Musculoskeletal Disorder among Municipal Solid Waste Collectors

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ABSTRACT

Objective: This cross sectional study investigates the prevalence of MSDs among solid waste collectors.

Method: Data collection was conducted through face to face structured interviews with waste collectors using Nordic Musculoskeletal Questionnaire (NMQ). Next, Rapid Upper Limb Assessment (RULA) was used to observe the workers' exposure to the risk factors

Result: Results revealed that, the highest prevalence of MSDs symptoms during last 12 months is low back pain (54.50%) followed by upper back pain (27.30%) and at shoulder region (22.70%). RULA analysis of the observed results showed that 43.20% of the waste collectors have scored 7 indicates postural changes must be done immediately. Meanwhile 45.5% of waste collectors scored 5 an indication of postural changes must be carried out soon. From the chi-square analysis, the results displayed a significant association between neck and low back pain prevalence with the identified risk level at $p<0.05$.

Conclusion: Findings from this study provided an evidence of a significant association between MSDs symptoms reported in NMQ and the risk level exposed by the respondents obtained by RULA. Physical demanding activities among waste collectors such as handling heavy workload, awkward posture and repetitive task might be the reason of the association.

Keywords: *WMSD, solid waste collector, RULA*

1. Introduction

Municipal solid waste are produced and discarded every day and it can lead to pollution if it is not collected and treated accordingly. Municipal solid waste includes product packaging, food waste, plastics, furniture, clothing and electrical appliances. Production of solid waste shows the growth of country productivity. Its generation indicates the outcomes of the country economic productivity and its consumptions which include waste from households, commercials and institutions, (Jayakrishnan, Jeeja, & Bhaskar, 2013).

Waste collectors refer to a group of workers responsible for waste collection from different locations to the designated waste disposal area (Mohammed & Latif, 2014). Municipal solid waste worker plays an important role towards the effectiveness of the waste management strategy planned by the local authority to ensure cleanliness of the country. Effective waste collection strategy is crucial in every parts of the world. Collection and removal of waste are linked with numbers of hazards such as biological, chemical and physical hazards.

In a developing country such as Malaysia, municipal solid waste is handle manually (Bleck & Wettberg, 2012). Working procedures of waste might exposed workers to a diversity of occupational health hazards which might not be

treated adequately if the knowledge of safe work practices is not disseminated. One example of occupational health hazard is Work-related Musculoskeletal Disorders (WMSDs).

WMSDs symptoms may develop from exposure to work activities that require repetitive motions, frequent use of muscles and tendons in an awkward posture, lifting heavy load and most importantly is due to the long exposure of those aforementioned risks (Kemmlert, 1995) which many researchers called it as ergonomic risk factors (Sukadarin et al., 2016). Recent researches also discussed the findings on the cause and effect relationship between ergonomic risk factors and the development of WMSDS among workers. As can be seen in the publication of Meksawi et al., (2012), where by the significant risk lead to WMSDs are including high task repetition, forceful exertions, and awkward postures. Specifically for municipal solid waste collectors' wellbeing, this issue is important to be highlighted as this may cause discomfort and physical stress on parts of body due to daily work activities such as lifting, pushing and pulling. Therefore, this study intended to investigate the prevalence of musculoskeletal.

2. Materials and Method

2.1. Study design and location

A cross-sectional study conducted at one residential area near East Coast Region of Malaysia. Main source of solid waste generation at this location was from Municipal, which refers to waste generated by the community. The frequency of household waste collection activity at this location was three times a week which on Monday, Wednesday and Friday.

2.2. Sample size

The sample size was 44 municipal solid waste collectors who were working full time and aged between 15 – 45 years old. Respondents were selected based on convenience sampling method. Generally, all respondents involved with daily waste collection activity which includes collection from mobile receptacle bins (120L), (240L) and (660L).respondents had been selected in this study.

2.3. Questionnaire

2.3.1 Demographic

The survey questionnaire is consisted of demographic information; age, educational level, duration of employment in year in managing solid waste and working duration in a day.

