



A community-based cross-sectional study exploring knowledge, attitude, and practice of adults towards the use and hazards of plastic products

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ABSTRACT

Background: Plastic use is unavoidable in our ordinary lives. Community awareness regarding possible environmental and public health consequences of plastic waste contamination is necessary. Judicious approach is to choose healthy, high-quality plastic and use it appropriately. **Objective:** To assess the knowledge, attitude, and practices (KAP) of the public consumers towards the uses and health hazards of different plastic products and identify the related factors. **Method:** A community-based cross-sectional study was conducted in Assiut city using a self-administrated questionnaire using cluster sampling. KAP scores were calculated and compared against demographic factors. **Results:** Total 477 participants were included. Satisfactory knowledge and practice scores were low (24.3% and 19.3%, respectively) while those of positive attitude was high (80.1%). Mass media was the primary source of information about the uses and harms of plastics. Participants' knowledge was statistically significantly associated with their educational level and marital status. While positive attitude was statistically associated with female gender and older age (≥ 30 years). Satisfactory practice was significantly influenced by older age ≥ 30 years. **Conclusion:** Despite the observed low level of knowledge and practice, there was a higher percentage of positive attitudes. These findings point out a gap of knowledge which is influenced by the educational level. Therefore, introducing plastic, types, quality, uses, and health hazards to the school curriculum are essential. Furthermore, to plan for a public education program focusing on various single-use plastics to minimize the hazardous effects on health and the environment is mandatory.

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INTRODUCTION

Plastic is anywhere in today's life. It is used to package, cover, serve, and even dispose of a wide range of consumer products. Grocery packets, food packaging boxes and bags, bottles, juice straws, plastic containers, plastic cups, and cutlery are examples of single-use plastics.¹⁻³ Worldwide, from 1950 to 2015, 8300 million metric tons (Mt) of plastic was produced. Around 4900 Mt were discarded and accumulated in landfills or the natural environment.⁴ Many chemical and hazardous substances are found in plastics, including Bisphenol

A (BPA), thalates, antiminitroxide, brominated flame retardants, and poly-fluorinated chemicals, among others, which pose a significant risk to human health and the environment.⁵

The hazard of plastics is due to Nano-plastics' interaction with human cells and via exposure to harmful additives in plastic products.^{6,7} Both Nano-plastics and harmful additives occur in food packaging, household items, and even medical equipment, entering the body by ingestion, inhalation, and skin contact. Nano-plastics can cause

Table (1): Socio-demographic characteristics of the study respondents

Personal data	No. (477)	%
Age: (years)		
< 30	225	47.2
≥ 30	252	52.8
Mean ± SD (Range)	30.61 ± 10.35 (15.0-68.0)	
Gender:		
Male	169	35.4
Female	308	64.6
Education:		
Secondary	131	27.5
University	311	65.2
Postgraduate	35	7.3
Marital status:		
Single	243	50.9
Ever married	234	49.1
Occupation:		
Professional	50	10.5
Employee	149	31.2
Student	137	28.7
Skilled worker	54	11.3
Not working	38	8.0
Free business	49	10.3

SD: Standard Deviation

damage and inflammation in human skin, lung, and brain cells.⁸ It has also been associated with; endocrine disorders, cancer, and reproductive damage.⁹ Other system affections included; vision loss, eyes irritation, respiratory conditions, liver, gastrointestinal dysfunction, skin and lung diseases, cardiovascular, genotoxic, headache, and dizziness from using unhealthy plastics¹⁰ Plastic waste disposal can cause significant atmosphere pollution, which causes impaired immunity, congenital disabilities, developmental defects. In addition to its carcinogenicity, it will cause other consequences by affecting the respiratory, nervous, and reproductive systems.¹¹

When food or drinks are stored in plastic containers, some chemical materials are transferred to the food and drinks through the leaking process, confirming that specific plastic chemical components get in the food or water. As a result, chemical materials such as BPA seep into food over time when plastic water bottles and the inner linings of food cans are reused over time, particularly when heated. It may not be possible to eliminate use of plastic containers for food and drink. However, the prudent approach is to choose healthy, high-quality plastic and use it properly.¹²⁻¹⁴

It is inevitable to avoid plastic use. Although they are helpful for individuals, the challenges and costs

associated with plastic disposal represent a burden on society. Plastic takes thousands of years to biodegrade, posing a health and environmental danger to humans, livestock, and the ecosystem.¹⁵⁻¹⁷ The Mediterranean region is the world's fourth-largest producer of plastic goods. Egypt produces 5.4 million tons of plastic annually, making it the most significant plastic polluter in the Arab World. A recent report by the World-Wide Fund for Nature (WWF) revealed that Egypt is the most significant source of plastic pollution in the Mediterranean Sea. It is the most significant contributor to the region's mismanaged waste.¹⁸ Suffocation, intestine, and stomach diseases kill animals. This is a common manifestation in developing and underdeveloped countries due to insufficient processing of plastic bags, which are then consumed by animals.² Plastic bags and other single-use plastics also can clog rivers and exacerbate natural disasters.^{19,20}

