities.
STATISTICAL ANALYSIS

Student "t" test was performed on the data from the three groups to identify any significant differences in the physical parameters of the groups (p < 0.05). A two-tail chi square test of independence was applied to determine whether or not any test item had a significant association with feelings of discomfort. The frequencies of paired observations were first arranged into a 2 x 2 contingency table showing the combined distribution of the variables. Yates' correction was applied wherever required. The computed chi² was next compared with the critical chi² value for the chosen level of significance (p < 0.05).

RESULTS

The mean values of age and physical parameters (height, weight, BSA and BMI) of male and female subjects of the three groups are shown in Table 1a, 1b and 1c. No significant differences were found between the three groups or between the males and females within the groups.

<table>
<thead>
<tr>
<th>Table I (a). Physical characteristics of the Experimental group.</th>
<th>n = 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARAMETERS</td>
<td>MEAN (SD)</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>AGE (Yr)</td>
<td>11.4 (1.2)</td>
</tr>
<tr>
<td>HEIGHT (mm)</td>
<td>145.5 (9.5)</td>
</tr>
<tr>
<td>WEIGHT (Kg)</td>
<td>30 (5.9)</td>
</tr>
<tr>
<td>BSA (m²)</td>
<td>1.2 (0.2)</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>14 (1.9)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table I (b). Physical characteristics of the Control group I.</th>
<th>n = 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARAMETERS</td>
<td>MEAN (SD)</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>AGE (Yr)</td>
<td>11.7 (1.1)</td>
</tr>
<tr>
<td>HEIGHT (mm)</td>
<td>144.7 (8.5)</td>
</tr>
<tr>
<td>WEIGHT (Kg)</td>
<td>29.9 (5.4)</td>
</tr>
<tr>
<td>BSA (m²)</td>
<td>1.2 (0.1)</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>14.2 (1.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table I (c). Physical characteristics of the Control group II.</th>
<th>n = 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARAMETERS</td>
<td>MEAN (SD)</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>AGE (Yr)</td>
<td>11.7 (1.2)</td>
</tr>
<tr>
<td>HEIGHT (mm)</td>
<td>144.4 (6.0)</td>
</tr>
<tr>
<td>WEIGHT (Kg)</td>
<td>28.8 (4.1)</td>
</tr>
<tr>
<td>BSA (m²)</td>
<td>1.1 (0.1)</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>13.8 (1.7)</td>
</tr>
</tbody>
</table>
Table II represents the discomfort feeling reported by all the participants in the study. It is observed that 100% of the workers of the Experimental group, 82% male and 80% female of Control group-I, and 18% male and 16% female of control group – II reported experiencing some discomfort.

Table III represents the discomfort experienced by the workers (Experimental Group) engaged in their respective activities in the field. All workers reported discomfort feelings during spading activity, followed by seed planting (92%) and weeding (84%). Noteworthy is that the carrying of the seeds was the lowest rated activity (8%).

Table II. Feeling of discomfort in different groups.

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NUMBER</td>
<td>PERCENTAGE (%)</td>
</tr>
<tr>
<td>EXPERIMENTAL GROUP</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>CONTROL GROUP-I</td>
<td>41</td>
<td>82</td>
</tr>
<tr>
<td>CONTROL GROUP-II</td>
<td>09</td>
<td>18</td>
</tr>
</tbody>
</table>

Table III. Discomfort reported on during different activities.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NUMBER</td>
<td>PERCENTAGE (%)</td>
</tr>
<tr>
<td>WEEDING</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td>RIDGING</td>
<td>37</td>
<td>74</td>
</tr>
<tr>
<td>CARRYING OF SEEDS</td>
<td>04</td>
<td>08</td>
</tr>
<tr>
<td>PLANTING OF SEEDS</td>
<td>48</td>
<td>92</td>
</tr>
<tr>
<td>SPADING</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>SPRINKLING OF WATER</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>PICKING UP THE CROPS</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>CARRYING OF CROPS</td>
<td>23</td>
<td>46</td>
</tr>
</tbody>
</table>

The feeling of pain was recorded on the day of work, and at various time intervals up to one month later; these are reported for the Experimental group and Control group-I in Table IV (a) and IV (b) respectively.

Table IV (a). Discomfort experienced from a work day to a month later among the subjects (Experimental group).

