Occupational Health Hazards and the Use of Safety Protective Measures among Municipal Solid Waste Collectors

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Abstract

Background: Solid waste collection is a dangerous job that exposes the waste collectors to different occupational health hazards and certain occupation related morbidities. Aim: This study aimed to examine the relationship between exposure to occupational health hazards and the use of safety protective measures among municipal solid waste collectors. **Methods:** Correlational descriptive study design was used **Sample**: A convenient sample of 140 municipal solid waste collectors were included. **Settings**: The study was carried out at Local Council of 10 villages followed Birket Elsaba district, Menoufia Governorate, Egypt. **Tool**: An interviewing questionnaire was used which included five parts: (1) Demographic data. (2) Work related factors. (3) Current health problems. (4) Safety protective measures. (5) Knowledge of the municipal solid waste collectors about occupational health hazards in the work place. **Results:** The study reported that two thirds of the municipal solid waste collectors were exposed to physical hazards, 63.6% of them were exposed to psychological hazards. 55% were exposed to chemical hazards, 59.3% were exposed to ergonomic hazards while who were exposed to biological and accidental hazards were 60% and 59.3% respectively. Also, It reported that 42.9% of the sample used safety boots, 24.3% of them used gloves. Moreover, 7.1% of the sample used head covers and as same used special uniform. In addition, none of the them used goggles and mask while 18.6% of the them not used any personal protective equipment. Also, it reported that more than three quarters of the study sample washed their hands before eating while 7.1% of the sample change clothes before and after the shifts. So, the present study indicated that there were statistical significance difference between exposure of the study group to occupational health hazards as (physical, chemical, biological, ergonomic, psychological and accidental) hazards and the use of safety protective measures. **Conclusions**: This study concluded that there were statistical significance difference between exposure of the study group to different occupational health hazards and the use of safety protective measures ($p<0.05$). **Recommendations**: Periodic health education and awareness programs are needed to increase knowledge of municipal solid waste collectors on different occupational health hazards, ergonomic principles and importance of using safety protective measures in the work place.

Key Words: Municipal solid waste collectors, Occupational health hazards, Safety protective measures,

Introduction

Municipal solid waste (MSW) collection and discarding is a rising environmental problem that requires more attention from public health **(Manya, Leta & Khan, 2017).** Working in waste gathering is a hard job, because it requires repeated heavy physical activity as working on a vehicle for evacuating refuse containers into a truck or manual

lifting of heavy baskets (**Yohanis & Genemo, 2015**).

Waste collection is a risky job because; it constitutes 90 deaths per 100.000 solid waste collectors annually (**Bogale, Kumie, & Tefera, 2014**). In developing countries, municipal solid waste collectors have ten times more risk for gastrointestinal problems as acute diarrhea, and respiratory problems as dyspnea, cough, and chronic bronchitis. Also, they have six times for infectious diseases as hepatitis and parasites. In addition, they have six times for musculoskeletal problems and injuries related work accidents. These problems occur as a result of lack of educational level about hygienic measures, poverty, and restriction in resources and technology in developing countries (**Abou-El Wafa, El-Bestar & El-Gilany, 2015).**

Municipal solid waste include the waste which occur as a result of production and consumption of households, medical, institutions, markets, industries and commercial activities (**Eskezia et al, 2016**). Municipal solid waste workers have an important role in maintaining health and cleansing of the environment. But in their work, they are exposed to health hazards that arise at each step in the waste collection process (**Jayakrishnan, Jeeja & Bhaskar, 2013).**

Municipal solid waste collectors are exposed to different occupational health hazards as a result of the contents of the waste they handled, emissions from those waste, and the improper use of personal protective equipment when collecting waste, evacuating refuse containers into a truck (**Sani & Puziah, 2014**). Occupational health hazards varies from physical, chemical, biological, ergonomic, psychological, and accidental hazards that affect negatively on the health status of solid waste collectors (**James et al, 2015**).

Preventive or protective measures mean the use of protective devices such as gloves, masks, boot, handkerchief, helmet, earplugs, and special uniform. In addition, the personal hygienic practices that done while eating or drinking which always protect against infections or disease in solid waste collection (**Owen & Scott, 2018**).

Community health nurse plays an important role in prevention and management of waste related hazards and promote healthy behaviors among solid waste workers by determining occupational health hazards, identifying waste collectors, health problems, assessing their knowledge about exposure to different occupational health hazards, and assessing the use of safety protective equipment by solid waste collectors (**Das, 2016) (Hangulu, 2017).**

In addition, the community health nurse has a role in early case finding, management and referral to different community resources. Also, identifying job related accidents ,occupational health and safety issues, and safety technique that should be used in handling waste **(Khoshakhlagh et al, 2017) (Gizaw et al, 2016).**

Significance of the problems

Municipal solid waste rate is growing around the world because of increasing in population, modern lifestyles. Solid waste collection has ranked as the seventh dangerous job in the world (**Jerie, 2016**). Because of poor financial resources, lack of understanding of the problem and, occupational risks that are largely unmanaged in most of the

developing countries (**Occupational Safety and Health Administration ,2017**). In Egypt, Egyptian solid waste workers usually deal with hazardous waste manually which increase risks on their health. Also, management practice of waste usually based on collection and disposal with no attention to the health of solid waste collectors (**Ewis et al, 2013**).

