ORIGINAL RESEARCH ARTICLE

Level of Knowledge and Attitude Regarding the Environmental Impact of Plastic Consumption Amongst the General Population in Ajman, United Arab Emirates

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ABSTRACT

Background: As plastics are now an essential part of daily life, their manufacturing has increased dramatically and is still growing. The aim of this study was to assess the level of knowledge and attitude towards plastic consumption and to determine the factors related to it amongst the general population in Ajman, UAE.

Methods: A cross-sectional study was conducted using a validated self-administered questionnaire amongst 367 adults in Ajman, UAE. Ethical approval obtained from the IRB and informed consent was obtained from the participants before collecting the data. Data analysis was done using SPSS version 28. Chi-square test and binomial logistic regression analysis were used for assessing the association and factors.

Results: Approximately half (49.9%) of participants demonstrated adequate knowledge about plastic pollution, while 50.1% had inadequate knowledge. Attitudes were nearly evenly split, with 50.1% showing a positive attitude and 49.9% a negative attitude toward plastic consumption. Males were 2.219 times more likely to have inadequate knowledge compared to females (O.R. = 2.219, p = 0.001).

Conclusion: The public was not biased toward high awareness or strongly negative opinions regarding plastic consumption; rather, their knowledge and attitudes were evenly distributed. A negative attitude was described as a preference for convenience and a lack of concern for the environmental impact of plastic, whereas a positive attitude was defined as pro-environmental activity, such as recycling and support for plastic alternatives. Local governments can help increase awareness through a variety of programs and campaigns and through the use of interactive programs and some informational tools like social media may also be effective.

Keywords: Plastics, Plastic pollution, Environmental health, Awareness, Attitude

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INTRODUCTION

Plastics were initially commercially produced in the 1950s, and they have since evolved into an essential aspect of modern life. Every year, millions of tons of plastics are produced around the world, with Europe being one of the main users which highlights the importance of having an adequate level of knowledge about the impact plastic consumption has on the environment.[1]

It is reported that America generates the largest amount of plastic waste of any country in the world (42.0 Mt).[2] A study conducted among European citizens revealed that general awareness of the direct impact of plastic consumption and contamination on human health is high in Europe. A similar study conducted in Malaysia found that there was a high level of knowledge regarding the trend of utilization of plastic bags and the effect that plastic waste might have on the environment. However, it also revealed that there is a lower level of knowledge regarding the contribution of industries and supermarkets to plastic pollution and the inadequacy of landfill sites which further worsens the problems posed by plastic bags. The studies also revealed that having a higher level of knowledge of the detrimental impact that plastics have on the environment was associated with a more positive attitude towards recycling.[3]

In the UAE, the plastics recycling market was estimated at 0.84 million tonnes in 2020 and is projected to grow to 1.44 million tonnes by 2030, at a compound annual growth rate (CAGR) of 5.34%. Despite this growth, only 5–7% of plastics are currently recycled, while approximately 90% of plastic waste is sent to landfill, according to the Gulf Petrochemicals & Chemicals Association.[4] Recognizing this, the UAE government implemented a nationwide ban on single-use plastic bags in 2024, a landmark policy aimed at curbing plastic pollution and promoting sustainable alternatives.[5] Ajman's proximity to the Arabian Gulf heightens the urgency of addressing marine plastic pollution, as coastal cities are particularly vulnerable to the accumulation and environmental hazards of plastic waste. Despite these initiatives, there is still a lack of knowledge about how people use plastic and how it affects the environment, particularly at the community level.