Farhan R. Khan and his colleagues, in a small-scale study in Cairo, reported the presence of microplastics (MPs) in the digestive system of more than 75% of the sampled fish caught from the Nile River.²¹ Recently, there is a project to reduce the consumption of single-use plastic products in Egypt. The government issued a decree to stop providing financial services for single-use plastic manufacturers, as they have a significant negative impact on the environment; at the same time, technical support services will be provided to these projects to shift towards environmentally friendly alternatives.²²

The public health sector, environmental protection agencies, and policymakers play a significant role in preventing exposure to dangerous pollution levels.²³ Health education of the general public about the possible environmental and public health consequences of plastic waste contamination is necessary. This will help reduce emissions and preserve environmental quality. People must be conscious of the chemical components of plastic products and their health effects. It is essential to integrate plastic pollution and waste management programs into the educational curricula at all levels to provide trusted information.^{11,24}

To our knowledge, limited studies were conducted in our community to evaluate the Knowledge, attitude, and practice (KAP) of adult consumers to various single-use plastics (bags and containers).

Table (2): Participants' knowledge towards the use of plastics and its risks

Consumer' knowledge items	Correct		Incorrect	
	No.	%	No.	%
Best kind of packages for drinks and juices	323	67.7	154	32.3
Is using of plastic containers safe	77	16.1	400	83.9
What should be done to get rid of plastic bags	136	28.5	341	71.5
Does plastic have health risks?	332	69.6	145	30.4
Is it preferable to reduce consumption of plastic bottles and bags?	243	50.9	234	49.1
The most effective way to reduce the use of plastic bags	351	73.6	126	26.4
Does the symbol on the bottom of the package or the plastic bottle have a meaning?	321	67.3	156	32.7
Is it necessary to read the validity period for using plastic bottles and bottles?	413	86.6	64	13.4
What is the meaning of the symbol on the plastic packaging?	177	37.1	300	62.9
What is the meaning of the triangle at the bottom of the plastic package?	158	33.1	319	66.9
What is the meaning of the number inside the triangle?	186	39.0	291	61.0
Does washing the plastic container with water and detergent make them safe for use again?	315	66.0	162	34.0
Is exposing plastic containers to sunlight harmful?	265	55.6	212	44.4

Elsheikh assessed food handlers' knowledge regarding using selected plastic-type for foods and described that most respondents (83.9%) had poor knowledge.²⁵ Other researchers applied for an education program and measured the KAP of children's mothers towards the safe use of plastic food containers before and after their program. This intervention concluded that most children's mothers had unsatisfactory knowledge and improper practice regarding the safe use of plastic, which was enhanced after employment of an educational program.²⁶

The majority are still unaware of the risks of plastic pollution and its consequences. Because of the wide use of plastics in our community, understanding and engaging the public is vital for the success of any initiative. Therefore, the objective of the current study was to assess the KAP of the public consumers towards the uses and health hazards of different plastic products and identify the related factors.

METHOD

We conducted a community-based, cross-sectional study design.

Population: data was collected from adults (more than 18 years) who are residents of Assiut city, Assiut governorate, Egypt. Based on the total population of Assiut district (979,862), the estimated percentage of urban population is 26.4 %, and the percentage of adult population above 18 years is 55%. The sample frame equal 143,000.²⁷

Research tools: A self-administrated questionnaire was used to assess the participants' socio-demographic characteristics and KAP. The participant's socio-demographic characteristics: collected using five questions; regarding participant's age, gender, marital status, level of education, and job. The participants' knowledge was assessed using 14 Yes/No questions. The participants' Practices were assessed using 12 Yes/No questions. A score of one was given for the correct answer and zero for the wrong answer. These scores added up to calculate the overall knowledge and practice score. The participants' Attitude was assessed using 20 questions (agree, disagree, or to some extent). A score of two was given for the "agree," and one for "some extent," and a zero was given for "disagree." These scores were added up to get the overall attitude score. The interpretation of the KAP score; >60% considered satisfactory and < 60% considered unsatisfactory.^{14,25,26,28,29}

Tool Validation: A few academic and public health experts revised and validated the study tools. The Cronbach Alpha coefficient was calculated, 0.61, 0.64 & 0.67 for knowledge, attitude, and practice.