Data and studies about mortalities among solid waste workers from occupational exposure are rare (**Occupational Safety and Health Administration ,2017**). But, waste collectors exposed to occupational health hazards as a result of scarcity of using control measures, using of old equipment in dealing with waste, poor knowledge about work related risks, and lack of evaluation of occupational safety and health hazard in local councils (**Ewis et al, 2013**).

In the study carried out in Alexandria, the researchers reported that more than 90% of the waste collectors had health problems. all of the study sample had gastrointestinal complaints , 68.1% had worm infestations. The majority of the collectors complained from eye problems, 83% had skin problems, 57.7% had itching and nail infection, 49.3% of the collectors had cough and dyspnea. In addition, 74.5% of them had musculoskeletal pain. 54.3% of waste collectors complained from neck pain and 44.3% of them had low back pain (**Madian, & Abd El-Wahed, 2018**).

No studies have been conducted in Menoifia Governorate regarding relationship between occupational health hazards and the use of protective measures among municipal solid waste collectors, therefore this study was selected because community health nursing had the main role in increasing awareness of solid waste collectors of using safety protective measures, frequent observation of them at work place and increasing their knowledge about different occupational hazards. These roles help in maintaining the health of this target population which can lead to safe handling and manipulation of solid waste, decreasing pollution to the environment, and also, decreasing prevalence of communicable and non- communicable disease among the population in the community as a whole.

Aim of the Study

This study aimed to examine the relationship between exposure to occupational health hazards and the use of safety protective measures among municipal solid waste collectors.

Research Questions:

1-What is the level of municipal solid waste collectors' knowledge about occupational hazards ?

2- Is there a relationship between solid waste collectors' knowledge about occupational hazards and their exposure to different hazards?

3- Is there a relationship between solid waste collectors' using safety protective measures and exposure to occupational health hazards?

Subjects and Methods

Research design:-

Correlational descriptive study design was used to utilize the aim of this study.

Research settings:

A multistage random technique was used to select the setting according to the following system:

Stage I:

Random selection of one district from nine districts in Menoufia Governorate. The selected district was Birket Elsaba.

Stage II:

Birket Elsaba district consists of 21 villages. The researchers selected 10 villages randomly by arranging the villages in ascending manner and selected the odds numbers from all villages included in the selected district. These villages were Abu-Mashhour , Elshahid Fekry, Elroda, Ganzour, Kafr Ganzour, Kafr nafra, Tanbesha, Togh Tanbesha, Horin, Eldabiba . Each village has local council from which the sample was taken.

Subjects:-

A convenient sample of 140 municipal solid waste collectors were taken in the study. Each selected local council included 14 solid waste collectors which recruited either temporary or permanent. The work of solid waste collectors are classified into Cleaning the street , Caring and lifting of the solid waste, and evacuating refuse containers into a truck.

Tools of data collection

Data was collected through the following tool:

An interviewing questionnaire was developed by the researchers to collect the necessary data after reviewing the related literature. The tool divided into the following five parts:

Part I- Demographic data: - it included data about name, age, sex, educational level, marital status, presence of any chronic disease and smoking.

Part II- Work related factors: It included data about wok nature, years of working experience, working shift, daily working hours, work type, type of solid waste collected , method used to collect waste, sorting waste, , receiving any training program before starting work, and types of occupational health hazards exposed

Part III- Current health problems: it include data about various health problems reported by municipal solid waste collectors as gastrointestinal problems, respiratory diseases, eye diseases, skin problems and musculoskeletal problems.

Part IV- Safety protective measures: This part is developed by Awad, 2014. It was used to assess safety protective measures that were used by solid waste collectors. It included two closed and broad (yes/ no) questions about personal protective equipment and preventive measures. Personal protective equipment questions included six items as using of boots, goggles, mask, head covers, mask and special uniform. Preventive measures questions included six items as change clothes at the beginning and the end of the shift, ,hand washing (before eating- before drinking- before using cell phone -before and after using toilets – and before shake persons hands). Each item of safety protective measures score will be given as follows: one score for yes answer, and zero score for no answer. The total score was twelve. It was calculated and practices scores will be considered as the following:-

Practice scoring system:-

Item	Score	%
Poor practice (not used)	<6	< 50%
Good practice (used)	6-12	>50%

Part VI- Knowledge of the municipal solid waste collectors about occupational health hazards in the work place. It was developed by Awad, 2014 to assess knowledge of the solid waste collectors about different occupational health hazards. It included five closed and broad (yes/ no) questions about physical hazards, chemical hazards, biological hazards, ergonomic hazards and psychological hazards and the researchers added one question about accidental hazard. These six broad question included nineteen sub question were classified as following: four questions about physical hazards, two questions about chemical hazards, three questions about biological hazards, three questions about ergonomic hazards, four questions about psychological hazards, and three questions about accidental hazards. Each item of knowledge will be given as follows: one score for yes answer, and zero score for no answer. The total score was nineteen. It was calculated and considered as the following:-

Knowledge scoring system:

Item	Score	percentage
Poor knowledge	<10	< 50 %
Satisfactory knowledge	10-14	50- 75 %
Good knowledge	15-19	>70%

Methods

-Review of literature:

Revision to the past and present literatures pertinent to the topic was done using textbooks, articles and network about the studies related to solid waste collectors.

