



Knowledge and Practice of The Public About Use and Disposal of Plastic Bags: An Online Egyptian Descriptive Study

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ABSTRACT

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Background: Due to their unique properties, plastics are characteristic of modern times. However, they can significantly threaten health, the environment, and the economy. Awareness of hazards and their causes is an essential step toward their prevention. **Objective:** to assess the public's knowledge and practice regarding plastic bags use and disposal and to identify their associated sociodemographic factors. **Methods:** This online cross-sectional study was conducted from May to December, 2022. A validated questionnaire included a sociodemographic profile and questions to measure participants' knowledge and practice regarding the use and disposal of plastic bags. Binary logistic regression analysis was used to identify significant predictors of knowledge and practice. **Results:** A total of 635 participated in the study. Nearly all participants (99.7%) regularly used plastic bags in their homes. More than half of the participants (57.2%) had good knowledge about the use and hazards of plastic bags, and most (73.1%) had good disposal practices. Being young (AOR 2.58) or a female (AOR 2.62) significantly predicted good knowledge. The significant predictors of good practices were being older (AOR 1.71), a male (AOR 3.51), or with higher education (AOR 2.79). **Conclusions:** A good percentage of Egyptian adults have adequate knowledge about plastic bags and their hazards and favorable disposal practices. Age and gender were significant predictors of both. However, there is still a need for interventions and activities that can raise public awareness and promote better practices. Legislation prohibiting plastic bag production, distribution, and use is highly recommended.

INTRODUCTION

Due to their unique properties, plastics are one of the principal materials of the modern economy. Plastic is cheap, easy to make, resilient, lightweight, and waterproof, making it popular in various applications.¹ These properties have led to expanded plastic production over the years. The most produced plastic product is plastic packaging, including plastic bags.² This has led to increased plastic waste; a recent report

found that plastic waste doubled from 2000 to 2019, and only 9% was recycled.³

Plastic production, consumption, and disposal have many adverse effects on the environment, human health, the economy, and society. In the environment, plastics can destroy habitats and are significantly hazardous to land and marine wildlife by ingestion and entanglement, causing choking. They can block

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water channels, intensifying natural disasters (e.g., floods) and providing breeding places for insects, thus increasing the risk of vector-borne diseases.⁴

In addition, plastics production processes, disposal practices (e.g., burning), and breakdown release highly toxic chemical pollutants and greenhouse gases that can cause adverse health effects in humans, leak into the environment, become ingested by animals and marine life and enter the food chain, and contribute to climate change. These chemicals are carcinogenic and endocrine disruptors and can lead to nervous, respiratory, hepatic, renal, and reproductive health problems.⁵

Moreover, plastic pollution can have several negative economic impacts. Visual pollution and ecosystem damage cause financial losses in the shipping, fishing, and tourism industries. The high cost of managing vast amounts of plastic waste and the additional costs of clean-up activities cause further economic losses.¹⁴ Many countries have adopted some form of legislation to regulate plastics. Regulations range from banning specific products, materials, or production levels, their manufacture, distribution, and use constraints, and imposing taxes and fees to post-use disposal regulations.⁶

The Middle East and North Africa (MENA) region faces many challenges in confronting the increase in plastic waste. Several countries, including Egypt, have made policy recommendations and drafted or executed local and national laws to restrict the importation of single-use plastic bags and their use, replacement, or ban.⁷ On June 5, 2017, the Minister of Environment launched a national initiative to reduce Egypt's consumption of plastic bags.⁸ Among other Arab countries, Egypt has made policy recommendations to ban single-use plastic bags (SUPBs) and replace them with biodegradable ones.⁷ In June 2019, six cities in the Red Sea Governorate in southeast Egypt banned the use of plastic bags, and now, 15 cities have implemented the ban.⁹

In addition to legislation, governments need to address the source of the problem and improve waste management practices. Creating and raising awareness among the public, shop owners, and manufacturers about the harm caused by single-use plastics and how to reduce it is an additional essential step that will help and encourage changes in their behavior toward better practices.¹

Although previous studies have assessed the level of knowledge and practice regarding the use and disposal of plastic bags in many countries,¹⁰⁻¹² studies are limited in Egypt. The objective was to assess the public's knowledge and practice regarding plastic bags use and disposal and to identify their associated sociodemographic factors.