<table>
<thead>
<tr>
<th>DISCOMFORT FEELING AT DIFFERENT TIME</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NUMBER</td>
<td>PERCENTAGE (%)</td>
</tr>
<tr>
<td>PAIN FELT DURING WORK</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td>PAIN FELT AFTER WORK</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>PAIN FELT DURING SLEEP AT NIGHT</td>
<td>49</td>
<td>98</td>
</tr>
<tr>
<td>PAIN FELT DURING 24 HOURS AFTER WORK</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>PAIN FELT DURING 7 DAYS AFTER WORK</td>
<td>36</td>
<td>72</td>
</tr>
<tr>
<td>PAIN FELT DURING LAST 1 MONTH</td>
<td>32</td>
<td>64</td>
</tr>
</tbody>
</table>
Table IV (b). Feelings of discomfort feeling at different time among the subjects (Control group-i).

<table>
<thead>
<tr>
<th>DISCOMFORT FEELING AT DIFFERENT TIME</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISCOMFORT FELT DURING WORK</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>DISCOMFORT FEELING</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td>NUMBER PERCENTAGE (%)</td>
<td>16%</td>
<td>44%</td>
</tr>
<tr>
<td>DISCOMFORT FELT AFTER WORK</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>DISCOMFORT FEELING</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>NUMBER PERCENTAGE (%)</td>
<td>24%</td>
<td>40%</td>
</tr>
<tr>
<td>DISCOMFORT FELT DURING SLEEP AT NIGHT</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>DISCOMFORT FEELING</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>NUMBER PERCENTAGE (%)</td>
<td>30%</td>
<td>48%</td>
</tr>
<tr>
<td>DISCOMFORT FELT DURING 24 HOURS AFTER WORK</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>DISCOMFORT FEELING</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>NUMBER PERCENTAGE (%)</td>
<td>20%</td>
<td>36%</td>
</tr>
<tr>
<td>DISCOMFORT FELT DURING 7 DAYS AFTER WORK</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>DISCOMFORT FEELING</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>NUMBER PERCENTAGE (%)</td>
<td>12%</td>
<td>20%</td>
</tr>
<tr>
<td>DISCOMFORT FELT DURING 1 MONTH</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>DISCOMFORT FEELING</td>
<td>01</td>
<td>02</td>
</tr>
<tr>
<td>NUMBER PERCENTAGE (%)</td>
<td>4%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table V shows the number and percentage of subjects who were compelled to stop their regular working activity because of the discomfort they were experiencing. It is observed that 88% male and 96% female workers of the experimental group were unable to perform their regular work, and 4% reported still feeling discomfort after a month.

Table V. Stoppage of work by subjects due to discomfort feeling.

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WORK STOPPAGE</td>
<td>WORK STOPPAGE</td>
</tr>
<tr>
<td></td>
<td>NUMBER</td>
<td>PERCENTAGE (%)</td>
</tr>
<tr>
<td>EXPERIMENTAL GROUP</td>
<td>44</td>
<td>88</td>
</tr>
<tr>
<td>CONTROL GROUP-I</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>CONTROL GROUP-II</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

In the Experimental group, 64% male and 72% female felt pain in the neck region, and 66% male and 58% female felt pain in the shoulder region. The hand was found to be another body zone affected with 58% male and 68% female of the Experimental group reporting discomfort in the hand, whilst 52% male and 72% female of the Experimental group suffered pain in the knee region. However, it was the lower back region of the body which suffered most; all the male and 98% female of the Experimental group reported LBP.

Table VII shows the association between discomfort and no discomfort among the male subjects of different groups, as well as among the female subjects of different groups. In both cases a significant association was observed among the male and female subjects of the different groups. While there was a significant difference between the experimental group and the two control groups there was no significant difference between the male and female child workers (see Table VII).
Table VI. Discomfort experienced in different body parts (reflected as a %).