- A written administrative approval:

Ethical committee approval was taken to perform the present study. An official letters was obtained from the dean of the Faculty of Nursing at Menoufia University to the directors of the local council of each selected village. The researchers offered the official letters and provided a description for the purpose of this study to obtain the agreement of the directors to collect data and complete the study.

Ethical considerations and human rights:

The researchers followed all ethical issues required to conduct the study. Informed and written consents were taken from the solid waste collectors who were agree to participate in this study. Full description about the aim, the nature and the importance of the study and interviewing questionnaire were done to all workers. Protection of human rights that the participation or withdrawn from the study at any time were voluntary. The collectors reassured that information taken would be confidential and only used to achieve the purpose of the study.

-Validity and reliability

The validity of the tool was assessed and tested for its content validity by four experts in the community health nursing. The relevancy, clarity, and simplicity of each item in the questionnaire were tested by the experts and they found the questionnaire is valuable and supportive so, the needed modifications required were done.

Reliability of the tool was assessed by using test retest reliability method with two weeks separately between them. This method was done through administration of the same questionnaire to the same solid waste workers under the same conditions on one or more times. Then comparison between answers of repeated tests was done. The correlation between scores on the two tests is used to estimate the reliability. The tool was strongly reliable to achieve the purpose of the study in which R= 93.6.

- Pilot study:

Before collection of data, a pilot study was carried out on 14 solid waste workers to examine the applicability, simplicity and viability of the constructed questionnaire, and to estimate the needed time to complete it. The pilot sample were taken from the local council of shenta el hagr village. This village also followed Birket Elsba district and excluded from the study sample to ensure the stability of the result. Based on the pilot study results, necessary clarification and modifications of some questions were done. Then the study tool was developed to be used in data collection.

-Procedure:

1- This study was conducted during the period starting from December 2019 to the end of February 2020.

2- An official letter included the purpose of the study was taken from the faculty of nursing, Menoufia University to the director of each selected local council, requesting their cooperation and permission to conduct the study.

3- At the beginning of interview with solid waste collectors, the researchers were introduced themselves, and established a trust relationship with them.

4- Data was collected from the solid waste collectors using the study tool after description of purpose and nature of research for full cooperation. The sample were asked for an oral consent for participating in the study.

5- The researchers were able to interview about 14 solid waste workers from one Local Council weekly. The average time taken for completing questionnaires was around 20-30 minutes.

Statistical analysis:

Statistical analysis data was coded and transformed into a well-designed form to be suitable for entry into the computer entry process. Data was entered and analyzed by using SPSS program (Statistical Package for Social Science). Graphics were prepared using Excel program. Quantitative data were presented by using mean (X) and standard deviation (SD). Qualitative data were presented by using frequency distribution tables , number and percentage. Also, It was analyzed using chi-square ($\chi 2$) test. Level of significance was set as P value.

Results

Table (1) represents demographic data of the studied solid waste collectors. It illustrates that 40.7% of studied sample were among age group between 30-40 years, followed by age group 20-30 years (32.1%), 70% of the study sample were male and 40% of them were read and write. Also, it shows that 65.7% of the study sample were married.

Also, it illustrates distribution of medical data of the study sample. It illustrates that 87.1% of the sample had chronic diseases. Also, it shows that

36.4 % of the study sample had diabetes mellitus and 60.7% of them were smokers.

Table (2) represents distribution of work characteristics of the study sample. It shows that 79.3% of the sample had permanent work and 61.4% had experience more than 5 years. Also, it shows that 82.1% of the study sample work in the morning shift, all of the sample spent 8 hours a day in the work , and 90% of the sample work 6 days weekly.

Also, this table shows that more than half of the sample were cleaning the street and 71.4% collected house hold waste. Also, it shows that 55% of the study sample collect waste by hand, 88.6% sorting waste after collection. and all of the study sample didn't receive any training program before starting work.

Table (3) represents distribution of solid waste collectors' level of knowledge about occupational health hazards in the work place. It illustrates that one third of the sample (35.7%) mentioned heat stroke as physical hazards while 75.0% of the sample mentioned inhalation of insecticide/ herbicides, solvents, paints, cleaning products, cosmetics drugs and aerosol containers under pressure in the household waste as chemical hazards. Also, it shows that nearly one half of the sample mentioned infection from exposure to dust, insect and diaper as biological hazards. Also, it shows that 45.7% of the solid collectors mentioned back pain as ergonomic hazards. Regarding to psychological hazards (30.0%) have job stress, while (15.7%) have family problem. Regarding to accidental hazards (45.0%) mentioned it as falling from truck.

Figure (1) represents distribution of study group according to their exposure to different types occupational health hazards. It shows that two thirds (71.4%)of the sample were exposed to physical hazards, 63.6% of the study sample were exposed psychological hazards, 59.3% were exposed to ergonomic hazards. While who were exposed to chemical, biological and accidental hazards were 55%, 60% and 59.3% respectively.

Table (4) reveals the distribution of solid waste collectors regarding their health problems. It illustrates that the 90.7% had health problems. The common frequent complain reported among solid waste collectors were gastrointestinal problems (82.2%) and 60.9% of the sample complained from worm infestation. furthermore, 73.6% of the study sample complained from respiratory disease especially cough (43.7%) as reported by them.

Also, it illustrates that 78.6% of the study solid waste collectors had eye disease especially redness as reported by 66.4% of them. On the other hand , 81.4% of the study sample had skin problems especially itching stated 43.9% of solid waste collectors. In addition, musculoskeletal problems was stated by 76.4% of the study sample especially bach pain reported by 39.3% of them.