METHODS

A cross-sectional study with an analytical component was conducted from 8th May to 31st December 2022.

Egyptian adult people (≥ 18 years old) who accepted to participate in the study are included.

Sample size was calculated using the one-proportion sample size equation.¹³ The exact prevalence of plastic use in Egypt is still being determined. To get the maximum sample size, we assumed 50% use, with a precision (margin of error) of 5%. The minimum required sample size was 384. The survey was distributed using a snowball sampling method.

Data were collected using an online Google form. The questionnaire link was shared through the country's social media (Facebook and WhatsApp). All completed forms were analyzed.

A Questionnaire including Knowledge and practice questions was used. The questionnaire was a semi-structured Arabic questionnaire was prepared after reviewing previous literature,^{14,15} to cover the following items: (1) Sociodemographic profile, e.g., age, sex, education, residence, marital status, occupation, and income level. (2) Knowledge (15 questions): Nine questions formatted as close-ended statements with a single yes, no, or don't know answer in addition to six questions evaluated through multiple choice options. Questions were asked about the characteristics and the use of plastic bags, their environmental and health hazards, reasons for their use, their alternatives, sources of information about them, and ban legislation. (3) Practice (11 questions) about the reuse, separation, and methods of disposal of plastic bags, as well as avoiding their use.

Scoring: Knowledge and practice scores were calculated using the median score as an arbitrary cutoff point due to the lack of standardized cutoff points and the non-normality of data.¹⁶ As for knowledge, for the single choice nine questions

Table 1: Public knowledge about the use and hazards of plastic bags during the study period in Egypt (n=635)

Items	Correct answers* N (%)
Plastic bags are biodegradable (No*)	195 (30.7)
Plastic bags are recyclable (Yes*)	372 (58.6)
Single-use plastic bags have started to be banned in Egypt (Yes*)	6 (0.9)
Single-use plastic bags used to deal with solid waste are excluded from the ban (No*)	126 (19.8)
Shop owners are fined for using single-use plastic bags in ban areas (Yes*)	30 (4.7)
Plastic bags have adverse environmental effects (Yes*)	414 (65.2)
Storing and using hot food in plastic bags are harmful to health (Yes*)	596 (93.9)
Do you know that online shopping reduces the use of plastic bags (Yes*)	240 (37.8)
Do you know alternatives to plastic bags (Yes*)	384 (60.5)
Median knowledge score (4) groups	
Good (≥ 4)	363 (57.2)
Poor (< 4)	272 (42.8)

answered as yes, no, or don't know, correct answers received a score of one, while the wrong ones or don't know were given a 0. Specific questions were reversed to get the correct score. Each favorable practice scored one, while unfavorable ones were given a 0 for the eleven questions. The median cutoff points of knowledge and practice were 4 and 6, respectively (Scores <4 and <6 was considered poor knowledge and practice, and scores ≥ 4 and ≥ 6 were regarded as good knowledge and practice, respectively).

Validation of the study tool: For the content validity, the questionnaire with an online content validity form with detailed instructions was sent to ten public health experts. The content validity was determined using the methods described by Yusoff.¹⁷ For knowledge questions, the item-content validity index (I-CVI) ranged from 0.5 to 1, the total scale-content validity index (S-CVI) was 0.91, and the S-CVI/universal agreement (S-CVI/UA) was 0.80. For practice, the item-content validity index (I-CVI) ranged from 0.4 to 1, the total scale-content validity index (S-CVI) was 0.87, and the S-CVI /universal agreement (S-CVI/UA) was 0.73. The item-content validity index (I-CVI) ranged from 0.8 to 1 for relevance. Thus, the questionnaire met a satisfactory level of content validity. For reliability, a pilot study with 30 participants (not included in the full-scale study) was conducted to test the questionnaire's reliability. Cronbach's alpha for the tool was found to be 0.70.

