ERGONOMIC STUDY OF MUSCULOSKELETAL PROBLEMS AMONG RESIDENTIAL BUILDING SWEEPERS

HEMANI MALHOTRA
Assistant Professor
Sir Vithaldas Thackersey College of Home Science
(Autonomous), SNDTWU,
Juhu, Mumbai. (MS) **INDIA.**

ABSTRACT

Knowledge of ergonomics is important in order to prevent injuries and enhance health in the workplace (Swedish Work Environment Authority, 1998). Musculoskeletal disorders (MSDs) are amongst the most common work-related problem throughout the world and India is no exception. The present study aimed to identify the prevalence of musculoskeletal pain among residential building sweepers among urban Mumbai city. Cross sectional descriptive study was conducted among 120 sweepers (60 male and 60 women) from western suburban residential buildings from urban Mumbai city. A modified Nordic Questionnaire was used to collect the necessary information followed by interview technique to elicit occupational activities data of residential sweepers. The results from Nordic Questionnaire showed that there is a high frequency of perceived musculoskeletal problems among residential sweepers. The results showed that most of the residential sweepers suffered from some MSD symptoms. The highest prevalence was reported in shoulder (91.67%) and arm (83.33%) among male residential sweepers. Among the female residential sweepers arm (93.33%) and low back (83.33%) were the most affected regions. The study concludes that the building residential sweepers and majorly females experienced a number of musculoskeletal problems. There is a need for occupational health intervention; MSD risk factors can be an appropriate base for planning and implementing ergonomics intervention programmes in the workplace.

Keywords: ergonomics, musculoskeletal problems, sweepers, repetitive work, risk factors

INTRODUCTION

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimise human well-being and overall system performance (IEA, 2012). Musculoskeletal disorders represent a major

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problem in terms of human suffering, as well as economic losses for society; (European Agency for Safety and Health at Work, 2007; Woolf & Pfleger, 2003).

Work related safety and health hazards are a major public health concern worldwide and are under-researched especially in low and middle income countries. According to the World Health Organization (WHO), 58 percent of the global population spends one-third of their time at work during adulthood. Therefore, the issue of work related safety has gathered increasing attention in the public health domain (Ashraful Kabir, 2015).

Musculoskeletal disorders is an umbrella term for disorders and diseases in the musculoskeletal system, which includes muscles, nerves, tendons, ligaments, joints, cartilage and spinal discs. Work-related musculoskeletal disorders (WMSD) include disorders and diseases of the musculoskeletal system that are believed to have a work-related causal component (Hagberg *et al.*, 1995).

Some broad population surveys such as the National Health Interview Survey (NHIS) from 1988 and the 1990 Ontario Health Survey (OHS) found increased back pain or long-term back problems with exposure to factors such as lifting, pulling, and physical pushing (Guo et al. 1995)

The issue of musculoskeletal problems in adult population is overwhelming. Low back pain is very common that almost half of the adult population suffered from low back pain which last for more than 24 hours at times during the year (Tessa, 2010) and often causes lost workdays (Guo et al., 1999). Low back pain does not only signify poor quality of individuals' life, but also showed decreased in labour productivity due to off work, absenteeism and early retirement (Tsuboi et al., 2002). It had been observed that individuals who suffered from low back pain problems might develop major physical, social and mental disruptions, which could affect their occupations (Tavafian et al., 2007).

Veena Shatrugna et al (2008) found that lumbar spine Bone Mineral Density was significantly lower among the sweepers when compared with the beedi makers and the groups performing walking and weight-bearing activities (sweepers and construction workers) had a higher prevalence of osteoporosis in the lumbar spine.

PURPOSE OF THE STUDY

Sweepers are the vulnerable segment of our community and suffering from different occupational health problems due to limited education, lack of knowledge on occupational health hazards. Musculoskeletal disorders represent one of the leading causes of occupational injury in the developed and developing countries. The economic loss due to such disorders affects not only the individual but also the organization and the society as a whole. In many

countries, the prevention of work related musculoskeletal disorders has been considered as a national priority. In India occupational hazards are prevalent in the agriculture, construction, carpentry, brickfield worker, stonecutter, metal worker, car repair and sweepers. The purpose of this study was to determine the prevalence of musculoskeletal pain among residential building sweepers among urban Mumbai city.

METHODOLOGY

Locale of the study:

Study was conducted in western suburban residential building of urban Mumbai city.

Selection of the subjects:

Inclusion criteria for sample selection:

- Sweepers between 18 – 60 years of age.
- Subjects sweeping for past five years.
- Subjects working between Borivali and Bandra.

Exclusion criteria for sample selection:

- Sweepers with any physical disabilities.

