Research article (Award paper)
An ergonomic evaluation of the prevalence of musculoskeletal disorders among fish processing workers of Suri

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ABSTRACT

Introduction and Aim: Fish processing industries have been showing tremendous growth in recent years. Various modern processing technologies and equipment are incorporated in the fish processing plants. Some of the tasks in fish processing plants yet involve manual handling. Prolong working in wet environment in awkward confined posture leads to the development of musculoskeletal disorders (MSDs). The current study aimed at evaluating the prevalence of work-related MSDs among fish processing workers.

Materials and Methods: A total of thirty subjects from fish processing plant between 28-40 years were selected randomly from a fish processing plant in Suri of West Bengal. A modified Nordic questionnaire was applied for the assessment of the discomfort or pain of the processing workers. The study included postural analysis utilising the standardized Rapid Upper Limb Assessment (RULA) tool.

Results: The present study showed that 60% of the fish processing workers complained discomfort or pain in different parts of the body majorly in neck, wrist and lower back respectively. The RULA score of posture adopted during job tasks majorly scaling, trimming, filleting of fishes indicated medium risk of musculoskeletal injury and sharpening of blade involved low risk of developing MSDs.

Conclusion: It may be concluded that neck and lower back are the major occupational health issues prevailing in fish processing workers. Prolong working in awkward posture and in repetitive manner led to increased risk of developing work-related MSDs.

Keywords: Fish processing workers; scaling; trimming; filleting; MSDs.

INTRODUCTION

Consumer of fish attains greater demand as a result of the wider range of availability. The amino acid amino profile content, high mineral and vitamin content and low cholesterol composition also makes it a suitable choice of annual protein besides being the cheapest and safer source of animal protein. Indian fish processing industry is considered to be 50 years old and it is evolving with the adoption of modern facilities and technology meeting the international protocol and norms (1). However, the socio-economic condition of the workers working in the fish processing industry is found to be below the international standards. Women have been a predominant part of the fishing industry largely taking part in the fishing and processing related activities respectively (2). The labour involved in the fishing industry is segregated along the sex lines where men are actively taking part in seafood harvesting related activities and women are mostly involved in processing activities (3). The activities involved in fish processing can eventually lead to direct consumption or further preservation (4). The activities involved with the traditional aspects of fish processing are majorly washing, scaling, splitting, trimming and smoking of fishes. Increment in the production level and consumption of fishes can result in increased incidence of asthma and work-related respiratory allergy (5). The fish processing industry have the increased potential of causing respiratory diseases due to the presence various contaminants such as histamine, endotoxins and various chemical additives. The gases produced as a result of the anaerobic decomposition of the fish can result in various acute respiratory diseases (6,7).

Working condition, safety training, age, weather, work experience are the considerate factors contributing to various occupational hazards (8,9). The kind of worker employment based on temporary or permanent is also a contributing factor leading to increase the likelihood of occupational accidents (10). The adverse work environment condition, poor perception of the working conditions, prevalence of adverse health condition of the workers as a result of the increased incidence of the occupational injury (11). This present study aimed at assessing the prevalence of work-related musculoskeletal disorders (MSDs) and evaluating the effect of postures leading to occurrence of musculoskeletal injury among fish processing workers of Suri.

MATERIALS AND METHODS

Subjects
The subjects of the study were the male fish
processing workers of Suri. Fifty subjects were selected on random basis for the research study. The selected study subjects were in the age group of 28-40 years and had a working experience of 5-8 years. The subject’s consent was taken verbally before the application of questionnaire for the processing of the study on a further note.

**Questionnaire study**

For the assessment of discomfort and pain that were present in the bodies of the male fish processing workers, a modified Nordic questionnaire was used. The entire questionnaire was divided into the main categories, which included subjective symptoms of musculoskeletal system or work-related pain indicating discomfort in various parts of the body. If any discomfort was felt, it was in the areas dealing with the neck, shoulder, elbow, wrist, hand, upper back, lower back, hip, knee, and ankle, as well as any other reported associated disabilities. The questionnaire was used to assess the probability of developing musculoskeletal disorders (MSDs) in the chosen subjects. The questionnaire was used during a one-on-one interview with in the selected subjects.

**Posture analysis**

RULA (Rapid Upper Limb Assessment) tool was applied for the assessment of discomfort in practiced posture among fish processing workers of the Suri. The entire process was carried out by means of digital videography. It was then followed by drawing of stick diagram taking the still photo as the reference and was analysed by the application of Ergonomics software ErgoFellow 3.0 that has been created by FBF Sistemas, Brazil.

**Statistical analysis**

For the selected level of significance (p<0.05), a one tail chi square test of independence has been employed to determine whether there is any correlation between the year of working experience and the occurrence of uncomfortable feeling.