The sample size was calculated using Epi-Info program Version 7, with power (90%) and confidence interval (95%), and the margin of error of 5%. No previous data showed the prevalence of KAP on the use of plastic in the general population; 50% was assumed for calculation of sample size

Table (3): Participants' attitude towards the use of plastics and its risks

Consumer' attitude items	Agree		Neutral		Disagree	
	No.	%	No.	%	No.	%
Plastic is important and necessary in our life	238	49.9	211	44.2	28	5.9
Plastic is used extensively and continuously at home	292	61.2	163	34.2	22	4.6
We can Dispense with plastic	114	23.9	183	38.4	180	37.7
The hazards of plastic are more than its benefits	206	43.2	205	43.0	66	13.8
Plastic is made from chemicals that are harmful to health	206	43.2	217	45.5	54	11.3
Plastic is a danger to humans/ the environment	205	43.0	207	43.4	65	13.6
Plastic is not biodegradable, so it is dangerous	220	46.1	148	31.0	109	22.9
Putting hot food/ drink in plastic containers is dangerous because it interacts with food	363	76.1	73	15.3	41	8.6
The interaction of food with unauthorized plastic materials causes many diseases	396	83.0	67	14.0	14	2.9
Fatty substances are the most interacting foodstuffs with the chemical in plastic, as the plastic material is easily dissolved with it	220	46.1	188	39.4	69	14.5
Plastic products may cause various diseases in humans	271	56.8	156	32.7	50	10.5
Mineral water bottles are valid for one use only	287	60.2	126	26.4	64	13.4
The environmental problems caused by using plastic containers are important to me	250	52.4	158	33.1	69	14.5
The storage of plastic containers near heat sources makes it unsafe to reuse.	384	80.5	69	14.5	24	5.0
I reuse shopping plastic bags	153	32.1	163	34.2	161	33.8
I think single-use plastics (bottles and bags) can harm the environment	230	48.2	178	37.3	69	14.5
Plastic causes cancer, liver problems, birth defects, bronchitis, and indigestion	260	54.5	152	31.9	65	13.6
I support the idea of replacing the manufacture of plastic bags with cloth and paper bags	292	61.2	112	23.5	73	15.3
I support the idea of replacing the making of plastic bottles with glass bottles	330	69.2	104	21.8	43	9.0
Plastic should be used in objects that are far from direct human use, such as chairs, hangers, or tables	341	71.5	94	19.7	42	8.8

(Population proportion 50%). The calculated sample size was 384 subjects, and we decided to recruit 500 to overcome incomplete questionnaires. As a pilot, 20 adult persons completed the questionnaire to determine the clarity of questions, completeness of response sets, time required to complete it, and the success of the data collection technique. The data of the pilot study was not used in the study analysis.

Assiut city is divided into two parts (Qessm Awal & Qessm Thane). The sample was divided into 20 clusters; every cluster was 25 persons. The researchers recruited 10 clusters from each part. The response rate was 95.4% (477 participants completed the study questionnaire).

A group of trained nurses collected the data under the supervision of the researchers. The data collectors invited adult persons to participate. They

explained the purpose of the study to them, and informed consent was obtained prior to the interview. The first house in each area (Qessm Awal & Qessm Thane) was selected randomly. A systematic random sampling technique was applied to recruit each cluster. Every fifth house was visited and requested one adult person to participate in the study. If the selected person refused to participate, another eligible adult in the same household was invited to fill the study questionnaire. If no other available adult in the same house, the data collectors moved to the next house using the same pattern until the recommended sample size was recruited. On average, 30 minutes was the time needed to fill the questionnaire.

Statistical analysis: The collected data was coded and entered using Statistical Package of Social Science (SPSS version 20). Data presented using

Table (4): The participants practice of using plastics and its risks

Participants' practices items	Yes		No	
	No.	%	No.	%
Buy plastic because it is cheap	291	61.0	186	39.0
Check the number on the bottom of the plastic package	300	62.9	177	37.1
Re-use bottles of detergents, soft drinks for drinking water after cleaning them well	258	54.1	219	45.9
Use plastic containers and bags to keep food in the freezer	359	75.3	118	24.7
Use plastic bags to store sandwiches	349	73.2	128	26.8
Re-use bottles of drinking water more than once	283	59.3	194	40.7
Use plastic boxes to store food	356	74.6	121	25.4
Use plastic containers to make pickles at home	353	74.0	124	26.0
Avoid heating food or placing hot food in plastic containers	342	71.7	135	28.3
Use plastic utensils when heating food in the microwave	101	21.2	376	78.8
Use plastic plates for hot food	98	20.5	379	79.5
Use plastic equipment and toys for young children	395	82.8	82	17.2

Table (5): The distribution of study participants according to their score of Knowledge, attitude and Practice

KAP score	No. (477)	%
Knowledge:		
Unsatisfactory	361	75.7
Satisfactory	116	24.3
Mean ± SD	6.91 ± 2.32	
Attitude:		
Negative	95	19.9
Positive	382	80.1
Mean ± SD	28.28 ± 4.96	
Practice:		
Unsatisfactory	385	80.7
Satisfactory	92	19.3
Mean ± SD	5.39 ± 2.35	

SD: Standard Deviation

frequency, percentage, mean ± SD. KAP scores were calculated and compared against demographic factors. A Chi-square test was used to analyze categorical data. Logistic regression analysis and Spearman's correlation coefficient were applied to examine the relationship between participants' KAP and the different demographic characteristics. Statistical significance was set at a *p*-value (<0.05).