Statistical analysis: Data were collected, coded, and analyzed using IBM SPSS version 26 (Armonk, NY: IBM Corp.). No missing data was detected. Qualitative data were summarized as numbers and percentages. A chi-squared test was done to compare categorical variables. Binary logistic regression analysis was used to detect significant predictors of knowledge and practice. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

More than half of the participants (57.2%) had good knowledge about the use and hazards of plastic bags. While 58.6% were aware of the recyclability of plastic bags, a smaller but still substantial 30.7% knew that plastic bags are not biodegradable. Most participants were aware of the environmental (65.2%) and health (93.9%) risks associated with plastic bags. Although a considerable number (60.5%) were aware of alternatives to plastic bags, only a few knew about the emerging bans on their use (0.9%) and the potential fines for shop owners (4.7%) (Table 1).

Nearly all participants (99.7%) regularly used SUPBs at home. Most of them (83.3%) used more than five plastic bags per person per week mainly because of their availability, the absence of alternatives, and their lightweight (77%, 67.7%, and 58%, respectively). Among those who knew an alternative to plastic bags, 51% were acquainted with paper bags and 39% with cloth bags. Most of those who knew that plastic bags

Table 2: Reasons for using plastic bags, knowledge about alternatives, and environmental hazards (n=635)

Items	N (%)
Use single plastic bags at home	633 (99.7)
Reasons for using plastic bags	
Availability	489 (77.0)
Absence of alternative materials	430 (67.7)
Lightweight	368 (58.0)
Low price	218 (34.3)
Durability	152 (23.9)
Number of plastic bags used/person/week.	
< 5	106 (16.7)
5-10	278(43.8)
>10	251 (39.5)
What are plastic bag alternatives that you know (n=384) **	
Paper bags	196 (51.0)
Cloth bags	150 (39.1)
Fiber bags	19 (4.9)
Other durables	19 (4.9)
What are the adverse impacts of plastic bags that you know (n=414) **	
Health problems	325 (78.5)
Killing animals if eaten by mistake	272 (65.7)
Closure of sewage systems	262 (63.3)
Deterioration of the beauty of nature	216 (52.2)
What are the sources of your knowledge on the use of plastic bags**	
Radio and Television	349 (55.0)
Journals	222 (35.0)
School	200 (31.5)
Professionals and Politicians	42 (6.6)
Parents	37 (5.8)

**Categories are not mutually exclusive

are hazardous reported health problems, animal deaths, and the occlusion of sewage systems as the most common hazards. Moreover, more than half of the participants (55%) attributed their knowledge about plastic bags to radio and television, followed by newspapers (35%) and school education (31.5%) (Table 2).

Table 3 shows that most of the participants (73.1%) had good practices regarding the disposal of plastic bags. About one-third reused plastic bags, the majority (83%) used garbage collection to dispose of plastic bags, and nearly half (47.4%) separated plastic bags from other waste before disposal. In addition, most of them packed their items in aluminum containers

(89.4%), used reusable bags (66.1%), and paid for alternatives when available (60.9%).

Those <40 years old, females, or single were significantly more likely to have good knowledge about plastic bags and their hazards. On the other hand, those who were >40 years old, males, from rural residences, married, with university education, or employed were significantly more likely to have good practices of plastic bag disposal (Table 4).

Multivariate analysis of predictors (Table 5) showed that being <40 years old (AOR 2.58) or a female (AOR 2.62) significantly increases the odds of good knowledge among participants. Furthermore, the significant independent predictors of good practices among respondents were being >40 years old (AOR 1.71), a male (AOR 3.51), from a rural residence (AOR 1.9), married (AOR 3.95), with basic (AOR 2.9) or university (AOR 2.79) education, a government employee (AOR 3.17), a private employee (AOR 4.19), or a housewife (AOR 2.93).