2.3.2 Nordic Questionnaire (NMQ)

A standardized set of self-administered Nordic Questionnaire (NMQ) is used in the study. This questionnaire is designed to identify musculoskeletal problems experienced by workers in various industries and parts of the body which were affected (Kuorinka et al., 1987). It comprises of three sections including prevalence of symptoms within 12 months, and 7 days plus the intensity of WMSDs experienced by respondents.

2.3.3 Rapid Upper Limb Assessment (RULA)

Rapid Upper Limb Assessment (RULA) developed by McAtamney and Corlett (1993) is used to evaluate respondents' exposure to ergonomics risk factors because it's a quick observation method of posture analysis. (Pourmahabadian, Akhavan, & Azam, 2008). The grand score of RULA is determining the level of risk that required certain action according to result of scoring. For example, scoring one to two indicates an acceptable posture, scoring three to four indicates the need for further investigation while score five to six indicates that further investigation and change is needed and lastly by scoring seven, it indicates the need for an investigation and change to be implemented.

2.4. Study Techniques

2.4.1 Observation

Respondents' daily routine work had been observed in order to identify the ergonomics problems that faced by them. In addition, by using this technique, researchers also easy to understand the whole work process of waste management.

2.4.2 Video Recording

Beside field observation, video recording is made on each respondent while performing their work task for 10-15 minutes. This was done to ensure that the actual activities were captured so that the RULA assessment can be analysed and re-evaluated in the laboratory if necessary.

3. Results and Discussion

A total number of 44 respondents were involved in this study. The respondents were interviewed during their resting hours. Most of the respondents responsible for waste collection using 120 Liter (L) type of garbage bins.

Table 1 shows the result of demographic information. The workers are between 26-35 years old with the highest percentage of 40.90% from the total respondents. Their educational status is the highest at primary level with 47.7% followed by secondary level with the frequency of 16 (36.4%) and lastly, respondents with no education made up

of 15.9% with the frequency of 7. All of the respondents were male and the majority of them have a working experience within 3 to 6 years. In terms of working hours, from the total number of respondents, 36.4% work for 8 hours, 31.8% for 12 hours, and 25% for 9 hours per day. The respondents smoking habit indicated that a majority of them 81.80% were smokers.

Table 1. Demographic information of respondents

Age	N	Percentage (%)
15-25 years	10	22.7
26-35 years	18	40.9
36-45 years	16	36.4
Level of Education		
None	7	15.9
Primary	21	47.7
Secondary	16	36.4
Duration of Employment		
< 3 years	10	22.7
3 to 6 years	15	34.1
7 to 10 years	10	22.7
10 and above years	9	20.5
Working Duration per Day (hours)		
8	16	36.4
9	11	25
10	1	2.3
11	2	4.5
12	14	31.8

Table 2 and Figure 1 present the distribution prevalence of MSDs symptom during the last 12 months. Result exhibited that the highest prevalence were low and upper back pain with the frequency of 24 and 12 of the total respondents experienced the symptoms. Study conducted by Mohammed & Abdul (2014), revealed that, 60% of the total respondents' complain having lower back followed by upper back pain 53.3%.

Table 2. The prevalence of MSDs symptoms among Solid Waste Collectors during the Last 12 Months Table 2 The prevalence of MSDs symptoms among Solid Waste Collectors during the Last 12 Months.

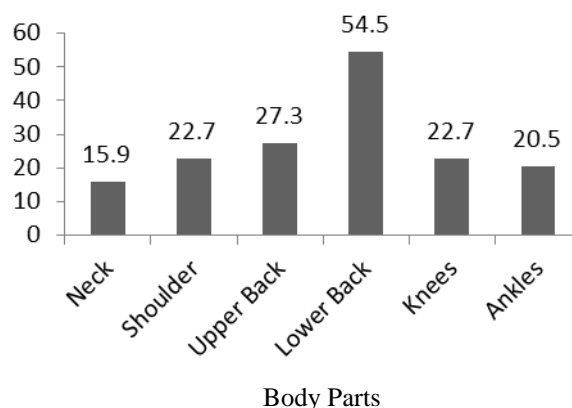| Musculoskeletal complaints	Previous 12 Months	
	Frequency	Percentage (%)
Neck		
No	37	84.10
Yes	7	15.90
Shoulders		
No	34	77.30
Yes, in the right shoulder	3	6.80
Yes, in the left shoulder	6	13.60
Yes, in both shoulders	1	2.30
Upper back		
No	32	72.70
Yes	12	27.30
Low back (small of the back)		
No	20	45.50
Yes	24	54.50
One or both knees		
No	34	77.30
Yes	10	22.70
One or both ankles/feet		
No	35	79.50
Yes	9	20.50