RESULTS

As shown in Table 1, the mean age of study participants was 30.61±10.35 with a range of (18-68), 64% were female, and 65.2% had a university education, 50.9% were single, 31.2% were employees. In comparison, 28.7% were students. Table 2 indicated that the highest percentage of participants had a correct knowledge item regarding; the necessity to read the validity period for using plastic bottles, the most effective way to reduce the use of plastic bags, and the plastic health

risks (86.6%,73.6%, & 69.6%) respectively. While they had incorrect knowledge regarding; the safety of consumption of plastic containers, how to get rid of plastic bags, the meaning of the symbols at the plastic container, and the meaning of the number inside the triangle (83.9%,71.5%, 66.9%, & 61.0%) respectively. Mass media was the primary source (60.2%) of knowledge about plastic and its risk, followed by the academic source (one-third). While family and friends and personal experience shared information by 18-19% each (data not shown).

Table 3 demonstrates the users' attitude towards plastics and their hazards. The participants agreed for the majority of the positive attitude statements; putting hot food/ drink in plastic containers is dangerous because it interacts with food, the interaction of food with unauthorized plastic materials causes many diseases, the storage of plastic containers near heat sources makes it unsafe to reuse, plastic should be used in objects not in direct human use, such as chairs, hangers or tables, supporting replacing of plastic bottles with glass bottles, supporting replacing plastic bags with cloth and paper bags (76.1%,83.0%, 80.5%, & 71.5%, 69.2%,& 61.2%) respectively.

Table 4 shows that more than three-quarters of the study participants follow unfair practices such as the use of plastic containers and bags to keep food in the freezer, using plastic boxes to store food, using plastic containers to make pickles at home & using plastic equipment, and toys for young children (75.3%, 74.6%, 74.0%, & 82.8%) respectively. There was a significantly positive correlation between consumers' knowledge and practices (*r*=0.367). Data not shown. Table 5 shows that satisfactory knowledge and practice scores were low

Table (6): Relationship between the participants' level of knowledge, attitude and practice and their demographic characteristics

Participants' Characteristics	Knowledge			Attitude			Practice		
	Un satisfactory	Satisfactory	P-value	Negative	Positive	P-value	Un satisfactory	Satisfactory	P-value
Age: (years)									
< 30	77.3%	22.7%	0.427	24.0%	76.0%	0.035*	84.9%	15.1%	0.029*
≥ 30	74.2%	25.8%		16.3%	83.7%		77.0%	23.0%	
Gender:									
Male	76.9%	23.1%	0.640	27.8%	72.2%	0.001*	81.7%	18.3%	0.699
Female	75.0%	25.0%		15.6%	84.4%		80.2%	19.8%	
Education:									
Secondary	81.7%	18.3%	0.026*	20.6%	79.4%	0.972	76.3%	23.7%	0.328
University	74.9%	25.1%		19.6%	80.4%		82.3%	17.7%	
Post-graduate	60.0%	40.0%		20.0%	80.0%		82.9%	17.1%	
Marital status:									
Single	80.2%	19.8%	0.018*	21.8%	78.2%	0.291	83.1%	16.9%	0.173
Ever married	70.9%	29.1%		17.9%	82.1%		78.2%	21.8%	
Occupation:									
Professional	64.0%	36.0%	0.051	24.0%	76.0%	0.664	74.0%	26.0%	0.122
Employee	71.1%	28.9%		15.4%	84.6%		75.2%	24.8%	
Student	78.8%	21.2%		20.4%	79.6%		84.7%	15.3%	
Skilled worker	81.5%	18.5%		24.1%	75.9%		81.5%	18.5%	
Not working	89.5%	10.5%		21.1%	78.9%		84.2%	15.8%	
Free business	75.5%	24.5%		22.4%	77.6%		89.8%	10.2%	

(24.3% and 19.3%, respectively) while those of positive attitude was high (80.1%).

Table 6 illustrates the relationship between the participants' sociodemographic data and their KAP. Higher knowledge score between participants' higher educational, and unmarried ($P= 0.026$ & 0.018), and positive attitude among >30 years old & females ($P= 0.035$ & 0.001) respectively. Correct practices were observed among participants >30 years old ($P=0.029$). The logistic regression analysis revealed a statistically significant association between participants' knowledge and their level of education. The respondents' attitude was influenced by age and education. ($P<0.05$). Data are not shown.

DISCUSSION

There is a growing concern regarding plastics due to the rapid increase in their use and improved awareness of the health problems.²⁴ This study can provide us with baseline data on the adult consumer awareness of single-use plastics.