No studies have assessed knowledge and attitudes toward plastic consumption among Ajman's general population, highlighting a critical research gap. Furthermore, no articles were available regarding the knowledge and awareness regarding the environmental impact of plastic consumption amongst the general population in the United Arab Emirates. However, in 2017, a survey was conducted on the awareness and attitudes of secondary school students regarding plastic pollution in Sharjah, United Arab Emirates. It revealed that 85.5% of the students think plastic wastes are harmful to the environment. On the contrary, less than 52.11% had knowledge on the multiple aspects of plastic pollution. This indicates a poor environmental background among Sharjah students regarding pollution and the harmful effects of plastic wastes on nature.[6]

Plastics have become an integral part of everyday life, resulting in the massive increase in its production which has shown no signs of slowing down. There is an awareness of plastic pollution and that it takes a significant amount of time for plastics to degrade, however, there is a lack of knowledge about the harmful consequences of plastic degradation and its impact on the environment.[7] This stresses the importance of gauging the level of knowledge that the public has on the effects that plastics have on the environment.

The aim of this study was to assess the level of knowledge and attitude towards plastic consumption and to examine the association between the level of knowledge, attitude and sociodemographic factors such as age, gender, nationality, marital status, education level, and occupation amongst the general population in Ajman, United Arab Emirates.

METHODOLOGY

The study was conducted in Thumbay Medicity, between August 2022 and November 2022. This study followed a cross-sectional study design amongst the general public in Ajman, United Arab Emirates. The study population included those who are residing in Ajman, United Arab Emirates.

Both genders and people who are above 18 years of age were included in the study. Those who did not give informed consent to the study and those who were unable to comprehend the questionnaire were excluded.

Sample size calculation: From a thorough literature review, a 50% prevalence was assumed based on Afroz et al. (2017) in Malaysia, as no UAE-specific data were available. The sample size was calculated using formula $n = Z^2pq/L^2$ where p is 0.5, q is 1-*p, z* is 1.96 for 95% confidence limit and L is 5%. The calculated sample size was 384.

Study instrument and validation procedure: A questionnaire was developed which answers the objectives of the research and it was divided into different sections namely, sociodemographic characteristics, level of knowledge of plastic consumption and attitude towards plastic consumption. A pilot study was conducted among 5 participants. The questionnaire comprised 19 knowledge questions (scored 0-19) and 18 attitude questions (scored 0-72, Likert scale). The content validation of this questionnaire was done by the three experts in the field and the comments were incorporated.

Ethical issues: This proposed study was sent to the institutional review board (IRB) of Gulf Medical University for approval which was subsequently ap-

proved on April 15, 2022, by the Gulf Medical University IRB (Ref: IRB/COM/STD/73) and informed consent was obtained from the participants before collecting the data. The confidentiality and anonymity of the data were maintained as the identities of the participants were not revealed in the questionnaire. Access to the data was only for the IRB members, research investigators and statisticians. The data was not shared or submitted anywhere and this was only used for research purposes. No drugs or placebos were used in this research.

Pilot study: A pilot study with 5 participants tested questionnaire clarity and feasibility, leading to minor wording adjustments. Following this, the questionnaire was given out as printed forms as well as distributed as an online form.

Data Collection Method: The questionnaire was distributed on paper as well as in the form of an online form. Participants were chosen via convenience sampling due to resource constraints, potentially introducing selection bias. 240 forms were printed, of which all 240 were filled and valid. 127 online responses were received, of which all 127 were valid. A total of 367 valid responses were thus collected for data analysis.

Statistical Analysis: The data was entered into excel sheet and further analysis was done using SPSS version 28 and was presented as tables and charts. Descriptive statistics was used wherever needed. Chi-square test and binomial logistic regression were used to determine the association between level of knowledge and attitude regarding plastic consumption as well as for the association between the sociodemographic factors and the level of knowledge and attitude. P value less than 0.05 was considered as statistically significant. A knowledge score was acquired by grading the participants out of 19 and the median score (16 out of 19) was used as the cut-off point to determine whether the participant had adequate or inadequate knowledge.

Similarly for attitude, an attitude score was acquired by grading the participants out of 72 and the median score (46 out of 72) was used as the cut-off point to differentiate between a positive or negative attitude.