**RESULTS**

The average age of the male fish processing workers is 33 years old. Their average height is 165.08 cm, and their average weight is 67.8 kg as shown in Table 1.

**Table 1: Demographics of the fish processing workers**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Fish processing workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>33.69±3.51</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.08±3.37</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>67.79±2.04</td>
</tr>
</tbody>
</table>

It was found that 35% had a working experience of 1-4 years, 45% of the study subjects had a working experience of 5-8 years and 20% of the study subjects had more than 10 years of working experience as shown in the table 2.

**Table 2: Average years of working experience of the fish processing workers**

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th>1-4 yrs</th>
<th>5-8 yrs</th>
<th>&gt;10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35%</td>
<td>45%</td>
<td>20%</td>
</tr>
</tbody>
</table>

It was found that the study participant had 7 days as their average working days in a week. The average duration of rest of the fish processing workers per day basis was found to be 1 hour whereas the average duration of work of the fish processing workers per day was found to be 10 hours respectively as shown in the Table 3.

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

<table>
<thead>
<tr>
<th>Duration of work per day (in hour)</th>
<th>Duration of rest per day (in hour)</th>
<th>Number of working days in a week</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 (±0.80)</td>
<td>1(±1.00)</td>
<td>7</td>
</tr>
</tbody>
</table>

It was found that the minimum working experience was 1 year and maximum working years was found to be 11 years. On the basis of the findings the working experience were categorised into three groups respectively – 1-4 yrs, 5-8 yrs and <10 years. It was in Table 4 that maximum number of people worked with a working experience of 5-8 years. Continuing working in the same posture over the years have led to the development of discomfort at different parts of the body with maximum discomfort felt at lower back and neck respectively as shown in Fig. 3.

**Table 4: Working hours and the frequency of discomfort among fish processing workers**

<table>
<thead>
<tr>
<th>Work experience (Years)</th>
<th>Total no. of subjects</th>
<th>Subject with discomfort</th>
<th>Chi-square value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4 yrs</td>
<td>15</td>
<td>9</td>
<td>0.1828</td>
</tr>
<tr>
<td>5-8 yrs</td>
<td>25</td>
<td>20</td>
<td>Not significant (p&lt;0.05)</td>
</tr>
<tr>
<td>&lt;10 yrs</td>
<td>10</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 1: Graphical representation of fish processing workers with discomfort**

It was found that 68% of the fish processing workers have responded to discomfort feeling as shown in Fig.1. It was found that 68% of the study participants complained to have discomfort feeling in various part
of the body. Among which 53% of the study participants complained to have discomfort feeling during work and 46% of respondents reported experiencing pain in various body parts during their downtime as shown in the Table 5.

![Discomfort feeling in any part of the body](image)

**Fig. 2:** Percentage distribution of feeling of discomfort in varied body parts

**Table 5:** Discomfort feeling during work and during rest in the workers

<table>
<thead>
<tr>
<th>Discomfort feeling</th>
<th>Discomfort feeling during work</th>
<th>Discomfort feeling during rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>68%</td>
<td>53.3%</td>
<td>46.7%</td>
</tr>
</tbody>
</table>

Participants reported discomfort in several body parts, with the lower back (61%) and neck (60%) registering the highest levels of discomfort, respectively, as shown in Fig. 3. About 50% of the fish processing workers had pain in upper back and 40% of the workers felt pain in finger.

![Discomfort at various parts of the body of fish processing workers](image)

**Fig. 3:** Discomfort at various parts of the body of fish processing workers

It was found in Table 6, the discomfort in various part of the body was experienced by the fish processing workers and was found to be in collaboration with the different job task involved in fish processing in order to look for the MSD risk with respect to the RULA score. It was seen that the posture adopted by the fish processing workers majorly included sharpening of blade, scaling of fish, carrying of fish, trimming and filleting of fish respectively. The sharpening of blade, scaling of fish, trimming of fish and filleting of fish involved medium risk of development of MSDs respectively. On the basis of the questionnaire study, it was found that 55% of the fish processing workers complained to have increased tendency of getting cut and laceration during time of scaling (Fig. 3). However, 55% of the study participants have complained to have cut and laceration tendency during trimming of fish (Fig. 4). It was found that 55% of the study participants did complain to have cut and laceration in the filleting task respectively as shown in Fig. 5.

![Cut/Laceration during scaling](image)

**Fig. 4:** Percentage distribution of cut/laceration during scaling of fish

![Cut/Laceration during trimming](image)

**Fig. 5:** Percentage distribution of cut/laceration during trimming of fish

On the basis of the questionnaire study, it was found that 60% of the fish processing workers neither used personal protective equipment (PPE) nor were aware of its utility while carrying out the different job task majorly scaling, trimming and filleting of fishes involved in the fish processing industry as shown in Fig. 6 respectively.