The present research revealed that only 24% of the participants had adequate knowledge regarding single-use plastics. Consistently with the results of a

study conducted in Egypt among food handlers to assess their knowledge regarding using selected plastic-type for foods, it reported (83.9%) of respondents had poor knowledge.²⁵ Moreover, in agreement with community KAP research assessing plastic waste disposal. They found that most participants did not have adequate knowledge regarding plastic waste disposal.¹⁴ While previous investigations reported, higher ($>50\%$) had adequate knowledge regarding plastic disposal.³⁰⁻³² Increasing awareness about such a prevailing problem is essential in changing people's behavior, since the participants' awareness affects their attitudes and readiness to change. Comparable conclusions were observed in different research.^{33, 34} The score of knowledge (70-82.5%) was observed in other research studies.³⁵⁻³⁷ These findings point out a gap of knowledge among residents in Assiut city. They pose a question upon the educational system of whether students are getting adequate education regarding environmental hazards. The higher the participants' awareness, the more desire to participate and improve their community.³²

The multivariate regression analysis revealed that participants (university or postgraduate education) have statistically significantly better knowledge than secondary school students. Students receiving higher academic courses are likely to be knowledgeable on various public health issues, including plastic use and risk. In developing countries, poor awareness among people, in general, has been reported as the leading cause resulting in adopting environmentally unfriendly practices.^{38,39} Reusing plastic bags may lead to less generation of waste. This strategy has been framed as unhygienic. In the present study, one-third of the consumers were reusing plastic bags. Other studies, 97% of consumers were reusing plastic bags without washing them. These reusable bags carried harmful microbes, which cause cross-contamination of food packed in it, thus posing a risk on health.⁴⁰ Williams DL *et al.*, stated that *Escherichia Coli* was identified in 8% of reused bags and several enteric bacteria and other opportunistic microbes.⁴¹ Fortunately, most of our participants (70.0%) were aware that plastics posed a health hazard. In concordance to this finding, the reports from multiple studies; most of the participants in different countries were concerned about the effects of plastic waste on health and the environment.⁴²⁻⁴⁵ Plastics can cause serious health problems due to chemical reactions in plastic materials and food items that generate carcinogenic substances.⁴⁶

In the current survey, 60.0% of the participants appreciated the significant roles of mass media in raising the awareness of the public and disseminating the information about the risk of plastic use and its wastes, followed by the role of the educational school materials (27.8%), the outcome of other research also observed the same, where they described that certainly, media is the most common source of information.^{31,44,45} These findings suggest that raising awareness should target social media to reach the majority. In surveys completed in Istanbul and UAE, equivalent suggestions were mentioned about the importance of spreading information through social media and the internet, which provide an amusing educational method^{32,34} While, school-based studies revealed that students retrieved knowledge mainly from school materials.^{30,43}

There is a significant association between our participants' knowledge regarding the hazards of using plastic bags and their education. This observation aligned with another community-based

study that concluded a significant association between awareness score and education.⁴⁷ An anticipated finding is that educated participants will be more concerned about the health and the environment.³¹

Moreover, regarding the symbols printed in the bottom of plastic containers, about two-thirds of the participants noticed the presence of the symbol. They expected that it has a meaning, even though only one-third of them documented the meaning of these symbols and the number written inside the triangle. In Thailand, most participants noted symbols on plastic containers, but 70% knew that the symbols reflect the quality of plastic containers.²⁸ Another study conducted in Iran on medical students revealed that half had seen the symbols. However, only 6 % knew their meaning.⁴⁸ This variability could be due to the differences in participants' cultures and education.

Despite the inadequate knowledge regarding plastic use, most of our participants (80%) have a positive attitude towards the use of plastics. This result is parallel to the outcomes from multiple types of research.^{28,29} The positive attitude among two-thirds of participants towards banning plastics, replacing plastics with other safe material; cloth and paper bags, and changing plastic bottles with glass bottles. This agreed with the conclusions of other studies that strongly favored the ban of using plastic bags and suggested using safe substitutes bags.^{43,45,49} Worthy alternatives of environmentally friendly materials should become available in customary shopping facilities such as supermarkets and stores.⁹ The majority (> 70%) of the participants avoided heating food or placing hot food in plastic containers. Other investigations were conducted to explore the KAP related to plastic containers for food and drinks; most participants disagreed with using plastic containers when heating food in the microwave.^{28,48} Heating will combine the plastic with oils inside the food that can produce dioxin poison.⁵⁰ This may indicate that consumers are aware of the adverse effects of plastic containers. However, they still need more knowledge about plastic use for food and drink.²⁸

Solid wastes are the final phase of plastic bags.⁵¹ We found that one-third of the participants disagreed with dispensing the plastic bags. Other research conducted in developing countries revealed several problems associated with plastic bag wastes; human and environmental problems were raised by many of the respondents.³¹ Therefore, proper attention

should be paid to the effective disposal of plastic bag wastes to avoid environmental hazards.⁵²

A small percentage of the consumers have acceptable practices. Their good practice level was even less than their satisfactory knowledge level. Other researchers concluded that a small percentage of their participants had good practice and it was lower than their knowledge score.^{1,28,30} There is a gap between knowledge and performance regarding their practice on plastic usage. One of the reasons behind the gap could be that the knowledge attained is frequently forgotten shortly after it is acquired.⁵³ There was a positive correlation between knowledge and practice in the present analysis. Matched with investigators finding^{14,15} an expected outcome. Our participants commonly use plastic bags regularly because it is cheap or free of cost, readily available, and more convenient. This opinion was equivalent to the opinion reported from another research.^{1,38}

CONCLUSION

This study provides a baseline of the KAP regarding plastic use and its hazards among the Egyptian community. Despite the observed low level of knowledge and practice, there was a higher percentage of positive attitudes. Participants' knowledge was influenced by their education. These findings point out a gap of knowledge among residents in Assiut city. Therefore, introducing different aspects of plastics, including; types, quality, uses, and health hazards, to the school curriculum is essential. Furthermore, to plan for conducting a public education program focusing on various single-use plastics to minimize the hazardous effects on health and the environment.