DISCUSSION

The current study's results showed that nearly all the participants used plastic bags regularly, and most used more than five bags per person/week. Similarly, a study in India demonstrated that most participants used plastic bags regularly.¹⁸ This high rate of plastic bags usage was owed to their availability, lightweight, affordability, durability, and absence of alternatives in this study and previous studies.^{12,19-22} The increase in plastic-producing industries mainly drives the high utilization of plastic bags. In addition, plastic bags' unique characteristics make them suitable and efficient for use.¹²

More than half of the participants (57.2%) had good knowledge levels comparable to levels reported by other researchers.^{10,18} Most participants were aware of plastic bags' environmental and health hazards and could mention these hazards in agreement with previous research.^{11,12,18-25} In addition, many identified alternatives to plastic bags, with paper and cloth bags being the most famous. Other studies also showed a high level of knowledge about plastic bags' alternatives but frequently mentioned fiber bags in addition to paper and cloth bags.^{12,18} However, compared to Thiruketheeswaranathan²¹ and Shaira²² a lower percentage of our participants (73%, 61% versus 30.7%) knew plastic bags are not biodegradable.

Table 3: Public practice concerning plastic bags disposal during the study period in Egypt (n=635)

Items	Correct answers* N (%)
Do you pack your items in aluminum containers instead of plastic bags (Yes*)	568 (89.4)
Do you use reusable bags during shopping (Yes*)	420 (66.1)
Do you pay for plastic bag alternatives when available (Yes*)	387 (60.9)
Do you reuse old plastic bags for multiple shopping (Yes*)	201 (31.7)
Do you use garbage collection to dispose of plastic bags (Yes*)	527 (83.0)
Do you separate plastic bags from paper and glass waste before disposing of them (Yes*)	301 (47.4)
Do you bury plastic bags (No*)	26 (4.1)
Do you throw plastic bags in drains (No*)	547 (86.1)
Do you incinerate plastic bags (No*)	136 (21.4)
Do you throw plastic bags in open space (No*)	494 (77.8)
Do you sell plastic bags for recycling (Yes*)	178 (28)
Median practice score (6) groups	
Good (≥ 6)	464 (73.1)
Poor (< 6)	171 (26.9)

Only a few of our participants knew that SUPBs have started to be banned in Egypt and that shop owners can be fined for using them. Although studies in urban regions in India^{20,23} reported that most of their participants knew about the plastic ban legislation; other studies, similar to the current study, reported low percentages of their participants learning about the ban on single-use plastics in their regions.^{22,26} This unfamiliarity with the plastic ban may be due to the lack of effective awareness campaigns in publicizing related information.

The participants in the current study owed their information about plastic bags to the radio and television, newspapers, and school education. Indeed, mass media were a common source of knowledge reported by previous research, not only for general knowledge and information about hazards and alternatives^{12,19} but also for information about the plastic ban.²⁰ This indicates that mass media can effectively raise the desired awareness among the public. Therefore, public awareness campaigns should leverage these platforms to disseminate information about the hazards of plastic bags and the benefits of alternatives. This could significantly reduce plastic bag use and promote better disposal practices.

About one-third of participants re-used plastic bags in agreement with comparable or even higher percentages in some research^{11,21,23} but contrary to a much lower percentage in Misgana and Tucho's

study.¹² Most participants used garbage collection sites to dispose of plastic bags (mainly after waste separation), while other common methods included selling bags for recycling and incineration. Thiruketheeswaranathan²¹ described similar methods. However, several other research^{12,19} described a high prevalence of poorer disposal practices, such as open dumping and throwing in drains, which a few participants in the current study reported. Moreover, most participants packed their items in aluminum containers, used reusable bags, and paid for alternatives when available, as did participants in several other studies.^{20,25} Such positive practices would be essential when implementing measures to reduce and ban the use of SUPBs and their waste.