<table>
<thead>
<tr>
<th>BODY PARTS</th>
<th>ZONE OF THE BODY</th>
<th>% OF SUBJECTS FEELING DISCOMFORT (EXPERIMENTAL GROUP)</th>
<th>% OF SUBJECTS FEELING DISCOMFORT (CONTROL GROUP-I)</th>
<th>% OF SUBJECTS FEELING DISCOMFORT (CONTROL GROUP-II)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MALE</td>
<td>FEMALE</td>
<td>MALE</td>
</tr>
<tr>
<td>NECK</td>
<td></td>
<td>64 (32)</td>
<td>72 (36)</td>
<td>8 (4)</td>
</tr>
<tr>
<td>SHOULDER</td>
<td>LEFT</td>
<td>8 (4)</td>
<td>2 (1)</td>
<td>2 (1)</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>36 (18)</td>
<td>46 (23)</td>
<td>14 (7)</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>22 (11)</td>
<td>16 (8)</td>
<td>6 (3)</td>
</tr>
<tr>
<td>ELBOWS</td>
<td>LEFT</td>
<td>2 (1)</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>20 (10)</td>
<td>14 (7)</td>
<td>10 (5)</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>2 (1)</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>WRISTS</td>
<td>LEFT</td>
<td>2 (1)</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>18 (9)</td>
<td>40 (20)</td>
<td>4 (2)</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>10 (5)</td>
<td>6 (3)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>HANDS</td>
<td>LEFT</td>
<td>4 (2)</td>
<td>4 (2)</td>
<td>NIL</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>38 (19)</td>
<td>48 (24)</td>
<td>12 (6)</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>16 (8)</td>
<td>16 (8)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>UPPER BACK</td>
<td>LEFT</td>
<td>22 (11)</td>
<td>30 (15)</td>
<td>NIL</td>
</tr>
<tr>
<td>LOWER BACK</td>
<td>LEFT</td>
<td>100 (50)</td>
<td>98 (49)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>THIGH</td>
<td>LEFT</td>
<td>16 (8)</td>
<td>12 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>16 (8)</td>
<td>12 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>NIL</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td>KNEES</td>
<td>LEFT</td>
<td>NIL</td>
<td>2 (1)</td>
<td>NIL</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>44 (22)</td>
<td>66 (33)</td>
<td>14 (7)</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>8 (4)</td>
<td>4 (2)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>ANKLES</td>
<td>LEFT</td>
<td>NIL</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>32 (16)</td>
<td>36 (18)</td>
<td>8 (4)</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>NIL</td>
<td>2</td>
<td>NIL</td>
</tr>
<tr>
<td>FEET</td>
<td>LEFT</td>
<td>NIL</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>32 (16)</td>
<td>34 (17)</td>
<td>NIL</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>NIL</td>
<td>2 (1)</td>
<td>NIL</td>
</tr>
<tr>
<td>LEGS</td>
<td>LEFT</td>
<td>NIL</td>
<td>NIL</td>
<td>NIL</td>
</tr>
<tr>
<td></td>
<td>BOTH</td>
<td>10 (5)</td>
<td>36 (18)</td>
<td>24 (12)</td>
</tr>
<tr>
<td></td>
<td>RIGHT</td>
<td>NIL</td>
<td>NIL</td>
<td>2 (1)</td>
</tr>
</tbody>
</table>

Figures in brackets refer to the number of subjects who rated that particular area.

DISCUSSION

It is evident from this study that although the agricultural workers were very young (10 to 14 years), the type of task they perform was strenuous, which is highly likely to eventually lead to Musculoskeletal disorders. It was found that all the male and female pre-adolescent agricultural workers (Experimental group) experienced some form of discomfort in different parts of their body. It is argued that this is due to the many manual tasks performed in tropical agriculture requiring the workers adopt postures which are highly undesirable based on sound ergonomics criteria. Interestingly over 80% of the Control group – I also complained of some feelings of discomfort to. This may be because many of them are involved in moderate to heavy household work on a regular basis. The subjects of Control group-II hardly felt any such discomfort, clearly reflecting the more sedentary lifestyle they lead.
Table VII. Association of discomfort and no discomfort feeling between different groups and between different sexes.

<table>
<thead>
<tr>
<th>SEX</th>
<th>GROUPS</th>
<th>SUBJECTS WITHOUT DISCOMFORT FEELING</th>
<th>SUBJECTS WITH DISCOMFORT FEELING</th>
<th>TOTAL A+B+C+D</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXP GR</td>
<td>00 (B) 09 (D) 50 (A) 41 (C)</td>
<td>50 (A) 41 (C)</td>
<td>50 50 100 99 91 9.89</td>
<td>Significant</td>
</tr>
<tr>
<td>MALE</td>
<td>CONT-1</td>
<td>09 (B) 41 (A) 50 50 100 39 59 72.92</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EXP GR</td>
<td>00 (B) 41 (A) 50 50 100 39 59 72.92</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CONT-2</td>
<td>09 (B) 41 (A) 50 50 100 39 59 72.92</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CONT-2</td>
<td>41 (D) 09 (C) 50 50 100 40 57 72.92</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEMALE</td>
<td>EXP GR</td>
<td>00 (B) 10 (D) 50 (A) 40 (C)</td>
<td>50 50 100 10 90 11.11</td>
<td>Significant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CONT-1</td>
<td>10 (D) 40 (A) 50 50 100 39 59 72.92</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EXP GR</td>
<td>00 (B) 42 (D) 50 (A) 08 (C)</td>
<td>50 50 100 40 58 72.41</td>
<td>Significant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CONT-2</td>
<td>42 (D) 08 (C) 50 50 100 39 59 72.92</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CONT-2</td>
<td>42 (D) 08 (C) 50 50 100 48 52 41.02</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All workers (both male and female) reported discomfort feelings during spading, and over 90% felt discomfort during the planting of seeds. Spading, planting with traditional hoes, weeding and ridging are the agricultural activities during which the workers are most often required to work stooped for many hours a day, resulting in musculoskeletal problems among the pre-adolescent agricultural workers. These findings support the findings of Nwuba and Kaul (1986) who examined the working posture of the Nigerian hoe farmers; they reported that the workers in their project developed strain in the low back, and argued that this was detrimental to the workers health.