RESULTS

This study was conducted about the level of knowledge and attitude regarding the environmental impact of plastic consumption amongst the general population in Ajman, United Arab Emirates. We acquired a total of 367 responses with a response rate of 87%. Table 1 shows the sociodemographic characteristics of the participants. It revealed that 255 (69.7%) participants were 30 years old or younger and 111 (30.3%) participants were greater than 30 years of age. The results also revealed that 205 (55.9%) students took part in the study and 162 (44.1%) participants were not students.

Table 1: Sociodemographic characteristics of the participants

Sociodemographic	Participants (%)
Age* (n=366)	
<= 30 years	255 (69.7)
>30 years	111 (30.3)
Gender* (n=362)	
Male	133 (36.7)
Female	229 (63.3)
Nationality* (n=363)	
African region	17 (4.7)
South-east Asian region	146 (40.2)
Eastern Mediterranean region	150 (41.3)
European region	13 (3.6)
Western pacific region	23 (6.3)
American region	14 (3.9)
Marital status* (n=365)	
Single	238 (65.2)
Married	127 (34.8)
Student (n=367)	
No	162 (44.1)
Yes	205 (55.9)
Level of knowledge*(n=361)	
High school	234 (64.8)
Undergraduate	90 (24.9)
Post graduate	37 (10.2)
Occupation (n=367)	
Employed	151 (41.1)
Unemployed	216 (58.9)

*Missing responses were excluded from respective analyses.

Additionally, 151 (41.1%) of the participants were employed while 216 (58.9%) of them were unemployed. Moreover, 133 (36.7%) of the respondents were males, whereas 229 were females (63.3%). Furthermore, results showed that 150 (41.3%) of the participants were from the Eastern Mediterranean region, 146 (40.2%) were from the South-east Mediterranean region, 23 (6.3%) were from the Western pacific region, 17 (4.7%) were from the African region, 14 (3.9%) were from the American region and lastly 13 (3.6%) were from the European region. Regarding marital status, 238 (65.2%) were single and 127 (34.8%) were married. The results for the level of education amongst the participants showed that 234 (64.8%) had completed high school and 90 (24.9%) had finished their undergraduate degree and 37 (10.2%) had acquired a postgraduate degree.

Table 2 shows the level of knowledge of the participants about the environmental impacts of plastic consumption. Out of 367 participants, 308 (83.9%) of them believed that there is an increasing trend in the utilization of plastic bags. Furthermore, 352 (95.5%) believed that plastic consumption negatively affects the environment. 330 (89.9%) understood that it takes years for the degradation of plastic and 329 (89.6%) believed that microplastics pose a problem to the environment. Moreover, 349 (95.1%) agreed that plastics have a harmful impact on marine ecosystems and 308 (83.9%) disagreed that oceans are suitable sites for disposing of plastics. 235 (64%) approved of the deposition of plastics in landfill sites and incinerators even though 339 (92.4%) agreed

that burning plastics releases poisonous fumes and 325 (88.6%) believed that plastics buried deep in landfills can leach harmful chemicals that spread into groundwater. In addition, 333 (90.7%) believed that plastic production contributes to climate change.

Table 2: Level of knowledge of the participants about the environmental impacts of plastic consumption

