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## Musculoskeletal discomforts faced by workers in food processing enterprises of Punjab

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### Abstract

Workers of food processing enterprises face several health problems like musculoskeletal disorders, work related stress, rhinitis, dermatitis, respiratory problems, poisonings and hearing loss. Among which most prevalent is musculoskeletal disorders or discomforts. Present study was conducted to identify the body parts affected due to the food processing activities performed by respondents in different micro, small and medium scale enterprises; to study the extent of musculoskeletal discomforts faced by the respondents and to identify the most exertion prone activities in micro, small and medium scale food processing enterprises. For conducting the present study, six micro, three small and two medium scale food processing enterprises were selected from Punjab and 50 respondents were selected randomly from each scale of enterprises making a total of 150 respondents. Musculoskeletal discomforts faced by respondents were studied with the help of Postural Discomfort Scale, Standard Nordic Musculoskeletal Questionnaire and Rating of Perceived Exertion Scale. Results revealed that highest discomfort was faced in wrist, neck and low back region of the respondents.

**Keywords:** Food processing, musculoskeletal discomforts, perceived exertion, postural discomfort, workers

### Introduction

Musculoskeletal discomforts are one of the most common types of injuries in the food processing enterprises. These are not the result of a particular event such as a fall rather they are the development of damage to muscles, nerves, tendons, ligaments, joints, cartilage or spinal discs over time. It takes several weeks, months or years to develop the musculoskeletal discomforts. It develops due to tissue damage as a result of micro traumas which occur from many small injuries. The major reasons for the development of musculoskeletal discomforts are repetitive work, forceful work, handling heavy loads and contact pressure due to sustained static posture. The work pattern in food processing industries is very repetitive and speedy and the workers are exposed to several health risks. Studies also reveal that maximum number of workers were facing musculoskeletal disorders (MSDs) which are the most prevalent occupational health hazards in India (Ansari and Sheikh 2014) [1]. Therefore, the present study was conducted with the following objectives:

1. To identify the body parts affected due to the food processing activities performed by respondents in different micro, small and medium scale enterprises
2. To study the extent of musculoskeletal discomforts faced by the respondents
3. To identify the most exertion prone activities in micro, small and medium scale food processing enterprises

### Methodology

For conducting the present study, six micro, three small and two medium scale food processing enterprises were selected from Punjab and 50 respondents were selected from each type of enterprises making a total of 150 respondents. The musculoskeletal discomforts faced by the respondents were recorded with the help of subjective ergonomic assessment tools like Postural Discomfort Scale (Corlett and Bishop 1976) [3], Standard Nordic Musculoskeletal Questionnaire (Kuorinka *et al* 1987) [4] and Rating of Perceived Exertion Scale (Varghese *et al* 1994) [9]. The recorded responses were evaluated on the basis of calculating mean of the scores. Mean of all the three type of enterprises were taken and the ranks were given to final mean scores wherever applicable.

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**Results and Discussion**

**Body part discomfort of respondents by using Postural Discomfort Scale (Corlett and Bishop 1976) [3]**

Body part discomfort was assessed with the help of Postural Discomfort Scale developed by Corlett and Bishop in 1976 [3]. The mean score of respondents (Table 1) depicts that moderate discomfort was felt in the wrist (2.84), neck (2.79) and lower back (2.58) regions. Mild discomfort was felt in the upper back (2.10), upper arms (2.06), thighs (2.02), legs (1.97), shoulders (1.96), buttock (1.94), lower arms (1.86), mid back (1.46) and very mild discomfort was felt at the feet (1.44). Looking into all the enterprises separately, in micro scale enterprises moderate discomfort was felt in the neck (3.02), wrist (3.32) and upper arms (2.68); mild discomfort was felt at lower arms (2.48), upper back (2.12), buttock (1.96), legs (1.88), shoulders (1.62) and mid back. Whereas, very mild discomfort was felt at thighs (1.48) and feet (1.18). In small scale enterprises, moderate discomfort was felt at neck (2.76) and wrist (2.54); mild discomfort was felt at buttock (2.44), thighs (2.14), upper back (2.10), lower arms (2.08), shoulders (1.98), lower back (1.82) and mid back

