Background

In Iran, municipal solid waste is collected manually requiring strenuous physical activities. Shiraz is a large city of Iran with 1.800.000 of the population and 240 square kilometers of area. Nearly, 1000 tons of solid waste is daily produced in this city which is collected by 270 waste collectors.

Waste collecting as a job with strenuous physically demanding activities leads to high prevalence of musculoskeletal disorders (MSDs).

Based on our field observations, municipal solid waste collectors repeatedly bend their back to rapidly lift the bags and often carry them in jogging/running status due to time pressure during working time.

The present study was conducted to determine the prevalence rate of MSDs as well as to identify the occupational risk factors leading to the development of MSDs among solid waste collectors in Shiraz city.

Methodology

• Study design: Cross-sectional

• Participants: Out of 270 male workers mentioned above, 230 of them had the criteria for entering the study and finally 200 (87%) voluntary waste collectors participated in this study.

• Data collection procedures:
  ✓ Task analysis was performed using field observation, interview, and video capture. (Fig. 1)
  ✓ Data gathering tools included occupation-specific physical and organizational demands questionnaire, and Nordic musculoskeletal questionnaire (NMQ).

• Data analysis: Multiple logistic regression analysis was used for modeling of MSDs risk factors in each body region.

Results

All workers were male, and their mean age and work experience were 35.49±6.75 and 6.72±6.04 years, respectively.

Table 1: motion and timeline analysis of waste collection during shift work (300 min).

<table>
<thead>
<tr>
<th>Observed motion</th>
<th>Duration of motion</th>
<th>Time allocated to motion (s)</th>
<th>Relative duration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharifian H, Malekahmadi A, Mansour Ziaei, Alireza Choobineh, Mehdi Aminian 2012</td>
<td>MSDS symptoms among municipal solid waste collectors in Shiraz, Iran</td>
<td>C</td>
<td>1520</td>
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<tr>
<td>Mansour Ziaei, Alireza Choobineh, Mehrdad Aminian 2012</td>
<td>Musculoskeletal disorders among municipal solid waste collectors in Shiraz, Iran</td>
<td>A</td>
<td>465</td>
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</tbody>
</table>

Figure 1: rating of occupation-specific physical and organizational demands among the waste collectors (n=200).

Figure 1: workers’ motion analysis demonstrated the variety of main tasks. (A) Stoop lifting bag/bucket; (B) Semi-squat lifting bag/bucket; (C) Pulling/pushing waste container; (D) Avalanche without bag/bucket carriage; (E) Walking along with bag/bucket carriage; (F) Running without bag/bucket carriage; (G) Running along with bag/bucket carriage; (H) Jumping up/down on the garbage truck; (I) Picking up/dumping trash containers by a hand lever; (J) Stopping or standing.

Discussion

• In the present study, 92.5% of municipal waste collectors reported MSDs symptoms at least in one of the nine defined body regions during the last 12 months.

• A high rate of reported symptoms in lower back, knee and ankle/foot was expected due to the frequent stoop lifting of bag/bucket as well as the long period of bag carriage.

• Lifting bag/bucket was associated with high risk of MSDs in the shoulder (OR=2.45), lower back (OR=3.94), and elbow (OR=6.19). Waste collectors had frequent excessive back flexion, back rotation, and repetitive arm abduction, and as well as static elbow extension during bag holding and carrying.

• Previous studies in developing countries showed that the prevalence of MSDs symptoms among waste collectors were 60.8% in Egypt-Mansoura, 61.3% in Nigeria-Port Harcourt, 65% in Iran-Tehran, 70% in India-Chennai, 79% in India-Mumbai, and 88.2% in Brazil-Pelotas and Rio Grande.

• The prevalence of MSDs has also been high among waste collectors of developed countries such as Germany, Netherlands, and USA.

Conclusion

• The results of the present study showed that the prevalence rate of MSDs was high among municipality waste collectors during the last year prior to the study.

• The most prevalent MSDs symptoms were reported in the lower back, knee, ankle/foot, and shoulder regions.

• Our study suggests the following ergonomic measures:
  ✓ Recruiting more waste collectors to provide them more vacations and reduce the cumulative tensions on their musculoskeletal system, thereby reducing the occurrence of MSDs among waste collectors.
  ✓ Putting more garbage bins in the streets and alleys to reduce the long distance walking along with bag carriage, as well as to reduce the frequency of bending of workers while taking the garbage from the ground as the most important risk factor for MSD occurrence.
  ✓ Lowering platform height behind the garbage truck to reduce the pressure on the knee while waste collectors jump up and down from the platform.
  ✓ Use of wearable loading auxiliary equipment, such as exoskeleton, to reduce the pressure on workers’ musculoskeletal system and thus to prevent the incidence of MSDs, especially low back pain among waste collectors.

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