The significant predictors of good knowledge were being <40 years old or a female. This could be because younger individuals and females are more likely to be exposed to environmental education and campaigns. Those of good practices were being >40 years old, a male, from a rural residence, married, with a basic or university education, an employee (government or private), or a housewife. This could be attributed to the fact that these demographics may have more resources and knowledge to adopt better practices.

Previous studies were inconsistent regarding the predictors of SUPBs' knowledge and disposal practices. Most studies found no relation between any or some of the sociodemographic characteristics and

Table 4: Sociodemographic factors associated with good knowledge and practice towards plastic bags use and disposal (n=635)

	Total	Good Knowledge		Good Practice	
	N	N (%)	p	N (%)	p
Overall	635	363 (57.2)	-	464 (73.1)	-
Age					
< 40	331	228 (68.9)	<0.001	229 (69.2)	0.021
≥ 40	304	135 (44.4)		235 (77.3)	
Sex					
Male	203	93 (45.8)	<0.001	169 (83.3)	<0.001
Female	432	270 (62.5)		295 (68.3)	
Residence					
Rural	158	84 (53.2)	0.241	132 (85.5)	0.001
Urban	477	279 (58.5)		332 (69.6)	
Marital status					
Single	145	98 (67.6)	0.008	99 (68.3)	0.004
Married	477	260 (54.5)		360 (75.5)	
Divorced/Widow	13	5 (38.5)		5 (38.5)	
Educational level					
Primary/Secondary	214	130 (60.7)	0.077	168 (78.5)	<0.001
University	337	179 (53.1)		249 (73.9)	
Postgraduate	84	54 (64.3)		47 (56.0)	
Occupation					
University Student	76	40 (52.6)	0.250	45 (59.2)	0.007
Government Employee	484	278 (57.4)		364 (75.2)	
Private Sector	32	23 (71.9)		27 (84.4)	
Housewives	43	22 (51.2)		28 (65.1)	
Income level					
Low	27	15 (55.6)	0.333	16 (59.3)	0.222
Middle	589	334 (56.7)		433 (73.5)	
High	19	14 (73.7)		15 (78.9)	
Knowledge					
Poor	272	-	-	198 (72.8)	0.892
Good	363	-		266 (73.3)	

P-values were calculated using Chi square

good knowledge or practices.^{10,12,24} Others reported results similar to the current study^{23,24} while Ashimi et al¹¹, contrary to the current results, found higher knowledge among participants > 30 years old and males.

As younger participants are more exposed to a wide variety of media, particularly social media, and probably because their education is more pro-environmental, they are expected to have better knowledge.^{24,27} However, in terms of practices, as people age and become more responsible, they are more likely to participate in actions that preserve a clean environment.²⁸

The current study noted that while females had better knowledge, males had better disposal practices. While it was previously implied that women care more about the environment, they concentrate on the fine details of using and selecting plastics. At the same time, men are more practical in cleaning the environment from plastic. Thus, males and females play different roles in protecting the environment at the public and household levels.²⁹

Moreover, while the level of education didn't predict the level of knowledge in the current study, those with lower education had better plastic disposal practices.

Table 5: Univariate and multivariate analysis of predictors of good public knowledge and practice towards plastic bags use and disposal (n=635)