(1.68). Very mild discomfort was felt at legs (1.40), upper arms (1.38) and feet (1.16). Ray and Desai (1995) [7] also observed that 80 percent of women in small scale industries experienced body pains and aches on daily basis and the major body parts involved were back, legs, head, neck and hands. In medium scale enterprises, severe discomfort was felt at the lower back region (3.82); moderate discomfort at the wrists (2.68), legs (2.64) and neck (2.60); mild discomfort at thighs (2.46), shoulders (2.28), upper arms (2.12), upper back (2.08) and feet (2.02). Whereas, very mild discomfort was felt at buttocks (1.42), mid back (1.20) and lower arms (1.04).

Body part discomforts are attributed by the improper posture during work which can be due to improper workstation or tool design and improper work pattern. According to National Institute for Occupational Safety and Health (1997) [5] the neck or shoulder musculoskeletal discomforts occur due to improper work pattern like static contraction for longer duration, static loading for longer time or awkward working postures of the workers.

**Table 1:** Mean of Body Part Discomfort Score by using Corlett and Bishop scale (1976) [3]

| Body Parts | Mean score         |                    |                     |               | Rank |
|------------|--------------------|--------------------|---------------------|---------------|------|
|            | Micro Scale (n=50) | Small Scale (n=50) | Medium Scale (n=50) | Total (n=150) |      |
| Neck       | 3.02               | 2.76               | 2.60                | 2.79≈3        | II   |
| Shoulders  | 1.62               | 1.98               | 2.28                | 1.96≈2        | VIII |
| Upper Back | 2.12               | 2.10               | 2.08                | 2.10≈2        | IV   |
| Upper Arms | 2.68               | 1.38               | 2.12                | 2.06≈2        | V    |
| Mid Back   | 1.52               | 1.68               | 1.20                | 1.46≈2        | XI   |
| Lower Arms | 2.48               | 2.08               | 1.04                | 1.86≈2        | X    |
| Wrists     | 3.32               | 2.54               | 2.68                | 2.84≈3        | I    |
| Lower Back | 2.12               | 1.82               | 3.82                | 2.58≈3        | III  |
| Buttocks   | 1.96               | 2.44               | 1.42                | 1.94≈2        | IX   |
| Thighs     | 1.48               | 2.14               | 2.46                | 2.02≈2        | VI   |
| Legs       | 1.88               | 1.40               | 2.64                | 1.97≈2        | VII  |
| Feet       | 1.18               | 1.16               | 2.02                | 1.44≈1        | XII  |

Mean score 1=Very mild, 2=Mild, 3=Moderate, 4=Severe, 5=Very severe

**Musculoskeletal problems faced by respondents by using Standard Nordic Musculoskeletal Questionnaire (Kuorinka et al 1987) [4]**

Results in Table 2 revealed that maximum number of total respondents were having problems in the neck (59.33 %) followed by low back (42.67 %), knees (36.00 %), upper back (32.00 %), shoulders (32.00 %), Hips/thighs (24.67%), wrists/hands (23.33%). Very few of them were prevented from doing their work due to the trouble in last 12 months and maximum number of those who were prevented had trouble in

their knees (12.00%), neck (11.33%), low back (7.33%) and shoulders (6.00%). In last 7 days respondents had trouble in their low back (28.67%) neck (26.67%) and knees (16.67%) and in rest of the body parts very few had faced trouble. Choubineh et al (2008) [2] also studied the posture of workers engaged in small scale rubber industry and reported the similar findings that maximum number of workers faced low back pain (50.2%), followed by pain in knees (48.5 %) and upper region of back (38.1 %).