Ethical Consideration

The study was reviewed and approved by the ethical committee of faculty of Medicine, Assiut University (number 17300783). The respondents provided informed consent before filling the questionnaire.

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Conflict of Interest

All authors have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authors Contribution

WSH contributed to research conceptualization, project administration, data curation and analysis, methodology, writing: original draft preparation, review & editing. and SRM contributed to data curation, writing review & editing, and validation. Both authors read and approved the final version of the manuscript

REFERENCES

1. Shaira H, Ismail I, Ahmed N, Arooj P, Shreya P, Shafir R, and Nazeer R (2020): Assessment of Knowledge, Attitude, and Practice Regarding Single-Use Plastics among the Residents of a Rural Area in a Coastal District of Karnataka - A Descriptive Study. *National Journal of Community-Medicine*,11(2):87-92.
2. Vassanadumrongdee S, Hoontrakool D, and Marks D (2020): Perception and behavioral changes of Thai youths towards the plastic bag charging program. *Applied Environmental Research*. 42(2) (2020): 27-45
3. Rivers, N., Shenstone-Harris, S., and Young, N (2017): Using nudges to reduce waste? The case of Toronto's plastic bag levy. *Journal of Environmental Management*, 2017, 188, 153-162.
4. Roland Geyer, Jenna R. Jambeck, Kara Lavender Law. Production, use, and the fate of all plastics ever made. *Sci. Adv.* 2017;3: e1700782 19 July 2017.
5. Jambeck JR, Geyer R, Wilcox C, Siegler TR, and Perryman M (2015): Plastic waste inputs from land into the ocean. *Science* 347: 768-771.
6. Hermabessiere, L., Dehaut, A., Paul-Pont, I., Lacroix, C., Jezequel, R., Soudant, P., et al. (2017). Occurrence and effects of plastic additives on marine environments and organisms: a review. *Chemosphere* 182, 781-793. doi:10.1016/j.chemosphere.2017.05.096
7. Revel, M., Châtel, A., and Mouneyrac, C. (2018). Micro(nano)plastics: a threat to human health? *Curr. Opin. Environ. Sci. Health* 1, 17-23. doi: 10.1016/j.coesh.2017.10.003
8. Lehner, R., Weder, C., Petri-Fink, A., and Rothen-Rutishauser, B. (2019). The emergence of nano plastic in the environment and possible impact on human health. *Environ. Sci. Technol.* 53, 1748-1765. doi: 10.1021/acs.est.8b05512
9. Synthia, I.J.; Kabir, S. An Investigation of Consumer Attitudes Towards New Varieties of Shopping Bags: Exploring Eco-Awareness and the Possibility of Behavior Change. *J. Dev. Areas* 2015, 49, 183-196. CrossRef
10. Wilcox C, Van Sebille E, and Hardesty BD (2015): Threat of plastic pollution to seabirds is global, seabirds, pervasive and increasing. *PNAS* 38: 11899-11904.
11. Alabi O, Ologbonjaye K, Awosolu O and Alalade O (2019): Public and Environmental Health Effects of Plastic Wastes Disposal: A Review. *J Toxicol Risk Assess* 5:021. doi.org/10.23937/2572- 4061.1510021