Sample Size:

A total of 120 sweepers (60 male and 60 women) from western suburban residential buildings from urban Mumbai were selected for the study.

Sampling Procedure:

Convenient sampling method was adopted.

Tools of Data Collection:

Questionnaire – cum – Interview schedule: A well – structured Questionnaire was developed to collect the necessary information followed by interview technique to elicit information on sweepers. The structured questionnaire was divided into five parts.

A. General Demographic Data:

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Questions focused on the marital status, family size, age, socio – economic conditions, income and educational qualification of residential sweepers.

B. Job Description:

This part of the questionnaire documented the job profile i.e. nature of job, type of work, total hours of work, number of hours worked per day etc.

C. Health Status:

Health profile was collected in this section of the questionnaire.

D. Musculoskeletal problems:

The musculoskeletal problems experienced by the sweepers were assessed in this section. This was done through validated tool i.e. Nordic Questionnaire Technique designed by Kuorinka I, Johnson B, Kilobom A, et al. (1987).

RESULTS AND DISCUSSION

In this section an attempt has been made to single out the important findings of the study on residential sweepers. The findings have been presented using statistical methods and their theoretical implications. The data has been statistically summarized as follows:

Table 1: Distribution of the sample

Gender	N	Age Groups				Mean $\pm$ SD	Range
		21-30	31-40	41-50	>51		
Male	60	18 (30)	22 (36.7)	15 (25)	5 (8.3)	37.33 $\pm$9.094	22 - 62
Female	60	11 (18.3)	21 (35)	21 (35)	7 (11.7)	39.65 $\pm$8.875	24 - 60

The figures in bracket indicate percentage

The above table depicts that the total of 120 sweepers (60 male and 60 women) from western suburban residential buildings from urban Mumbai were selected for the study. The table shows the age wise sample distribution among males and females. Ages are categorized into different age groups i.e. 21 to 30 years, 31 to 40 years, 41 to 50 years, 51 and above. From the above table it is identified that maximum number of respondents both males and females falls under 31 to 40 years of age i.e. 22 males and 21 females followed by 36 respondents which fall under 41 to 50 years of age and 29 number of respondents among 21 to 30 years of age.

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It was observed from the table that the mean age of female sweepers was 39.65 and for male sweepers were 37.33. From the above table it is concluded that most of the respondents are adults and carrying sweeping occupation for many years.

Table 2: Demographic profile of the sweepers

		Males n = 60	*Percentage %*	*Females n = 60*	*Percentage %*	*Total n = 120*	*Percentage %*
1	**Educational Qualification**						
	No education	6	10.00	30	50.00	36	30.00
	Up to Primary	33	55.00	28	46.67	61	50.83
	Matriculation or below	21	35.00	2	3.33	23	19.17
	XII th Passed	0	0.00	0	0.00	0	0.00
	Graduation and above	0	0.00	0	0.00	0	0.00
2	**Marital Status**						
	Married	37	61.67	45	75.00	82	68.33
	Unmarried	17	28.33	8	13.33	25	20.83
	Widow	5	8.33	7	11.67	12	10.00
	Divorcee	1	1.67	0	0.00	1	0.83
3	**Personal Habits**						
	Smoking	29	48.33	17	28.33	46	38.33
	Drinking	8	13.33	0	0.00	8	6.67
	Gutka	35	58.33	20	33.33	55	45.83
	Tobacco	16	26.67	22	36.67	38	31.67
	Pan	9	15.00	4	6.67	13	10.83
	No	1	1.67	6	10.00	7	5.83

As observed from the table it was found that majority of the sweepers had completed education till primary level i.e. 55% males and 46.67 females. It was also observed from the tables that 50% female sweepers had received no education. Similar findings were reported in a study by Abou-El Wafa et al (2015) where most of the male MSW collectors (89.2%) were illiterate.

On the basis of marital status it was found that majority of sweepers were married i.e. 61.67% males and 75% females.

With regards to personal habits it was found that male sweepers were addicted to gutka (58.33%) and smoking (48.33%) and female sweepers were addicted to tobacco (36.67%) and gutka (33.33%). Similar findings were reported in a study by Das Pradhan et al (2013) on

the women sweepers working under the Midnapore Municipality 100% female sweepers were addicted to chewing gutka and tobacco.

Table 3: Activities performed while sweeping

Sr. No.	Activities performed by the sweepers	Males (n=60)	Females (n=60)
1	Sweeping of Staircase/Floors	60	60
2	Collection of garbage & disposing	60	60
3	Disposing in BMC Garbage Container	60	60
4	Sweeping of Lobby/Passage area	51	57
5	Sweeping of Lift/Elevator	47	42
6	Sweeping of Building area/ parking area	53	53

The above table indicates that all the residential sweepers (males and females) follow a similar and systematic sequence of activities. They collect the garbage from individual houses, clean the floors and staircase while climbing down and put the collected garbage in the BMC garbage container.