Figure (2) shows distribution of safety protective measures used by solid waste collectors. Regarding personal protective equipment, it illustrates that more than one third of the sample (42.9%) used safety boots, while gloves were used by 24.3% of them. Moreover, 7.1% of the study sample used special uniform and as same used head covers. Also, it shows that none of the study sample used goggles and mask and 18.6% of the them reported not used any personal protective equipment**.** Regarding preventive measures, it reveals that 78.6%

of the study sample washed their hands before eating while only 7.1% of them changed clothes before and after the shifts.

Table (5) shows relationship between exposure of solid waste collectors to occupational hazards and their total score of knowledge. It reveals that there were statistical significance difference between total score of knowledge and exposure of the study group to occupational health hazards as (chemical , biological, ergonomic, psychological and accidental) hazards as (P<0.05). Also, it shows that there is no statistical significance difference between total score of knowledge about different occupational health hazards and exposure to physical hazards (P =.078).

Table (6) represents relationship between exposure of study sample to occupational hazards and the use of safety protective measures. It illustrates that there were statistical significance difference between exposure of the study group to occupational health hazards as (physical, chemical , biological, psychological and accidental) hazards and the use of safety protective measures (P<0.05).

Table (7) shows relationship between demographic data of the study sample and their exposure to occupational hazards. It reveals that there were statistical significance difference between exposure of the study group to occupational health hazards as (physical, chemical , biological, ergonomic, psychological and accidental) hazards and their age group and also, level of education (P<0.05). In addition, it illustrates that there was statistical significance difference between marital status and exposure of the study sample to physical hazards. But, there was no statistical difference between marital status and exposure of the study sample to different occupational hazards as (chemical , biological, ergonomic, psychological and accidental) hazards.

Table (1): Distribution of demographic data of study solid waste collectors (n=140).

Demographic data	Study group Total (n=140)	
	n	%
▪**Age (years):**		
20-29	44	31.4
30-39	58	41.4
40-49	18	12.9
50-60	20	14.3
	Mean ± SD	
	37.05 ±8.59	
▪**Sex:**		
Males	98	70.0
Females	42	30.0
▪**Educational level:**		
Illiterate	34	24.3
Read & write	56	40.0
Primary	22	15.7
Diplom	28	20.0
▪ **Marital status:**		
Single	39	27. 9
Married	92	65.7
Divorced	9	6. 4
▪ **Presence of any chronic disease::**		
Yes	122	87.1
No	18	12.9
▪ **Smoking**		
Smoker	85	60.7
Not smoker	5	39.3

Table (2): Distribution of work related characteristics of the study solid waste collectors (n=140).

Work related characteristics	The study sample (n=140)	
	n	%
▪ Wok nature		
Permanent	111	79.3
Temporary	29	20.7
▪ Years of working experience :		
≤ 5 years	54	38.6
≥ 5 years	86	61.4
▪ Working shift :		
Morning	115	82.1
Evening	25	17.9
Night	0	0.0
▪ Daily working hours:		
8 hours	140	100.0
12 hrs	0	0.0
>12 hours	0	0.0
▪ Weekly working days:		
- 6 days	126	90.0
- 7 days	14	10.0
▪ Work type:		
-Cleaning the street	63	45.0
-Caring and lifting	51	36.4
-Evacuating refuse containers into a truck.	26	18.6
▪ Type of solid waste you collect		
-Household waste	100	71.4
-Industrial waste	20	14.3
-Medical waste	20	14.3
▪ Method used to collect waste		
-By hand	77	55.0
-Use of equipment	40	28.6
-Both	23	16.4
▪ After collecting the waste, do you sorting material?		
Yes	124	88.6
No	16	11.4
▪ Do you receive any training program to prevent accident before starting work		
Yes		
No	0	0.0
	140	100.0

Table (3): Distribution of solid waste collectors' level of knowledge about occupational health hazards in the work place (n=140)

Occupational hazards	The study sample Total (n=140)	
	n	%
Physical hazards :		
Natural hazards such as:		
	50	35.7
Heat stroke.	49	35.0
Cold weather.	41	29.3
Noise		
▪ **Chemical hazards:-**		
- Inhalation of insecticide/ herbicides, solvents, paints, cleaning products and cosmetics drugs.	105	75.0
- Inhalation of car and regular batteries, oils, and greases.	35	25.0
▪ **Biological hazards:-**		
	32	22.9
-Twitching through contaminated syringes and other tree thorns		
-Wounds with broken glass and sharp objects.	44	31.4
-Infection from exposure to dust- insects and diapers	64	45.7
▪ **Ergonomic hazards:-**		
- Back pain	64	45.7
- Pain in the neck	44	31.4
- Fracture	32	22.9
▪ **Psychological hazards:-**		
	42	30.0
-Job stress	40	28.6
-Violence from public	36	25.7
-Repeated absence	22	15.7
- Family problem		
▪ **Accidents hazards :-**		
-Slipping	35	25.0
- Sudden twisting from heavy objects	42	30.0
- Falling from truck	63	45.0

Figure(1): Distribution of study sample according to their exposure to different types occupational health hazards (n=140).