12. Punitha K and Hemavathy V (2016): A study to assess the effectiveness of structured teaching program regarding hazards of plastic use among school-going children in Hilton matriculation higher secondary school, Chrompet, Chennai-44. *International Journal of Nursing and Patient Safety & Care* 1(1): 43-48.
13. Gundersen CN (2018): The Kenyan ban on plastic bags: a study of attitudes and adaptation in Nairobi. Master thesis. Department of International Environment and Development Studies. Faculty of Landscape and Society.
14. Manuel J, Varghese J, Jose J, Thomas J, Joseph J and Shettigar D (2015): An educational intervention program on hazards of plastic waste and its disposal among adults: a rural community-based study. *NUJHS* Vol. 5, No.2, June 2015, ISSN 2249-7110
15. Srinivasan N, Swarnapriya V, Felix A, and Pravin T (2019): Assessment of knowledge and practice on plastics among the professional course students of Annamalai University, Tamil Nadu. *International Journal of Community Medicine and Public Health*.2019 Feb;6(2):510-514
16. Thiruketheeswaranathan S (2019): Usage of Plastic Bags and Environment, Health Hazards: A Study to Assess Awareness Level Among a Small Population of Trincomalee Town. *Middle East Journal of Applied Science & Technology (MEJAST)*. Volume 2, Issue 3, Pages 42-44, July-September 2019.
17. Kakoti R (2017): Uses of plastic bags and environmental hazard- A study in Guwahati city. *Int J Appl Res.* 2017;3(4 6):1088-94.
18. WWF, World-Wide Fund (2019): Dalberg Advisors, WWF Mediterranean Marine, Initiative, 2019 "Stop the Flood of Plastic: How Mediterranean countries can save their sea."
19. Malik H and Roy K (2017): A descriptive study to assess the knowledge and attitude of adolescents regarding mismanagement of plastic wastes and its environmental hazards in the selected community areas, Nelamangala. *Int J Sci Res* 2017; 6:677-80.
20. Kanagabala B, William RF, Thirunaaukarasu D, and Jennifer HG (2018): Knowledge, attitude and practice on domestic usage of plastics in a rural area of Kancheepuram. *Natl J Res Community Med* 2018; 7:27-31.
21. Farhan R. Khan, Yvonne Shashoua, Alex Crawford, Anna Drury, Kevin Sheppard, Kenneth Stewart, and Toby Sculthorp 'The Plastic Nile': First Evidence of Microplastic Contamination in Fish from the Nile River (Cairo, Egypt) *Toxics* 2020, 8, 22; 1-13. doi:10.3390/toxics8020022 www.mdpi.com/journal/toxics
22. UNIDO, 2021. <https://www.unido.org/news/unido-and-japan-support-egypt-alternative-approach-single-use-plastics-production-and-consumption>
23. Proshad R, Islam MS, Kormoker T, Haque MA, and Mahfuzur Rahman MD (2018): Toxic effects of plastic on human health and environment: A consequences of health risk assessment in Bangladesh *Inter J Hlth* 6: 1-5.
24. Worm B, Lotze HK, Jubinville I, Wilcox C, and Jambeck J (2017): Plastic as a Persistent Marine Pollutant. *Annual Rev Environ Res* 42: 1-26.
25. Rawda M. Elsheikh (2016). University Accommodation 's Food Handlers; Knowledge, Attitude, and Practice (KAP) about using selected Plastic Type Foods Contact Materials *International Journal of Environmental Sciences*. Vol. 5. No. 4. 2016. Pp. 188-195. 2016.
26. El-sayed, Y., Marzouk, S. A., Mahmoud, T. M. , and Magrabi, N. M. E. (2019). Effectiveness of Educational Intervention on Knowledge, Attitude, and Practices of Children's Mothers Regarding the Safe Use of Plastic Containers. *American Journal of Nursing Research*, 7(5), 723-731.
27. Central Agency for Public Mobilization and Statistics, Egypt Statistical Yearbook - Population (2020). https://www.capmas.gov.eg/pages/publications.aspx?page_id_5104
28. Rachada Kasemsup and Naiyana Neesanan, 2011: Knowledge, Attitudes, and Practices Relating to Plastic Containers for Food and Drinks *J Med Assoc Thai* 2011; 94 (Suppl. 3): S121-S125.Full text. e-Journal: <http://www.mat.or.th/journal>
29. Vijyeta Bhasin, Shalini, Kirandeep Kaur Dhaliwal, and Anamika Gautam. Assessment of the Knowledge and Attitude Regarding Plastic Use and its Health Effects among Nursing Students of Selected Nursing Colleges of Ambala, Haryana. *Medico-legal Update*, January-March 2021, Vol. 21, No. 1
30. Tanima Ferdous, and Tapash Das: A study about the attitude of grade eight students for the use of plastic in Gwarko, Balkumari, Lalitpur district. *Procedia - Social and Behavioral Sciences* 116 (2014) 3754 - 3759. doi: 10.1016/j.sbspro.2014.01.836.
31. Adane L, and Muleta D. Survey on the usage of plastic bags, their disposal and adverse impacts on the environment: A case study in Jimma city, Southwestern Ethiopia. *J Toxicol Environ Health Sci* 2011; 3:234-48.
32. Mohammad Bakri Alaa Hammami, Eman Qasem Mohammed, Anas Mohammad Hashem1, Mina Amer Al-Khafaji, Fatima Alqahtani, Shaikha Alzaabi and Nihar Dash. Survey on awareness and attitudes of secondary school students regarding plastic pollution: implications for environmental education and public health in Sharjah city, UAE. *Environ Sci Pollut Res*.2017. DOI 10.1007/s11356-017-9625-x.
33. Aminrad Z, Zakariya S, Hadi A, and Sakari M (2013) Relationship between awareness, knowledge, and attitudes towards environmental education among secondary school students in Malaysia. *World Appl Sci J* 22(9):1326-1333. doi:10.5829/idosi.wasj.2013.22.09.275
34. Ergen A, Baykan B, and Turan S (2015) Effect of materialism and environmental knowledge on environmental consciousness among high school students: a study conducted in Istanbul province. *Int J Hum Sci* 12(1):511. doi:10.14687/ijhs.v12i1.3130
35. Ivy T, Road K, Lee C, and Chuan G (1998) A survey of environmental knowledge, attitudes, and behavior of students in Singapore. *Int Res Geo Environ Educ* 7(3):181-202. doi:10.1080/10382049808667574

