ERGONOMICS EVALUATION OF WORK RELATED MUSCULOSKELETAL DISORDERS (WMSDs) AMONG THE FEMALE BRICK FIELD WORKERS OF WEST BENGAL, INDIA

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1. Introduction

Manual brick field industry is one of the most important and oldest industries in India, where millions of female workers suffered from work-related musculoskeletal disorders (WMSDs). Work related musculoskeletal disorders are a common cause of pain in female brick field workers in brick field industries involved in moulding, carrying and stacking process. The main aim of the present investigation is i) to determine the prevalence of musculoskeletal disorders among female brick field workers, ii) to determine the repetitiveness of work iii) to determine the postural stress of the female brick field workers iv) to determine the prevalence of physiological stress among the female brick field workers compared to control workers.

2. Method

For this study, a total of 148 female brick field workers and 130 female control subjects were selected randomly. The control subjects were mainly involved in hand-intensive jobs (housemaid). The Modified Nordic Questionnaire was applied to assess the discomfort felt among both groups of workers (female brick field workers and female control subjects). Modified Nordic questionnaire studies and posture analysis were performed among them by Ovako Working Posture Analyzing System (OWAS) method. Repetitiveness of work and Hand Grip Strength of both the groups were also measured. Physiological stress was also assessed by measuring heart rates of the female brick field workers.

3. Results

Female brick field workers suffered from pain especially in the lower back (98%), hands (93%), knees (86%), wrists (85%), shoulders (76%) and neck (65%) (table 1). Among the brick-making activities, brick field workers felt discomfort during spading for mud collection (98%), carrying bricks (95%) and moulding (87%). From the analysis of different working postures of the female brick field workers during different activities in manual brick making, it is found that most of the working postures are of high risk and require immediate corrective measures, as indicated by OWAS system. Brick manufacturing considered as highly repetitive job, which include cutting mud with spade (83.33%), carrying mud (61.44%), inserting the mud in the dice (68.55%), lift the dice upward & downward forcefully (65.16%), stack bricks loading on head one by one (68.01%), carrying the bricks on head from stacks to kiln (58.64%), unloading the bricks on the kiln top (78.22%), setting bricks on kiln one by one (89.32%), after firing carrying bricks from kiln to storage (71.89%) (fig 1). From this study it was observed that there was a significant difference (p < 0.05) in hand-grip strength measured at 90° elbow flexion and 180° elbow flexion just after stoppage of work between the female brick field workers and the control subjects. The heart rate is the best indicator of physiological stress; in this study it was observed that just after work heart rate of the different groups of brick field workers (Brick moulders have a heart rate 130.9 beats/min, brick carriers have a heart rate 127.0 beats/min, brick stackers have a heart rate 140.0 beats/min) have a significant change of heart rate (p<0.001).
Table 1. Feeling of discomfort in different parts of the body among the female brick field workers and in the control group

<table>
<thead>
<tr>
<th>Part of the body</th>
<th>Brick field workers (N = 148) [n (%)]</th>
<th>Control group (N = 130) [n (%)]</th>
<th>Chi²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower back</td>
<td>145 (98)</td>
<td>28 (22.0)</td>
<td>168.78</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Hands</td>
<td>138 (93)</td>
<td>8 (6.0)</td>
<td>207.02</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Knees</td>
<td>127 (86)</td>
<td>26 (20.0)</td>
<td>118.48</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Wrists</td>
<td>126 (85)</td>
<td>4 (3.0)</td>
<td>183.91</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Shoulders</td>
<td>112 (76)</td>
<td>5 (4.0)</td>
<td>146.18</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Neck</td>
<td>96 (65)</td>
<td>3 (2.0)</td>
<td>115.40</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Figure 1. Average percentage of repetitiveness of different kinds of activities in brick manufacturing units

4. Discussion

This study mainly shows that the physical as well as biomechanical load of the brick field workers is high in comparison to the control group of workers due to carrying heavy loads in an awkward posture for prolonged period of time. Das 2014 stated that musculoskeletal disorders were observed among the brick field workers due to carrying heavy loads (manual material handling) for a long period of time. This study also revealed that brick field workers felt discomfort in their knees due to kneeling for a prolonged period of time during moulding, during loading and unloading the mud and bricks, and while setting the green bricks in the kiln. Das 2015 and Jensen et al. 2005 support this result, according to them, the prevalence of knee disorders in some occupations was possibly related to kneeling working postures. On consideration of the above facts, it is found that most of the postures adopted by the brick field workers are in conformity with the results of the work posture analysis. The posture analysis by OWAS system reveals that most of the postures require corrective measures immediately. This study showed that there was a significant difference in the hand-grip strength just after work between the brick field workers and...
the control group. If brick field workers are constantly engaged in hand-intensive jobs, they may be affected by discomfort (pain) in the upper extremities and significant changes in the hand-grip strength [5]. The heart rate is the best indicator of the physiological parameters. The fact that the heart rate of the brick carriers measured just after completion of work was very high may be due to constant movement of the body. Moreover, when a brick carrier bends forward to collect the bricks, the muscles of the abdomen contract and the muscles of the back are stretched. This contracting and stretching of the muscles requires energy. Thus, the heart rates are increased.

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References
Das, B. 2015 "An evaluation of low back pain among female brick field workers of West Bengal, India" Environmental Health and Preventive Medicine DOI: 10.1007/s12199-015-0476-0