Table 4: Prevalence of pain among residential sweepers

Body Parts	No Pain		Pain	
	Male (n=60)	Female (n=60)	Male (n=60)	Female (n=60)
Eye	59 (98.33)	57 (95.00)	1 (1.67)	3 (5.00)
Neck	43 (71.67)	39 (65.00)	17 (28.33)	21 (35.00)
Shoulder	5 (8.33)	5 (8.33)	**55 (91.67)**	**55 (91.67)**
Upper Back	31 (51.67)	30 (50.00)	**29 (48.33)**	30 (50.00)
Elbows	58 (96.67)	56 (93.33)	2 (3.33)	4 (6.67)
Lower Back	36 (60.00)	10 (16.67)	24 (40.00)	**50 (83.33)**
Arm	10 (16.67)	4 (6.67)	**50 (83.33)**	**56 (93.33)**
Hand/ Wrist	14 (23.33)	9 (15.00)	**46 (76.67)**	**51 (85.00)**
Thighs	57 (95.00)	51 (85.00)	3 (5.00)	9 (15.00)
Knees	56	40	4	20

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	(93.33)	(66.67)	(6.67)	(33.33)
Calf of legs	35 (58.33)	25 (41.67)	25 (41.67)	35 (58.33)
Feet/Ankle	46 (76.67)	46 (76.67)	14 (23.33)	14 (23.33)

The figures in bracket indicate percentage

The above table shows a prevalence of pain in different body parts. The data supports the fact that the 91.67% male sweepers experienced pain in shoulder, 83.33% in arm, 76.67% in hand/wrist and 48.33% in upper back.

Similar findings were reported by Tabatabaei S, et al., in a study conducted on musculoskeletal problems among workers of an Iranian communication company, where the results of Nordic musculoskeletal questionnaire revealed that the highest rates of WMSDs prevalence were found in shoulders (73%).

It was alarming evidence from the above table that majority of the female sweepers complained of entire body pain along with 93.33% , 91.67%, 85% and 83.33% reporting pain in arm, shoulder, hand/wrist and low back respectively.

Similar findings were reported in a study by Das Pradhan et al (2013) on the women sweepers working under the Midnapore Municipality 82.69% female sweepers experienced muscle pain with back pain.

In another study by Chandrasakaran A (2013) on women working in semiconductor that 44.8% out of 141 workers had complaints of body pain and the affected body parts were the hands and shoulders (38%), followed by the back (27%) and legs (26%)

Table 5: Frequency of pain scores among residential sweepers

Body Parts	Males					Females				
	No Pain 1	Pain				No Pain 1	Pain			
		Mild Pain 2	Moderate Pain 3	Severe Pain 4	Very Severe Pain 5		2-Mild Pain	3-Moderate Pain	4-Severe Pain	Very Severe Pain 5
Eye	59 (98.33)	1 (1.67)	0 (0)	0 (0)	0 (0)	57 (95.00)	2 (3.33)	1 (1.67)	0 (0)	0 (0)
Neck	43	2	12	3	0	39	6	12	3	0

	(71.67)	(3.33)	(20.00)	(5.00)	(0)	(65.00)	(10.00)	(20.00)	(5.00)	(0)
Shoulder	5 (8.33)	16 (26.67)	26 (43.33)	**13 (21.67)**	0 (0)	5 (8.33)	6 (10.00)	**37 (61.67)**	12 (20.00)	0 (0)
Upper Back	31 (51.67)	7 (11.67)	**17 (28.33)**	5 (8.33)	0 (0)	30 (50.00)	3 (5.00)	17 (28.33)	10 (16.67)	0 (0)
Elbows	58 (96.67)	1 (1.67)	1 (1.67)	0 (0)	0 (0)	56 (93.33)	3 (5.00)	1 (1.67)	0 (0)	0 (0)
Lower Back	36 (60.00)	8 (13.33)	10 (16.67)	6 (10.00)	0 (0)	10 (16.67)	1 (1.67)	30 (50.00)	**19 (31.67)**	0 (0)
Arm	10 (16.67)	14 (23.33)	**30 (50.00)**	6 (10.00)	0 (0)	4 (6.67)	3 (5.00)	**35 (58.33)**	18 (30.00)	0 (0)
Hand/ Wrist	14 (23.33)	11 (18.33)	**31 (51.67)**	4 (6.67)	0 (0)	9 (15.00)	4 (6.67)	**28 (46.67)**	**19 (31.67)**	0 (0)
Thighs	57 (95.00)	3 (5.00)	0 (0)	0 (0)	0 (0)	51 (85.00)	3 (5.00)	4 (6.67)	2 (3.33)	0 (0)
Knees	56 (93.33)	1 (1.67)	3 (5.00)	0 (0)	0 (0)	40 (66.67)	2 (3.33)	14 (23.33)	4 (6.67)	0 (0)
Calf of legs	35 (58.33)	4 (6.67)	20 (33.33)	1 (1.67)	0 (0)	25 (41.67)	6 (10.00)	24 (40.00)	5 (8.33)	0 (0)
Feet/ Ankle	46 (76.67)	5 (8.33)	9 (15.00)	0 (0)	0 (0)	46 (76.67)	4 (6.67)	7 (11.67)	3 (5.00)	0 (0)