Figure 1: Prevalence of MSDs Symptom among Solid Waste Collectors during the Last 12 Months

Previous studies conducted by Abou-El Wafa et al in 2012 in Egypt shows that the percentage of musculoskeletal complaints was higher among MSW collectors during 12 months with 60.8% compared to control group (43.6%). Low back area is the most affected body region. Study conducted by Mehrdad et al. (2008) among 142 respondents found that, the percentage of MSDs experienced are low back pain, knees, shoulders, upper back pain and neck region with the percentage of 45%, 29%, 24%, 23% and 22% respectively. This study also recorded highest MSDs symptom at the lower back area (54.4%). Further to that, findings from study conducted by Window & Keeffe (2006) show that legs, knees, thighs and elbow are found less prominent to be affected. In this study, the lowest recorded prevalence of MSDs among respondents is neck (15.9%), followed by ankles (20.5%) and knees and shoulders with 22.7% respectively.

RULA method is used to analyze ergonomics risk factors among respondents. This assessment provides quick and systematic assessment to the worker's posture (Mokhtar et al., 2013). Table 3 shows the distribution of RULA scores according to the job task. Result shows that 43.20 % of the waste collectors working posture were at the high level of risk and postural change should be implemented immediately. Observed risk factors that potentially lead to MSDs were manual handling, awkward posture and repetitive movements. Throughout the observation, most of the workers are exposed to awkward posture and repetitive movement. They keep repeating the same posture and movement for long period of time. They also posed an awkward posture when doing their tasks. They bend their back with the wrong posture when lifting the garbage. They also twist their neck, stretch their arm and shoulder to reach when they lift the garbage bins. They extend their hands above their shoulders level.

From reviewing various epidemiological studies that 9–18% of low back injuries are associated with push/pull and have reported an increased risk of shoulder complains in connection with regular push/pull work (Hoozemans et al., 1998). Meanwhile, 45.50% of the respondents' posture indicated medium risk and further investigation, and the changing of work postures are required. Lastly, 11.40 % of the total respondents were exposed to low risk posture which further investigation and changes of body posture is needed. Work as a waste collector required the workers to work with an abundance of heavy lifting as well as pulling and pushing of containers and prove that this work required physical strength (Rushton, 2003). In addition, Fabrizio (2009) agree that the workers who often expose to awkward and sustained postures and repetitive motions of the upper extremities will develop pain in their shoulder and neck (15.9%), followed by ankles (20.5%) and knees and shoulders with 22.7% respectively.

Chi-square test had been conducted to find out the association between discomfort of body parts experienced by respondents and individual posture scores. From the analysis, neck region and low back pain shows a significant association with posture score $p < 0.005$. According to Violante et al (2000), heavy manual works are believed to causes low back pain with bending and twisting shows significant association with low back pain. They used a lot of physical strength and need more energy to lift the garbage bins. As results, it causes compression and force on the back. In addition, Fabrizio (2009) agree that the workers who often expose to awkward and sustained postures and repetitive motions of the upper extremities will develop pain in their shoulder and neck. Based on the observation, waste collectors have to pull, push and lift the loads and caused them to bend, twist their neck and body, overreaching and raise hands above their shoulder levels.

5. Conclusion

In conclusion, this study demonstrated that musculoskeletal complaints exists among solid waste collectors' due to the exposure of ergonomic risk factors which include activities that involved heavy- lifting awkward posture and repetitive task.

Acknowledgement

Table 3. RULA scores according to the job task

Job Task	RULA Score (n=44)			
	3-4	6-5	>7	
	Low Risk	Medium Risk	High Risk	N
Collection from Mobile Garbage Bin (120L)	3	10	**7**	20
Collection from Mobile Garbage Bin (240L)	-	7	5	12
Collection from Mobile Garbage Bin (660L)	2	3	7	12
	5 (11.4%)	20 (44.5%)	19 (42.2%)	

N = Number of workers

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