**Table 2:** Distribution of respondents on the basis of musculoskeletal problems by using Standard Nordic Musculoskeletal Questionnaire (by Kuorinka et al 1987) [4] (n=150)

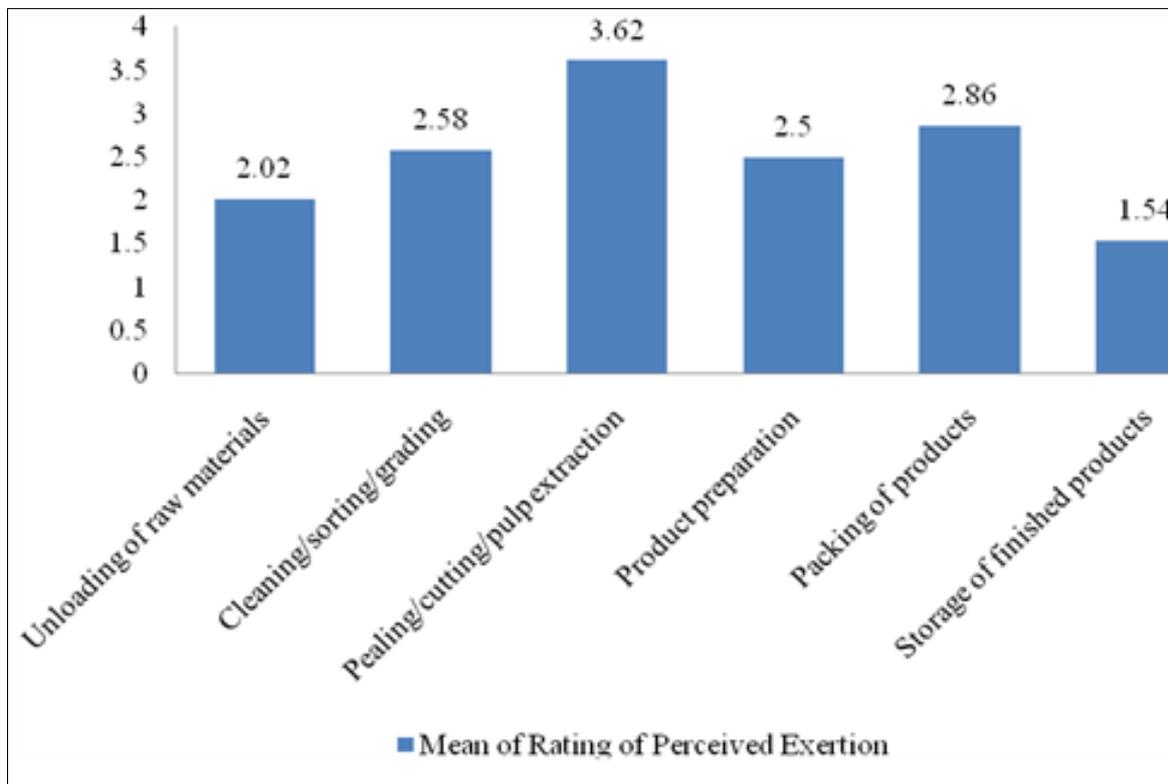
| Body parts   | Frequency and extent of musculoskeletal problems |  |                              |
|--------------|--|--|------------------------------|
|              | Trouble in last 12 months f (%)                  | Prevented from work due to trouble in last 12 months f (%) | Trouble in last 7 days f (%) |
| Neck         | 89 (59.33)                                       | 17 (11.33)   | 40 (26.67)                   |
| Shoulders    | 48 (32.00)                                       | 9 (6.00)   | 9 (6.00)                     |
| Elbows       | 5 (3.33)   | 2 (1.33)   | 1 (0.67)                     |
| Wrists/hands | 35 (23.33)                                       | 10 (6.67)  | 7 (4.67)                     |
| Upper back   | 48 (32.00)                                       | 3 (2.00)   | 13 (8.67)                    |
| Low back     | 64 (42.67)                                       | 11 (7.33)  | 43 (28.67)                   |
| Hips/thighs  | 37 (24.67)                                       | 0 (0.00)   | 14 (9.34)                    |
| Knees        | 54 (36.00)                                       | 18 (12.00)   | 25 (16.67)                   |
| Ankles/feet  | 24 (16.00)                                       | 3 (2.00)   | 4 (2.67)                     |

