Chapter 43
Working Posture Analysis of Female Residential Building Sweepers Using OWAS Method

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1 Introduction

The sweepers come from disadvantaged communities of society where they feel significant social exclusion and internally adopt belief of inferiority (Patwary 2010). Musculoskeletal injuries are a major occupational concern worldwide. Awkward working posture is a physical factor identified in occupational musculoskeletal injuries (Lee and Han 2013). The National Institute for Occupational Safety and Health reported that awkward working posture had a strong relation to the causation of musculoskeletal injuries.

Sarkar et al. (2016) revealed that manual material handling activities involve awkward postures which leads to occupational health problems. Many studies have found that sweepers are prone to develop musculoskeletal problems in the back, neck, shoulders, arms and hands (Wang and Chiou 2016).

One of the most important factors which leads to work related musculoskeletal problems is the poor posture adopted during work (Burdorf et al. 1991), ranging from minor back problems to severe handicapping (Keyserling 1986; Aaras et al. 1988).

One method for analyzing and controlling poor working postures in industry is the Ovako Working Posture Analysis System (OWAS) (Karhu et al. 1977). OWAS is a working postures analysis method based on observation to identify the poor working postures which cause musculoskeletal disorders. OWAS method, designed to help the work analysts, is a work sampling method based on the analysis of working postures examples collected in certain time periods (Akay et al. 2003).

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Sweepers are susceptible and suffer from various job-related health problems due to limited education and lack of knowledge on occupational health hazards. This activity is performed manually involving a variety of awkward postures without taking much precautionary measures which leads to various postural problems among sweepers. The purpose of this study was to investigate the postures adopted during the sweeping of residential buildings and to determine the prevalence of musculoskeletal pains among residential building sweepers of urban Mumbai city.

2 Methodology

Study Design

A cross-sectional study was carried out on 200 female sweepers working in western suburban residential buildings of Urban Mumbai City.

Participants

The study was conducted on female sweepers in western suburban area residential buildings of Mumbai City. The age of the subjects was between 18 and 60 years of age. Sweepers with at least five years of experience in sweeping job were included in the study. Many residential societies from the suburban Mumbai area were approached. The permission to conduct study was taken from building secretaries. The consent of the sweepers was taken prior to the commencement of the study.

Sample Size

A total of 200 sweepers were selected for musculoskeletal study and postural study was carried out on 120 sweepers. Convenient sampling method was adopted as only those societies who gave permission were considered.

Data Collection

Questionnaire was used to collect the necessary information followed by interview technique to elicit information on sweepers. The musculoskeletal problems experienced by the sweepers were assessed through a validated tool, i.e. Nordic Questionnaire Technique designed by Kuorinka et al. (1987). The postures that were adapted by the sweepers while sweeping were assessed through the method of observation, photographs and standardized evaluation method, i.e. OWAS method developed by Karhu et al. (1977). The OWAS action categories are given below.

OWAS action category	OWAS codes
No corrective measures required	1
Corrective measures required in near future	2

(continued)

(continued)

OWAS action category	OWAS codes
Corrective measures required as soon as possible	3
Corrective measures required immediately	4

3 Results

A cross-sectional study was conducted on 200 female sweepers working in residential buildings in Mumbai city to identify and assess the postural problems and the incidence of musculoskeletal problems experienced by the residential building sweepers.

Demographic Information

The demographic characteristics of the respondents are presented in Table 1. The data on age, educational background and marital status were collected.

The minimum age of sweepers in the study was 21 years, whereas the maximum age of 60 years. The mean age of all subjects was 38.4 ± 10.3 years. Table 1 gives the age distribution of sweepers in the study. Majority (34%) of sweepers in the study were from the age group of 31–40 years, followed by 27.5% sweepers being the age

Table 1 Demographic profile of the female residential sweepers

Parameters	Sweepers (n = 200) frequency	Percentage (%)
Age (Years)		
21–30 years	55	27.5
31–40 years	68	34.0
41–50 years	43	21.5
51–60 years	34	17.0
Educational level		
Illiterate	44	22.0
Primary School Education	138	69.0
SSC	16	8.0
HSC	2	1.0
Marital status		
Married	170	85.0
Unmarried	16	8.0
Widow	10	5.0
Divorcee	4	2.0

group of 21–30 years. Around 21.5% sweepers were in the age group of 41–50 years and the rest 17% were in the age group of 51–60 years.

With regards to the educational qualification and marital status of the residential building sweeper, the highest percentage (69%) of sweepers had only completed primary schooling, whereas 22% were illiterate. Only 8% sweepers had completed SSC, whereas 1% had completed HSC. Most sweepers were married (85%), whereas the rest 15% were either unmarried, widow or divorced.

Activities Performed by the sweepers

The sweeping activity involves various activities that needs to be followed by residential building sweepers which was analyzed and divided into 6 elementary jobs and is presented in Table 2.

Posture adopted by the respondents while performing the activity

Field observations show that because of continuous sweeping with traditional brooms and carrying collected waste either in the wheelbarrows/large bins to the community dustbins manually adopting habitual posture puts undue stress on workers resulting in MSD's. Therefore, the working postures of the respondents while performing different activities while sweeping residential buildings were observed and analyzed using OWAS method. The position of back, upper limbs, i.e. arms and lower limbs, i.e. legs as well as load of force used for lifting and carrying activities were considered for analysis of posture which is presented in Fig. 1.