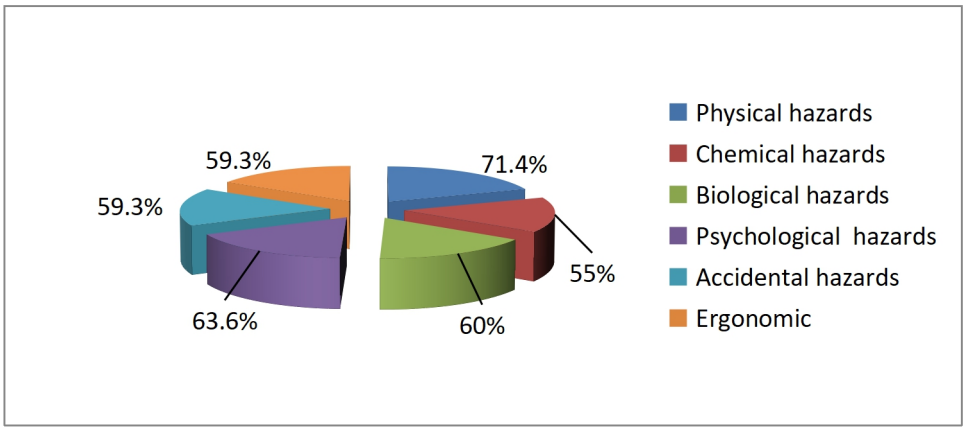

Table (4): Distribution of study solid waste collectors regarding their current health problems (n=140)

Items	The study sample(n=140)	
	n	%
Presence of health problems		
-No	13	9.3
- Yes	127	90.7
If yes, what it is?		
-Gastro intestinal problems	115	82.2
-Respiratory problems	103	73.6
-Eye problems	110	78.6
-Skin problems	114	81.4
-Musculoskeletal problems	107	76.4
Gastro intestinal problems	N =115	
Diarrhea	35	30.4
Dysentery	30	26.1
Constipation	23	20.0
Vomiting	9	7.8
Abdominal pain	28	24.3
Worm infestation	70	60.9
Dyspepsia	18	15.7
Respiratory problems	N =103	
Shortness of breath	40	38.8
Cough	45	43.7
Asthma	25	24.3
Pneumonia	19	18.4
Eye problems	N =110	
Redness	73	66.4
Inflammation	53	48.2
Skin problems	N = 114	
Itching	50	43.9
Redness	20	17.5
Inflammation	29	25.4
Spot	22	19.3
Nail pain	38	33.3
Musculoskeletal problems	N= 107	
Back pain	37	39.3
Knee pain	42	34.6
Shoulder pain	27	25.2
Arm pain	19	17.8

*** More than one answer was acceptable**

Figure (2): Distribution of safety protective measures used by study solid waste collectors (n=140)

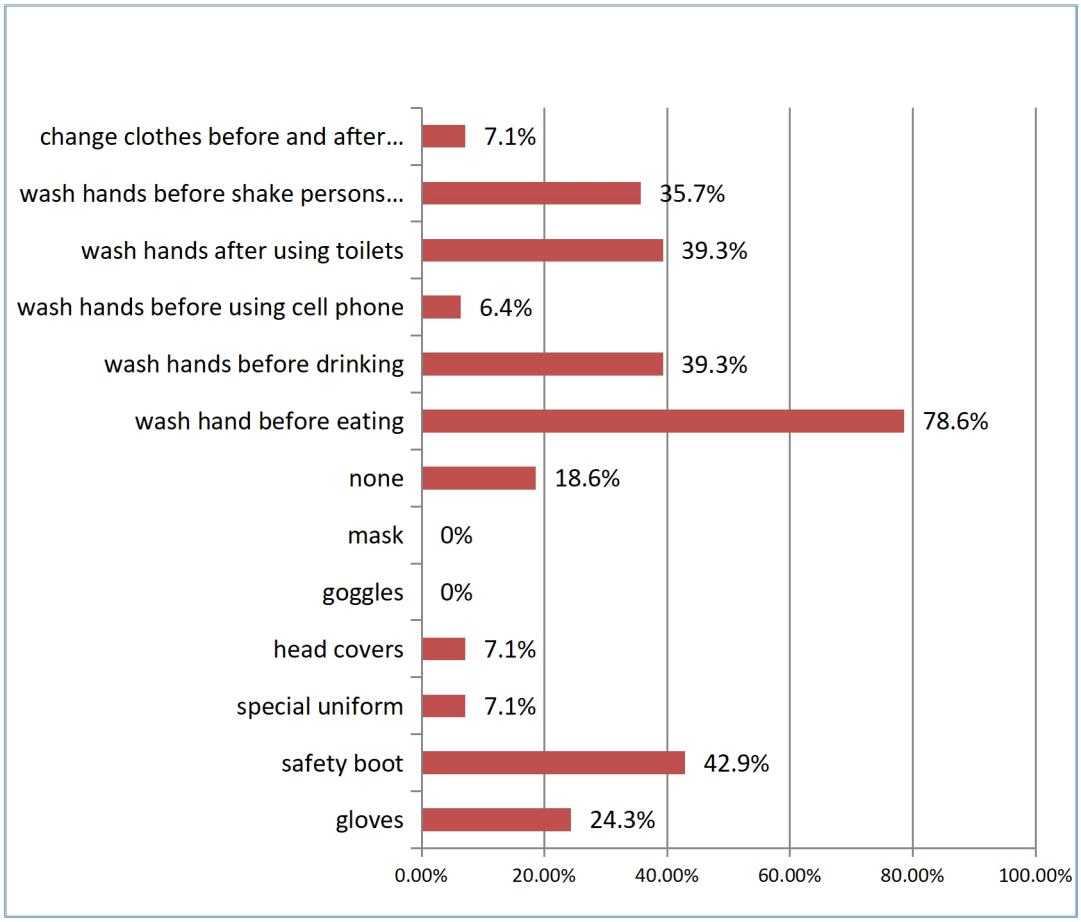

Table (5): Relationship between exposure of solid waste collectors to occupational hazards and their total score of knowledge (n=140)