The figures in bracket indicate percentage

The above table indicates that the frequency of pain experienced by the male sweepers. It is evident that 51.67% complained of moderate pain in hand/ wrist, 50% complained of moderate pain in the arm, 28.33% complained of moderate pain in the upper back and 21.67% complained of severe pain in the shoulder respectively. The reason for severe pain in the shoulder could be attributed towards the fact that mechanical loads on the skeleton that frequently exceeds maximum acceptance limits recommended; throwing waste bags resulted

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in high shear forces on the spine and carrying loads resulted in excessive torque to the shoulder resulting in increased incidence of musculoskeletal problem.

It can be observed from the above table that 61.67% female sweepers complained of moderate pain in the shoulder, 58.33% and 46.67% complained of moderate pain in the arm and hand respectively and 31.67% complained of severe pain in the lower back and hand/wrist. The reason could be as the female sweepers were married at early age and had gone through the child bearing process; they were doing household chores along with the sweeping occupation and also because of repetitive nature of work. Collection of household waste is also a repetitive job which requires heavy physical effort in carrying out activities such as lifting, carrying, pulling and pushing which leads to muscular strain .

Similar findings were reported in a study by Thayyil Jayakrishnan, Mathummal Cherumanalil Jeeja, Rao Bhaskar (2014) on solid waste management workers of Kerala. The work related health-problems were reported to be high. The prevalence of respiratory, dermatological, eye problems and injury, musculoskeletal problems were reported to be high among municipal solid work handlers. The joints affected in the order of predilection are knee, back; shoulder, elbow, ankle and neck (range 39-17%.).

Table 6: Cumulative frequency of pain among male and female sweepers (n=120)

Body Parts	1-No Pain	%	2-Mild Pain	%	3-Moderate Pain	%	4-Severe Pain	%	5-Very Severe Pain	%
Eye	116	96.67	3	2.50	1	0.83	0	0	0	0
Neck	82	68.33	8	6.67	24	20.00	6	5	0	0
Shoulder	10	8.33	22	18.33	63	**52.50**	25	20.83	0	0
Upper Back	61	50.83	10	8.33	34	28.33	15	12.50	0	0
Elbows	114	95.00	4	3.33	2	1.67	0	0.00	0	0
Lower Back	46	38.33	9	7.50	40	33.33	25	20.83	0	0
Arm	14	11.67	17	14.17	65	**54.17**	24	20.00	0	0
Hand/ Wrist	23	19.17	15	12.50	59	49.17	23	19.17	0	0
Thighs	108	90.00	6	5	4	3.33	2	1.67	0	0
Knees	96	80.00	3	2.5	17	14.17	4	3.33	0	0
Calf of legs	60	50.00	10	8.33	44	36.67	6	5.00	0	0
Feet/Ankle	92	76.67	9	7.50	16	13.33	3	2.5	0	0

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The above table shows the musculoskeletal problems experienced by the residential sweepers. It is observed from the above table that 54.17% residential sweepers complained of arm pain and 52.50% sweepers complained of shoulder pain.

Mirmohammadi S (2012) examined the study on Prevalence of Musculoskeletal Symptoms (38%) among Foam Industry Workers. The results confirm that the higher risk of musculoskeletal problems is related to the workplaces.

CONCLUSION

The study concludes that the building residential sweepers and majorly females experienced a number of musculoskeletal problems. The musculoskeletal problems are worsened by in-appropriate application of ergonomics principles, the non-availability of worker friendly tools and equipment. The sweepers are also unaware of the right posture to be adopted for carrying out the work activities. Sometimes they feel significant social exclusion and internally adopt beliefs of inferiority. More attention has been given on this weaker and vulnerable section of our society and policymakers should design periodic educational program which can play a main role in reducing the musculoskeletal problems resulting from the work position and postures. Training materials on occupational and environmental health and injury issues relating to residential sweeping can be developed to have a positive effect towards the improvement of awareness level among the residential sweepers.

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