Figure 1 shows the analysis of working posture adopted during residential building sweeping using OWAS Technique by female sweepers. The results of the OWAS identified that posture adopted during putting garbage into the bin fell into action

Table 2 Activities and postures adopted by the residential building sweepers

Sr. No	Activities performed	Posture adopted
1	Collecting garbage and putting it into big bin	Bending forward to collect dustbin from floor, both arms below shoulder level and weight of the body on one leg, adopting forward bending with arms abducted while putting garbage into a big bin and then again keeping the dustbin in place
2	Sweeping passage area	Bending forward with both the arms below shoulder level and sometimes body weight on one leg with slight bent at knee
3	Sweeping staircase	Forward back bent and twisted, with arms abducted
4	Sweeping parking area	Bending forward with both the arms below shoulder level, while collecting garbage; standing on both feet with knees bent
5	Pulling garbage bin	Forward bending with both the arms below shoulder level in backward direction, holding the big garbage bin and pulling it in forward direction with the force applied for pulling and with continuous walking
6	Carrying garbage on shoulder	Standing back straight, both the arms above shoulder level and standing on one leg with knee bent

Fig. 1 Analysis of working posture adopted during residential building sweepers using OWAS technique

category 4, which was the major poor posture adopted and needed corrective action immediately. The other activity of sweeping passage area, sweeping parking area and pulling garbage bin fell in category 3 that needed corrective action as soon as possible; followed by collecting garbage and putting in big bins and sweeping staircase which fell in category 2 and needed corrective measures in the near future respectively.

Musculoskeletal Problems among sweepers

The musculoskeletal problems experienced by the sweepers were assessed using Nordic Questionnaire Technique. Table 3 describes the occurrence of pain among the residential sweepers.

It is evident from Table 3 that the most commonly affected site was lower back with 85.5% sweepers suffering from lower back pain followed by 83% suffering from shoulder pain. Calf (52%) and upper back (44%) was also a common site of pain in sweepers.

Table 3 Responses on MSD problems experienced by residential building sweepers

Body Parts	Occurrence of pain	Mild pain	Moderate pain	Severe pain	Very severe pain
Eye	–	–	–	–	–
Neck	21.5	8	9.5	4	–
Shoulder	**83**	**20.5**	**48**	**12.5**	2
Upper back	34	12	17	5	–
Elbow	10.5	3.5	6.5	0.5	–
Lower back	**85.5**	**13**	**54**	**18**	0.5
Arm	28	9	11	7	1
Wrist	19.5	7	8.5	3	1
Thigh	2	0.5	1	0.5	–
Knee	23	4.5	11.5	5	2
Calf	**52**	**8**	**26.5**	**14.5**	3
Feet	17.5	3	8.5	5.5	0.5

*The figures indicate percentage

4 Discussion

The current study focused on the posture and MSD problems of female residential building sweepers. The workers adopt back bent, awkward and harmful posture leading to musculoskeletal problems as revealed by OWAS postural analysis method. Some of the activities identified as unsafe postures were putting the garbage in the bin, sweeping passage areas, sweeping parking areas and pulling garbage bins that needed urgent attention and corrective measures to prevent further deterioration. Similar Ph.D. study conducted by Chauhan (1997) on railway platform sweepers found workers performing similar activities like sweeping platforms, sweeping stairs, collecting garbage, putting it in a basket and dumping it in a big bin. The study recommended that correct posture at work should be ensured to reduce postural stress and fatigue as postural stress was recognized as one of the causative factors for high physiological cost and fatigue.

In the present study the daily occurrence of pain among female sweepers was very high and majority of them suffered from lower back and shoulder pain; followed by pain in the calf and upper back. The physical efforts required to carry out various activities of sweeping like lifting, carrying, pushing and pulling are very high that results in MSD's. Other reasons which are attributed towards the pain are marriage. Child bearing and household work. Chauhan (1997) also found low back and shoulder pain as a major musculoskeletal problem reported by railway platform sweepers. Another preliminary study by the present author (Malhotra 2017) on women residential building sweepers showed that the majority of the female sweepers complained of entire body pain along with pain in arm, shoulder, hand/wrist and low back, respectively. A study by Das et al. (2013) on the women sweepers working under the Midnapore Municipality reported that female sweepers experienced back pain

(82.69%). Study by Suthar and Kaushik (2013) on farm women found a high incidence of pain reported by farm women in various body parts, viz. neck, shoulder, elbow, wrist, mid back and low back, knee and calf muscles in overburdened rural women indicates that women are at continuous health risk. Bijetri and Sen (2014) found that women working in the manual brick manufacturing industry had 90% of body pain in wrists, back, knees, thighs, ankles due to awkward posture adopted by them and results of OWAS showed the corrective measures to be taken immediately. Chung et al. (2005) found that workers in the manufacturing industry in Korea were exposed to repetitive manual tasks adopting prolonged poor working postures that were closely related to back pain and other symptoms of musculoskeletal disorders. Results showed a linear relationship between the two types of discomfort, with the shoulder and low back postures being the dominant factor in determining the whole-body postural stresses.

5 Conclusion

The study concludes that the poor and prolonged static postures adopted by the female sweepers during the activity of sweeping needed corrective action immediately and for some postures immediate solution is needed as soon as possible. Poor postures adopted by them led to a number of musculoskeletal problems. Sweeping occupation includes various postures to be adopted which are repetitive and the awkward postures leads in the development of musculoskeletal problems. In addition, the sweepers are ignorant about the postures to be adopted while performing the sweeping activity. It was therefore evident that a major ergonomic guideline on right posture, safe measures, periodic medical check-up of the workers and ergonomic designing of brooms is essential. An intervention study is needed by conducting training programmes to improve the sequence of work activities, work posture adopted, design ergonomically designed tools like carts, brooms, etc., and improve the working conditions to minimize the occupational problems.

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