**Rating of perceived exertion faced by respondents using Rating of Perceived Exertion Scale (Varghese *et al* 1994) <sup>[9]</sup>**

**(a) Micro scale enterprises**

In micro scale enterprises, the processing activities were done while sitting on ground. Fig 1 portrays the mean of rating of perceived exertion of the respondents engaged in micro scale food processing enterprises. Highest exertion with moderate severity rate was reported while performing pre preparation activities like peeling/cutting/pulp extraction (mean score- 3.62), followed by packing of products (mean score- 2.86), cleaning/sorting/ grading (mean score- 2.58) and product preparation (mean score- 2.50). Light exertion was reported while unloading of raw materials (mean score- 2.02) and storage of finished products (mean score- 1.54). Peeling/cutting/pulp extraction was considered as highest exertion prone activities because these tasks were performed for longest duration and demanded static posture along with

repetitive hand movements. In micro scale enterprises, packing activity was performed with the help of manual sealer which was placed on the ground. Respondents had to sit on the ground in squatting posture and exerted force to operate the sealer. Product preparation was an activity which was performed either in sitting or in standing posture. It was again a repetitive task and required continuous human attention. Unloading of raw material was not a major exertion prone activity because respondents did not deal with the bulk of raw materials like in small or medium scale enterprises and very few respondents were directly involved in unloading activity. Storage of finished products was done either in the same hall in one corner or in the room next to the work area. It again required multiple movements because they used to shift the materials by placing it in the crates and no trolley was available.

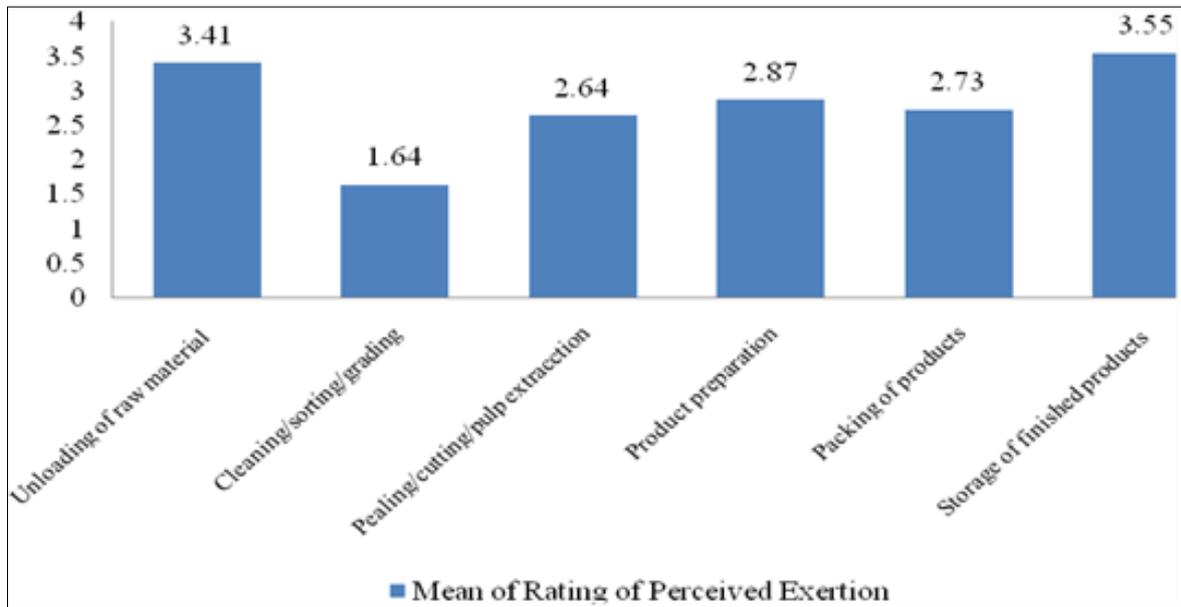


**Fig 1:** Mean of Rating of Perceived Exertion of respondents engaged in performing various activities at the micro scale food processing enterprises