Occupational hazards	Level of knowledge								χ^2	P
	poor		satisfactory		good		total			
	n	%	n	%	n	%	No.	%		
Physical hazards										
-Exposed	64	45.7	31	22.1	5	3.6	100	71.4	5.113	0.078
-Not exposed	18	12.9	17	12.1	5	3.6	40	28.6		
Chemical hazards										
-Exposed	55	39.3	19	13.6	3	2.1	77	55.0	11.964	0.003*
-Not exposed	27	19.3	29	20.7	7	5.0	63	45.0		
Biological hazards										
-Exposed	60	42.8	20	14.3	4	2.9	84	60.0	14.316	0.001*
-Not exposed	22	15.7	28	20.0	6	4.3	56	40.0		
Ergonomic hazards										
-Exposed	58	41.4	20	14.3	5	3.6	83	59.3	10.981	0.004*
-Not exposed	24	17.1	28	20.0	5	3.6	57	40.7		
Psychological hazards										
-Exposed	62	44.3	22	15.7	5	3.6	89	63.6	12.448	0.002*
-Not exposed	20	14.3	26	18.5	5	3.6	51	36.4		
Accidental hazards										
-Exposed	58	41.4	20	14.3	5	3.6	83	59.3	10.981	0.004*
Not exposed	24	17.1	28	20.0	5	3.6	57	40.7		

Significant & (p<0.05)

Table (6): Relationship between exposure of study solid waste collectors to occupational hazards and the use of safety protective measures (n=140).

Occupational hazards	Safety protective measures				Total		χ^2	P
	Used		Not used		No.	%		
	n	%	n	%				
Physical hazards								
Exposed	44	31.4	56	40.0	100	71.4	10.981	0.004*
Not exposed	5	3.6	35	25.0	40	28.6		
Chemical hazards								
Exposed	18	12.9	59	42.1	77	55.0	10.162	0.001*
Not exposed	31	22.1	32	22.9	63	45.0		
Biological hazards								
Exposed	19	13.6	65	46.4	84	60.0	14.5	0.000*
Not exposed	30	21.4	26	18.6	56	40.0		
Ergonomic hazards								
Exposed	19	13.6	64	45.7	83	59.3	13.138	0.000*
Not exposed	30	21.4	27	19.3	57	40.7		
Psychological hazards								
Exposed	20	14.3	69	49.3	89	63.6	16.855	0.000*
Not exposed	29	20.7	22	15.7	51	36.4		
Accidents hazards								
Exposed	19	13.6	64	45.7	83	59.3	13.138	0.000*
Not exposed	30	21.4	27	19.3	57	40.7		

Significant & (p<0.05)

Table (7): Relationship between demographic data of the study sample and their exposure to occupational hazards (n=140).

Demographic data	Types of hazards: Physical Exposed =100 n	%	P	Chemical Exposed =77 n	%	P	Biological Exposed =84 n	%	P	Ergonomic Exposed =83		P	Psychological Exposed =89 n	%	P	Accidental Exposed =83 n	%	P
Age																		
-20-29	36	25.7		29	20.7		30	21.4		30	21.4		30	21.4		30	21.4	
-30-39	45	32.1	0.003*	35	25.0	0.01*	39	27.9		38	27.1	0.03*	42	30.0	0.04*	38	27.1	0.03*
-40-49	11	7.9		5	3.6		8	5.7		7	5.0		8	5.7		7	5.0	
-50-60	8	5.7		8	5.7		7	5.0		8	5.7		9	6.4		8	5.7	
Educational level:																		
Illiterate	30	21.4		19	13.6		28	20.0		28	20.0		24	17.1		28	20.0	
Read & write	41	29.3	0.004*	25	17.9	0.03*	34	24.3	0.003*	33	23.6	0.003*	31	22.1	0.03*	33	23.6	0.003*
Primary	16	11.4		18	12.9		12	8.6		12	8.6		19	13.6		12	8.6	
Diplom	13	9.3		15	10.7		10	7.1		10	7.1		15	10.7		10	7.1	
Marital status:																		
-Single	34	24.3		19	13.6		28	20.0		19	13.6		24	17.1		19	13.6	
-Married	60	42.9	0.03*	53	37.9	0.64.	49	35.0	0.07	58	41.4	0.28	57	40.7		58	41.4	0.28
-Divorced	6	4.3		5	6.5		7	5.0		6	4.3		8	5.7		6	4.3	

Discussion

Municipal solid waste are made and thrown out daily as a result, it cause pollution and prevalence of diseases if it is not collected and treated well (Anand et al,2016). Municipal solid waste collectors plays a main role in cleansing environment by collecting, sorting ,treating and also landfill the waste. Solid waste collectors are subjected to many occupational health hazards that require more attention from local council through facilitating usage of safety protective measures and providing training program to the waste collectors before starting the work (**Thorn, Beijer and Rylander, 2016**).