36. Stevens E (2002) Green plastics: an introduction to the new science of biodegradable plastics. Princeton University Press, Princeton, pp.15-30
37. Jibreel, Mustafa and Al-shwafi, Nabil. (KAP)Survey on the usage of plastic bags, their disposal, and impacts on the environment: A case study in the Capital Secretariat, Sana'a, Yemen. International Journal of Scientific & Engineering Research, Volume 10, Issue 4, April-2019.
38. Gupta K, Somanathan R. Consumer response to incentives to reduce plastic bag use: Evidence from a field experiment in urban India Internet. Delhi: Delhi School of Economics; 2011. Available from: http://www.isid.ac.in/~pu/conference/dec_11_conf/Papers/KanupriyaGupta.pdf. Accessed on December 28th, 2019.
39. Joseph N, Kumar A, Majgi SM, Kumar GS, and Prahalad RB (2016): Usage of plastic bags and health hazards: A study to assess awareness level and perception about legislation among a small population of Mangalore city. J Clin Diagn Res 2016;10: LM01-4.
40. Sutton J, Turner B. Plastic bags: Hazards and mitigation Internet. California: Social sciences department, California Polytechnic State University; 2012 May. Available from: <http://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1082&context=socssp>
41. Williams DL, Gerba CP, Maxwell S, and Sinclair RG. Assessment of the Potential for Cross-contamination of Food Products by Reusable Shopping Bags. Food Protection Trends. 2011; 31:508-13.
42. Shetty RS, James BS, and Pandey AK (2019): Knowledge, Attitude, and Practices Towards Household Solid Waste Management among Semi-Urban Residents-A Community-based Cross-Sectional Study from Southern Part of Coastal Karnataka, India. Indian Journal of Public Health Research & Development. 2019;11(9).
43. Khanam N, Wagh V, Gaidhane AM, and Quazi SZ. Knowledge, attitude and practice on uses of plastic products, their disposal and environmental pollution: A study among school-going adolescents. J Datta Meghe Inst Med Sci Univ 2019; 14:57-60.
44. Uddin M, Hasan KM, Hossen MS and Khan MB (2018). People's perceptions about using polythene bags and its impact on the environment at Mymensingh in Bangladesh. International Journal of Natural and Social Sciences, 5(3): 37-43.
45. Ouge, Nicholas, Francis Oremo, and Salome Adhiambo. 2021. Investigating the Knowledge and Attitudes towards Plastic Pollution among the Youth in Nairobi, Kenya. Social Sciences 10: 408. <https://doi.org/10.3390/socsci10110408>
46. Narayan P. Analyzing plastic waste management in India: A case study of poly bags and PET bottles. Published by IIIIEE Lund: Lund University, Sweden. 2001, P.37-49.
47. Chittrakshi Khairnar, Shiya Rose G Shaji, Dipak Khemnar, Sandarbh Vyas, Anosh Gadkari and Dr. Sujita Devi. Assess the awareness regarding hazards of plastic bag use among adults. The Pharma Innovation Journal 2019; 8(6): 139-143.
48. Sima Nourbakhsh, Monavvar Afzal-Aghaee, Elham Rahmanpour Salmani, Mohammad Naderi, Reihane Zangi, and Reihane Feizi. Knowledge and Behavior Assessment about the Use of Disposable Plastic Containers amongst Medical Sciences Students in Northeastern Iran in 2016. Iranian Journal of Health, Safety & Environment, 2017-Vol.4, No.3, pp.804-811.
49. Abhigyan. Use of plastic bags: Factors affecting ecologically oriented behavior in consumers Internet. Delhi: Foundation for Organizational Research and Education; 2008. Available from: <http://www.freepatentsonline.com/article/Abhigyan/192438179.html>. Accessed on December 28th, 2019.
50. Esmaeeli M. The harmful effects of the use of disposable containers. Seventh Conference of Iranian Chemical Education; Iran, Zanjan, Zanjan University 2011 In Persian.
51. Clapp J, Swanston L, and Williams J (2008). Single-use plastic shopping bags: Issues for the region of Waterloo to consider University of Waterloo, Faculty of Environmental Studies, Waterloo, USA, pp. 2-13
52. Smith LC (2009). Paper or plastic? The economic implications of plastic carrier bag legislation in the United States. A Thesis Presented to the Department of Economics and Business faculty, The Colorado College, In Partial Fulfillment of the Requirements for the Degree Bachelor of Arts, pp. 34-36.
53. Kennedy T., Regehr G., Rosenfield J., Roberts S.W., and Lingard L. (2004). Exploring the gap between knowledge and behavior: a qualitative study of clinician action following an educational intervention. Academic Medicine: Journal of the Association of American Medical College, 79(5), 386-93.

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