Predictors	Univariate analysis		Multivariate analysis	
	COR (95%CI)	<i>p</i>	AOR (95%CI)	<i>p</i>
I. Good Knowledge:				
Age				
< 40	2.77(2-3.83)	<0.001	2.58 (1.77-3.74)	<0.001
≥ 40 (r)	1		1	
Sex				
Male (r)	1		1	
Female	1.97(1.41-2.76)	<0.001	2.62 (1.78-3.87)	<0.001
II. Good Practice:				
Age				
< 40 (r)	1		1	
≥ 40	1.51 (1.06-2.16)	0.021	1.71 (1.08-2.67)	0.020
Sex				
Male	2.31 (1.51-3.51)	<0.001	3.51 (2.06-5.94)	<0.001
Female (r)	1		1	
Residence				
Rural	2.22 (1.39-3.52)	<0.001	1.90 (1.09-3.30)	0.022
Urban (r)	1		1	
Marital status				
Single	3.44 (1.06-11.10)	0.029	3.37 (0.83- 13.57)	0.087
Married	4.92 (1.57-15.34)	0.002	3.95 (1.12-13.97)	0.033
Divorced/Widow (r)	1		1	
Educational level				
Primary/Secondary	2.87 (1.67-4.93)	<0.001	2.90 (1.55-5.43)	<0.001
University	2.23 (1.35-3.65)	<0.001	2.79 (1.59-4.89)	<0.001
Postgraduate (r)	1		1	
Occupation				
University Student (r)	1		1	
Government Employee	2.08 (1.26-3.45)	0.003	3.17 (1.66-6.05)	<0.001
Private Sector	3.72 (1.29- 10.71)	0.011	4.19 (1.33-13.21)	0.014
Housewives	1.28 (0.59-2.79)	0.525	2.93 (1.19-7.20)	0.019

AOR, adjusted odds ratio; COR, crude odds ratio; CI, confidence interval; r, reference group

It was formerly found that, unlike knowledge, a higher education level doesn't automatically result in more environmental concern or good practices.^{24,27}

In the current study, married participants were found to have better disposal practices. Married households are more likely to practice waste separation or collection for recycling as they are more responsible and concerned about the environment and pay more attention to their family's living environment.²⁴

Participants from rural residences in the current study had better disposal practices. Previous research noted that people from a rural background, compared to urban residents, had a greater connection with nature and higher levels of environmental identity, and this

relationship and sociocultural integration facilitated the recognition and implementation of natural resources protection practices.³⁰

CONCLUSIONS

The current study showed that many Egyptian adults know adequately about SUPBs, hazards, and favorable disposal practices. Age and gender were the significant predictors of knowledge. For practice, in addition to age and gender, being married, being from rural residences, and having a lower education significantly increased the odds of good disposal practices. However, the small gap between participants with good and poor knowledge raises concerns. It indicates

the need for intervention with policies and activities that can raise awareness and promote good behavior. Legislation prohibiting plastic bags production, distribution, and use is highly recommended.

Ethical Considerations

The study proposal was approved by the Institutional Review Board (IRB), Faculty of Medicine, Mansoura University (Reference number R.22.04.1702). After ensuring confidentiality, informed consent was obtained from participants.

Limitations: The current study has some limitations. The cross-sectional design collects data at only a specific time point, and the limitations of online data collection may limit the generalization of the study results. Another limitation is that no standardized tools have validated cutoff points for both knowledge and practice.

Recommendations: All available methods that can increase awareness and allow easy access to information about plastics should be utilized. Mass media is a proper channel that can be effectively employed. The increasing daily use of social media offers an excellent opportunity to reach many people. Incorporation of important information into school curricula presents a fruitful chance for acting pro-environmental generations. Making plastic bags alternatives widely available and affordable can help reduce plastic use. Encouraging proper disposal practices and even offering incentives can effectively prevent environmentally hazardous disposal methods. A firm, gradual implementation of the plastics ban is essential.

List of abbreviations: AOR, Adjusted odds ratio; CI, Confidence Interval; COR, Crude odds ratio; Mt, Million tons; SUPBs, Single-use plastic bags; SPSS, Statistical Package for the Social Sciences; IRB, Institutional Review Board.

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analyze, and interpret the data; drafted the manuscript; and revised the manuscript for important intellectual content. AH helped design the manuscript and modify it for important intellectual content. SM helped to collect the data through online platforms. RS contributed to the writing and revision of the manuscript. All the authors read, approved the manuscript, and consented to publish.

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