Regarding socio-demographic characteristics of the studied sample, the current study revealed that the mean age group among solid waste collectors was 37.05 ±8.59 and more than one third of the sample were between age group 30-40 years. Also, it showed than about two thirds of the studied sample were male, more than one third were read and write. In addition, more than one half of the studied sample were married. These findings were supported by studies were done by **Gizaw et al, 2014 & Mohd & Haliza, 2015**. They stated that the majority of the sample were aged between 35 - 44 years, followed by ages of 25-34. Most of the sample were married, illiterate and also read and write. This agreement in findings might be due to the low educational level demands in this field for employment in our community.

On the other hand, these findings was not supported by studies were done by **Marahatta, Katuwl & Rijal, 2017 & Zemichaelet al, 2014.** They reported that the majority of studied sample between the age group of 41-50 years followed by age group of 31-40, most of the sample are female and illiterate .This disagreement in findings might be due to differences in sample characteristics that were taken.

Concerning presence of chronic diseases, the current study reported that the majority of the studied sample had chronic diseases, one third of them had diabetes mellitus. Also, it showed that more than half of the sample were smokers. These findings were supported by a study was done by **Jariwala, 2013 & Pradeep, 2016**. They reported that majority of the studied sample had chronic diseases and were smoker. This agreement in findings might be due to the habit of smoking is found among this group to be used as anesthesia during the working hours. Also, as a result of their exposure to waste loading work, solid waste collectors were vulnerable to exposed to communicable and non-communicable diseases. But, These findings were not supported by a study was done by **Singh, 2017.** Who reported that only one third of the collectors were smoker. The disagreement in findings might be due to the nature of the present study that included the majority of male workers than other study included females workers that displayed a higher prevalence as compared to males.

As regard to distribution of work related characteristics among studied sample. The present study indicated that about two thirds of the studied sample had permanent work and more than half of the sample had experience more than five years. Also, the present study reported that the majority of the study sample worked in the morning shift, all of them spent eight hours a day in the work , and most of them worked six days weekly. These findings were supported by a study was done by **Debassu et al, 2016**. Who reported that majority of the sample had permanent job and only one half of the sample had experience more than five years and most of the workers spent eight hours daily usually in the morning shift. This agreement in findings might be due to that no differences in work characteristics in all countries.

Also. the current study revealed that nearly one half of studied solid waste collectors were cleaning the street ,two thirds of the sample collected house hold waste, more than one half of them collected waste by hand, the majority of them sorted waste after collection. and all of the studied sample didn't receive any training program before starting work. These findings were supported by studies were done by **Byung, Sangbok and Jae, 2016 & Shams El-Din, Mohammed and**

Abd El-Gaber, 2017. They reported that more than three quarters of the collectors sweep the street, the majority of them collected the waste manually, most of the collectors sorted the waste and the majority of the sample didn't receive any training program. This agreement in findings might be due to lack of knowledge provided from local council to this vulnerable group about safety manipulation of solid waste.

Concerning solid waste collectors' level of knowledge about occupational health hazards in the work place, the present study reported that one third of the studied sample mentioned heat stroke as physical hazards while three quarters of the sample mentioned inhalation of insecticide/ herbicides, solvents, paints, cleaning products, and cosmetics drugs as chemical hazards. Also, it showed that more than one third of the studied sample mentioned infection from exposure to dust, insect and diaper as biological hazards. In addition, nearly one half of them mentioned back pain as ergonomic hazards and as the same, falling from truck as accidental hazards. These findings were supported by studies were done by **Zaky, El- Magrabi & Mohammed, 2018 & Nayera, Mostafa, and Lamaya, 2015.** They reported that more than one third of the sample mentioned heat stroke and as physical hazards, Regarding to biological hazards only one third mentioned infection. Regarding to chemical hazards more than two thirds mentioned inhalation of insecticide/ herbicides, solvents, paints and cleaning products. Regarding mechanical hazards, nearly one half of the sample mentioned back pain. Regarding accidental hazards, nearly two thirds of them had slipping or falling from the truck.

Regarding to psychological hazards, nearly one thirds of the sample mentioned job stress as psychological hazards while one tenth had family problem. These findings were in agreement with the studies that were done by **Eskezia et al, 2016 & Shafik et al, 2019.** They reported that nearly one half of the sample had job stress and nervous tension, while one fifth had family problem. This agreement could be due to that there is increasing workload, violence from the public and exposed to other types of the hazards can increase their psychological hazards.

In relation to exposure of studied solid waste collectors to different types occupational health hazards, the current study revealed that two thirds of the sample were exposed to physical hazards, while more than half of the sample exposed to psychological, ergonomic, chemical, biological and accidental hazards. These findings were supported by a study that was done by **Shafik et al, 2019.** Who reported that more than half of the sample were exposed to physical hazards and more than three quarters were exposed to biological hazard. In addition, the majority of the waste workers were exposed to chemical hazards, mechanical and psychological hazards. From the researchers point of view, this may be due to that solid waste collectors did not receive any educational or training program about occupational hazards they will be exposed in the work place.

Regarding solid waste collectors' current health problems. The present study reported the majority of studied waste collectors complained from health problems and gastrointestinal problems were the most common among them, especially worm infestation that found among more than half of the sample. furthermore, about two thirds of the study sample complained from respiratory disease especially cough as

reported by more than one third of the sample.