It was observed that the subjects of the experimental group suffered severe discomfort in the upper body, primarily the neck, shoulders and hands, but that they suffered maximally from low back pain and pain in the knees. This may be because agricultural tasks often involve heavy spinal loading and repetitive movement of body parts over sustained period of time. Moreover low back problems among the agricultural workers appear to be associated with the types of postures which require extreme back flexion, lateral twist and bending, carrying and lifting of heavy loads. This study also supports the fact that low back pain was the most common and most expensive MSD experienced in workplace. Plante et al., 1997 reported that up to 80% of the adults will eventually experience back pain at sometime during their life, and 4.5% of the population has an acute low back pain episode every year.

CONCLUSION

From this study it can be concluded that pre-adolescent agricultural workers are continuously exposed to constant bending postures in their work environment: the result being that they suffer from acute discomfort and pain which may lead to long term musculoskeletal problems. A major problem associated with these occupational health problems in tropical agriculture arises from the informal nature of industry. Agricultural activities often take place on a small scale and involve small numbers of isolated workers, which makes the dissemination of safety information, improvement of equipment, or the enforcement of legislation a particular challenge.
A reduction in the incidence of occupational disorders in tropical agriculture requires a multidisciplinary effort. Ergonomics has much to offer in such an approach because it allows consideration of the interaction between poverty, poor health and low productivity. However, specific solutions to occupational health problems can only be feasible by taking into account the particular population and particular circumstances, hence the need for studies such as this one.

REFERENCES


8th World Conference on Injury Prevention and Safety Promotion

The International Convention Centre
Durban, South Africa
2 - 5 April 2006
Concept Of Communal Safety Among Urban Housewives Of India

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University of Calcutta
India

Co-authors
Ghoshal, Goutam
Das, Tamal

PROBLEM
The residential complexes inhabited by innumerable people can be regarded as major communities. It is important to take proper accident prevention and safety measures while designing such residential complexes. The kitchen is perhaps the smallest room in a modern-day apartment. It is not only a food preparation workplace but also a storehouse of different food items. Every member of a family visits this room, leaving aside the homemaker (women) who is required to spend an average of five to six hours daily in the kitchen.

OBJECTIVES
In the present study an attempt was made to identify the existing concept of safety in a community, to assess the smaller parts of a community and to modify and improve the conceptual aspects of a safe community.

METHOD
Thirty-five (35) non-pregnant, non-lactating urban housewives belonging to the Bengali community residing at different residential complexes of Kolkata, India were selected randomly for the study. The entire project was based on analysis of questionnaire.

RESULTS
The concept of safety and accident prevention is completely unknown to majority of the people. The relation between an individual and her environment was not a matter of concern to most individuals. They were concerned about their homes only. At most places dirt and noise were the prime hazards. Vibrations were felt at most homes due to the movement of heavy vehicles. The greenery around the complexes, though maintained, was not satisfactory to most individuals. Yet, they were not willing to take up the responsibility of improving the conditions. There were adequate streetlights in the locality, but once damaged, it took a long time for them to be replaced. There was no first-aid camp in the locality. Training courses on health promotion and safety were never organised in the localities. There was a medical centre in the complex but the doctor attended it only once a week for just a couple of hours. No chemist was found to remain open for 24 hours. There were no specific speed limits for driving within the community premises. Speed breakers though present were not highlighted. In most of the complexes adequate fire extinguishers were not present. At home the LPG cylinder leakage was not checked regularly. Family members never undergo regular medical check-ups. The electronic appliances at home were not well maintained and not regularly serviced. Staircases of the complexes did not have any fire extinguishing equipment. The common accidents at home included cuts and bruises that resulted mostly from slips and falls, being struck by objects or being caught in between objects. Burns were found to be the most prominent kitchen accident caused by the spilling of hot oil or water or contact with hot surfaces and electrical shocks. Cuts were the second most common accident, occurring mostly during the chopping of vegetables with a knife. Fire from the oven and the electrical appliances present in the kitchen was found to be the other common accident. It was found that most kitchen workers suffered from low back pain. Also prominent was pain in the upper back, knees, ankles and feet. They suffered from headaches and dizziness due to long working hours and excessive sweating during the summer months. The rate of accidents also showed a rise during the summer months.

CONCLUSION
The above investigation revealed that there is much ignorance and unawareness amongst the residents of the community regarding safety and accident prevention. It is thus important to make people understand the concept of safety and accident prevention.