**(b) Small scale enterprises**

This section presents the rating of perceived exertion felt by respondents in small scale enterprises where respondents had the freedom to work either by sitting on ground or standing. Fig 2 denotes that in small scale enterprises heavy exertion was experienced by respondents while storage of finished products (mean score- 3.55), moderate exertion was felt while unloading of raw materials (mean score- 3.41), product preparation (mean score- 2.87), packing of products (mean score- 2.73), peeling/cutting/pulp extraction (mean score- 2.64). Cleaning, sorting and grading was the activity with light exertion (mean score- 1.64). In small scale enterprises,

storage of finished products was done in a big sized drum like container which was transported to the storage room manually which makes the task heavy. Unloading of raw materials was done manually by making multiple trips to unload and store the raw materials. Product preparation, packaging and peeling/cutting/pulp extraction were done manually with the use of simple hand tools used in kitchen like spoon, knife and spatula. Cleaning was done in a semi-automatic vegetable washer in which respondents had to feed the material manually and it collects the washed vegetables from the outlet.

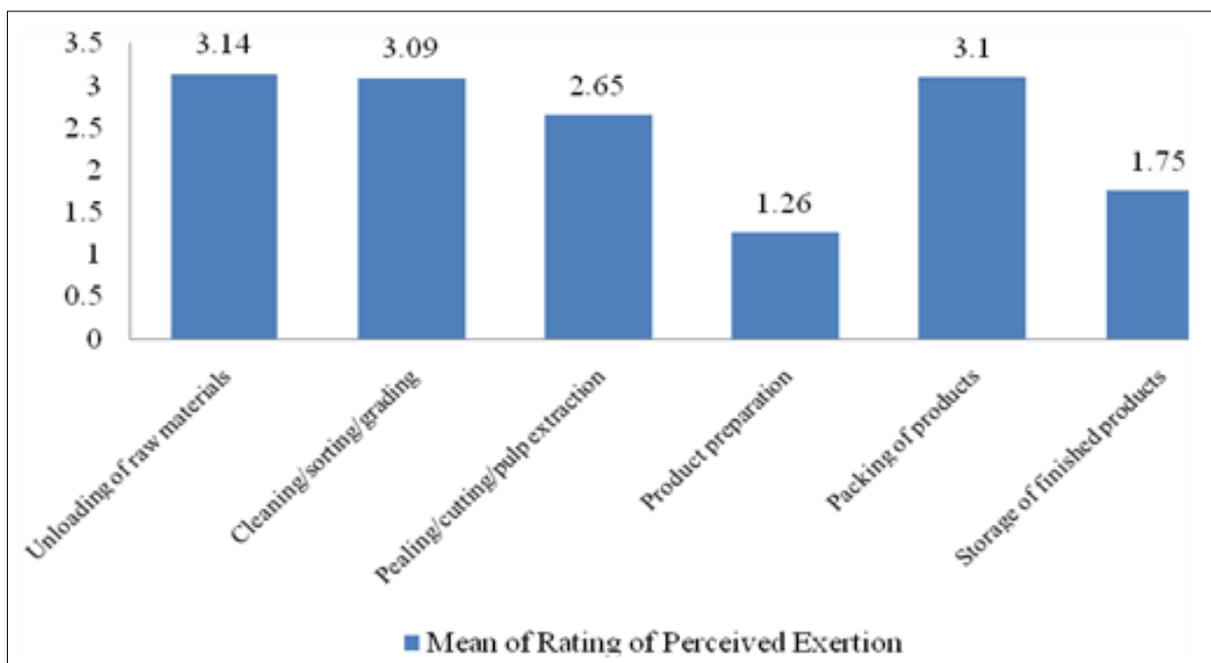


**Fig 2:** Rating of Perceived Exertion of respondents engaged in performing various activities at the small scale food processing enterprises