Also, the current study showed that about two thirds of the sample had eye disease especially redness as reported by more than half of them. On the other hand, more than two thirds of the sample had skin problems especially itching stated by more than one third of them. In addition, musculoskeletal problems was stated by two thirds of the studied sample especially back pain stated by one third of them. These findings were supported by studies that were done by **Madian, and Abd El-Wahed, 2018 & Nayera, Mostafa, and Lamaya, 2015.** They reported the majority of the waste collectors had health problems especially gastrointestinal complaints that stated by whole collectors and worm infestations is most common.

Also, These findings were supported by a study that was done by **Ravindra & Kaur,2016.**Who reported that the majority of the studied collectors had eye problems especially redness, more than three quarters had skin problems as itching and nail infection, less than half of the collectors had cough and dyspnea as respiratory problems. Also, less than three quarters of them complained of neck and low back pain as musculoskeletal problems.

This agreement in findings might be due to that prevalence of health problems and work related hazards among solid waste collectors in all community due to lack of knowledge, standardized guidelines and safety measures followed by solid waste collectors during waste collection, transport and handling.

Concerning safety protective measures that used by studied solid waste collectors. The present study revealed that more than one third of the sample used safety boot, while gloves were used by one fifth of them. Moreover, only little of them used special uniform and also head covers. On the other hand, nearly one fifth of the sample not used any personal protective equipment and also all of the study sample not used goggles and mask. Also, the present study reported that two thirds of the study sample washed their hands before eating while nearly one tenth of them change clothes before and after the shifts. These findings were supported by a study that was done by **Abd El-Wahab et al, 2014.** Who reported that minority of the studied sample used safety boot and gloves and most of the sample not used special clothes, face mask and goggles. In addition, most of the waste workers not washed their clothes in the work place.

This similarity might be due to shortage in supply and personal equipment provided to the solid collectors, no availability of washing facilities in the work place , and lack of awareness among collectors regarding importance of using safety measures to prevent occupational hazards in our local council.

Regarding the relationship between exposure of studied sample to occupational hazards and their total score of knowledge, the current study founded that there were statistical significance difference between total score of knowledge and the exposure of the studied solid waste collectors to occupational health hazards as (chemical , biological, ergonomic, psychological and accidental) hazards. Also, the present study indicated that there was no statistical significance difference between total level of knowledge about various occupational health hazards and the exposure to physical hazards. These findings were

supported by studies were done by **Abd El-Wahab et al, 2014 & Ateya et al, 2014.** They reported that there were statistical significance difference between total satisfactory level of knowledge about occupational hazards and some of their exposure to occupational health hazards as (biological, chemical psychological and ergonomic) hazards. Also. They reported that no statistical significance occur between total satisfactory level of knowledge and exposure to physical and mechanical hazards. This agreement in findings could be due to lack of educational program to solid waste collectors before recruitment in Egyptian local councils .

In relation to the relationship between exposure of studied sample to occupational hazards and their use of safety protective measures, the current study revealed that there were statistical significance difference between the exposure of the studied group to occupational health hazards as (physical, chemical , biological, ergonomic, psychological and accidental) hazards and their use of safety protective measures. These findings were supported by a study that was done by. **Kevin et al, 2016**. They reported that there were statistical significance difference between studied sample's exposure to various occupational hazards and their use of safety protective measures. These agreement in findings might be due to lack of using safety protective measures, absence of observation at work place and lack of knowledge about occupational hazards in Egyptian local councils. But this findings were not supported in the type of sample used.

Concerning the relationship between socio demographic data of the studied sample and their exposure to various occupational hazards, the present study founded that there were statistical significance difference between the exposure of the sample to various occupational health hazards and their age group and also, level of education. In addition, the current study revealed that there was statistical significance difference between marital status of studied sample and their exposure to physical hazards. But, there were no statistical significance difference between marital status and the exposure to other different occupational hazards These findings were supported by studies that were done by **Abd El-Wahab et al, 2014, Ateya et al, 2014 &. Mohammed,2014.** They reported that there were statistical significance difference between studied sample exposure to different occupational health hazards and their age group and level of education. This support in findings could be due to the more education, the more safety measures used and the lower exposure to occupational hazards.

Conclusion

The current study concluded that

The vast majority of studied solid waste collectors were exposed to different types of occupational health hazards especially physical hazards and psychological hazards. Most of the studied sample suffered from gastrointestinal, eye, respiratory , skin ,and musculoskeletal problems.

Also, this study concluded that the majority of studied sample had shortage in using safety protective measures. There were statistical significance difference between total satisfactory level of knowledge about occupational hazards and exposure to occupational health hazards. In addition, there were statistical significance difference between the exposure of the studied group to

occupational hazards their use of safety protective measures.

Recommendations

- Health education and awareness programs should be provided regularly to all municipal solid waste collectors for increasing their knowledge on occupational health hazards, use of protective measures and ergonomic principles.
- Periodic medical examination and immunization should be done to all municipal solid waste collectors.
- Periodic training program should be devolved and carried out by trainer in Local Council to educate all solid waste collectors on first aid of different accidents in the work place and proper use of personal protective equipment.
- Further research is needed to examine sustainable preventive strategies to prevent or reduce exposure to different occupational hazards among solid waste collectors.

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