![Do you use PPE?](image)

**Fig. 6:** Percentage distribution of PPE use among workers
Table 6: Analysis of the working posture of fish processing workers

<table>
<thead>
<tr>
<th>Job tasks</th>
<th>Posture</th>
<th>RULA score</th>
<th>MSD Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharpening of blade</td>
<td></td>
<td>5</td>
<td>Medium risk, changes may be needed</td>
</tr>
<tr>
<td>Scaling of fish</td>
<td></td>
<td>5</td>
<td>Medium risk, need further investigation</td>
</tr>
<tr>
<td>Carrying of fish in containers for processing</td>
<td></td>
<td>4</td>
<td>Low risk, changes may be required</td>
</tr>
<tr>
<td>Trimming of fish</td>
<td></td>
<td>5</td>
<td>Medium risk, need further investigation</td>
</tr>
<tr>
<td>Filleting</td>
<td></td>
<td>5</td>
<td>Medium risk, need further investigation.</td>
</tr>
</tbody>
</table>

**DISCUSSION**

It is found from the current study that 68% of the fish processing workers were found to have discomfort feeling as they were forced to do the task of the fish processing at an awkward position for a prolong working hours. It was seen in the Table 3 that the fish processing workers were working for 10 hours for seven working days. About 53% of the study subject felt discomfort during their working hours however 46% felt discomfort feeling during their rest time as shown in the Table 5. This may be due to adaptation of awkward position while working for a prolong period of time which leads to increased likelihood of developing MSDs. The likelihood is reinforced by the results of numerous research that show working in awkward positions for a prolong period results in various MSDs (12-14).

Table 4 and Fig. 1 has shown the categorisation of the work experience as 1-4 years, 5-8 years and >10 years with respect to the development of discomfort feeling in the present study respectively. It was observed from Fig.1 that 40% of the subjects with a work experience of 5-8 years have developed discomfort feeling, 18% of the subjects with a work experience of >10 years have experienced discomfort feeling. However, it was observed that there was no significant association among the number of years of employment and the emergence of discomfort among the fish processing workers. Referring to the Fig 3 it was found that the fish processing workers stated discomfort at various part of the body out of which 61% at lower back, 60% eye, 50% upper back, 40% finger, 39% wrist, 31% shoulder, 30% forearms, 18% eye and elbow respectively. This may be because of the adaptation of awkward posture during work for an extended period results in the increased likelihood of the development of musculoskeletal disorder (MSDs). Numerous studies have shown that working in an awkward and stationary position for long periods of time and repeatedly moving the hands and wrists can result in the development of musculoskeletal disorders (MSDs), which can cause pain in the neck and upper limbs, respectively (15,16). The present study has shown that about 55 % workers undergo cut and lacerations while performing scaling and trimming task of the fish processing work (Fig. 5). This might be due to the use of knives and sharp tools in the trimming process in a repetitive manner. It is also found that they do not use any PPE from the Fig 6 while carrying out trimming process. Lack of PPE use can lead to increase the risk of contact with hazards which eventually leads to the increased cuts and burns severity (17-19).

**CONCLUSION**

Based on the discussion and analysis of the present study, it is to conclude that 68% of the fish processing workers were having discomfort feeling in different parts of the body on account of working in awkward
posture affecting the lower back (61%) on a major note. It can be developed as a result of inaccessibility of ergonomic work station with proper height thereby showing failure in retaining the normal curvature of spinal cord while working eventually can lead to enhance the risk of development of low back pain (LBP). Working in a confined and static position for an extended time period without taking intermittent breaks in between can alleviate the pain perception and discomfort majorly in lower back, neck, upper back, wrist and fingers respectively. Repetitive task mainly involving sharpening of blade, scaling of fish and filleting contribute to the alleviation of the risk of developing musculoskeletal disorders (MSDs) and severity of cut and lacerations. 60% of the respondents were found to practice unprotected handling of fish in various processing stages which increases the likelihood of coming in contact with the protein content of fish leading to development of various skin diseases majorly dermatitis. Creating awareness about using PPE mainly gloves can lead to decrease the likelihood of having lacerations and cuts respectively. Implementation of ergonomic workstation with height adjustability can help in restoring the spine’s normal curvature and may reduce the risk of MSDs. However, it is also advised to practise proper ergonomic habits, take short breaks every hour, and follow job rotation in all the tasks involved in fish processing. Although it is non-significant but there is a slight role of years of work experience in the development of discomfort and pain among the fish processing workers. Efficient use of PPE (cut resistant hand gloves, boots, masks) while carrying out fish processing task can help in avoiding cut or lacerations. Correct ergonomic practices and workplace can lead to the improvisation of health of the workers as a whole and will further boost productivity of the fish processing workers.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest to disclose in the study.

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