**(c) Medium scale enterprises**

In medium scale enterprises, all the activities were performed in bulk. Respondents had to deal with huge amount of food materials. They also had to meet a particular daily target due to which they had to work continuously mostly in standing posture creating physical stress. It was recorded in Fig 3 that in medium scale enterprises, highest exertion with moderate severity rate was experienced during unloading of raw materials (mean score- 3.14), packing of products (mean score- 3.10), cleaning/sorting/grading (mean score- 3.09) and peeling/cutting/pulp extraction (mean score-2.65). Light exertion was felt while storage of finished products (mean score- 1.75) and very light exertion was felt during preparation of products (mean score- 1.26). In medium scale enterprises, unloading was done manually as well as with the use of machines. The respondents had to deal with large amount of heavy sacks, therefore the activity was rated as moderately exertion prone. Packing of products was done in

standing posture near the conveyor belt due to which limited time was available for respondents for packing the food materials and they had to make frequent multiple hand movements accompanied by twisting and bending of wrists to complete their task in time. Cleaning/sorting/grading was again done in standing posture near the conveyor belt. Working on conveyor belt demanded continuous static posture, sustained concentration and multiple movements of lower arms and fingers which made the activity strenuous. Storage of products was done mechanically but human involvement was there in arranging the boxes in storage room which caused light exertion to the respondents. Preparation of product was done mechanically. Like in preparing juice respondents had to set the recipe and feed the containers in the conveyor belt which were filled mechanically with the concentration mentioned during programming. Unloading of raw materials was the most exertion prone activity followed by cleaning/sorting and grading.



**Fig 3:** Rating of Perceived Exertion of respondents engaged in performing various activities at the medium scale food processing enterprises

The RPE while cleaning/sorting/grading of food products in micro, small and medium scale enterprises was 2.58 (Fig 1), 1.64 (Fig 2) and 3.09 (Fig 3) respectively. Results show that in micro, small and medium scale enterprises, the RPE while peeling/cutting/pulp extraction was 3.62 (Fig 1), 2.64 (Fig 2) and 2.65 (Fig 3) respectively. Rai (2012) conducted a study on women workers engaged in *Aonla* pricking activity in different postures and found that while working with fork, RPE was highest in squatting posture (2.7), followed by standing posture (2.4) and least in sitting posture (2.2). Similarly with hand tool RPE was observed to be highest in squatting posture (2.6), followed by standing posture (2.2) and least in sitting posture (2.0). Tewari *et al* (1998) also conducted similar study in fish processing activity and found that RPE of fisherwomen while washing, drying, sorting and selling of fish were 3.6, 3.2, 3.0 and 2.8 respectively.

### Conclusion

From the above study it can be concluded that while performing food processing activities, moderate discomfort was felt in the wrist (MS=2.84), neck (MS=2.79) and lower back regions (MS=2.58). Mild discomfort was felt in the upper back (MS=2.10), upper arms (MS=2.06), thighs (MS=2.02), legs (MS=1.97), shoulders (MS=1.96), buttock (MS=1.94), lower arms (MS=1.86), mid back (MS=1.46) and very mild discomfort was felt at the feet (MS=1.44). Another major finding of the study was that in micro scale enterprises, peeling, cutting and pulp extraction (MS=3.62); in small scale storage of finished products (MS=3.55) and in medium scale unloading (MS=3.14) and packing (MS=3.10) were the highest exertion prone activities.

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