Statements for assessment of knowledge	Knowledge	
	Yes (%)	**No (%)**
There is an increasing trend in the utilization of plastic bags.	308 (83.9)	59 (16.1)
Plastic consumption negatively affects the environment.	352 (95.9)	15 (4.1)
Plastics help protect the environment by reducing fuel usage, thus decreasing Greenhouse gas emissions.	97 (26.4)	270 (73.6)
It takes years for the degradation of plastic.	330 (89.9)	37 (10.1)
Microplastics result from plastics being broken down into smaller fragments.	312 (85)	55 (15)
Microplastics poses a problem to the environment.	329 (89.6)	38 (10.4)
Microplastics are used in some cosmetic products.	322 (87.7)	45 (12.3)
Biodegradable plastics are eco-friendly.	293 (79.8)	74 (20.2)
There are many alternatives to single-use plastic products.	344 (93.7)	23 (6.3)
Biodegradable plastics take significantly less time to fully break down compared to traditional plastics.	307 (83.7)	60 (16.3)
Plastics have a harmful impact on marine ecosystems.	349 (95.1)	18 (4.9)
Plastic may be mistaken for food by marine animals.	343 (93.5)	24 (6.5)
Plastic pollution only affects marine life.	86 (23.4)	281 (76.6)
Oceans are suitable sites for disposing plastics.	59 (16.1)	308 (83.9)
Plastics should be disposed of in landfill sites and incinerators.	235 (64)	132 (36)
Plastic buried deep in landfills can leach harmful chemicals that spread into groundwater.	325 (88.6)	42 (11.4)
Burning plastics releases poisonous fumes.	339 (92.4)	28 (7.6)
Plastic production contributes to climate change.	333 (90.7)	34 (9.3)
What happens to a plastic bottle if you bury it in the ground?* (n=365)		
a. It biodegrades and disappears.	50 (13.7)	
c. It turns into rock.		
b. It breaks up into tiny pieces but does not disappear.	315 (86.3)	

*Missing responses were excluded from respective analyses.

Table 3: Association between the level of knowledge and sociodemographic factors

Factor	Inadequate knowledge (≤16)**	Adequate knowledge (>16)**	P - value
Age* (n=366)			
<= 30 years	120 (47.1)	135 (52.9)	0.062
>30 years	64 (57.7)	47 (42.3)	
Gender* (n=362)			
Male	84 (63.2)	49 (36.8)	0.001
Female	97 (42.4)	132 (57.6)	
Nationality* (n=363)			
African region	12 (70.6)	5 (29.4)	0.212
South-east Asian region	74 (50.7)	72 (49.3)	
Eastern Mediterranean region	73 (48.7)	77 (51.3)	
European region	3 (23.1)	10 (76.9)	
Western pacific region	11 (47.8)	12 (52.2)	
American region	8 (57.1)	6 (42.9)	
Marital status* (n=365)			
Single	109 (45.8)	129 (54.2)	0.033
Married	73 (57.5)	54 (42.5)	
Student (n=367)			
No	88 (42.9)	117 (57.1)	0.002
Yes	96 (59.3)	66 (40.7)	
Level of knowledge*(n=361)			
High school	110 (47)	124 (53)	0.377
Undergraduate	50 (55.6)	40 (44.4)	
Post graduate	19 (51.4)	18 (48.6)	
Occupation (n=367)			
Employed	87 (57.6)	64 (42.4)	0.017
Unemployed	97 (44.9)	119 (55.1)	

**Median score for level of knowledge 16 out of 19.; *Missing responses were excluded from respective analyses.

Table 4: Attitude of the participants towards plastic consumption (n=367)

Attitude statements	Attitude				
	Neutral N (%)	Strongly Disagree N (%)	Disagree N (%)	Agree N (%)	Strongly agree N (%)
These days too many items are made from plastics.	33(9)	20(5.4)	7(1.9)	156(42.5)	151(41.1)
The benefits of plastic outweigh its disadvantages.	99(27)	68(18.5)	86(23.4)	77(21)	37(10.1)
Reusing plastic waste helps to reduce its hazard.	64(17.4)	23(6.3)	32(8.7)	156(42.5)	92(25.1)
Recycling of plastic waste helps to reduce its hazard.	49(13.4)	21(5.7)	13(3.5)	172(46.9)	112(30.5)
Plastic alternatives are easily available.	73(19.9)	15(4.1)	58(15.8)	138(37.6)	83(22.6)
I believe plastic products used in the food industry such as cups, straws, containers, etc. can be replaced.	47(12.8)	19(5.2)	20(5.4)	141(38.4)	140(38.1)
I prefer to buy plastic alternatives if the choice presents itself.	71(19.3)	27(7.4)	34(9.3)	137(37.3)	98(26.7)
Plastics are used a lot due to its cost (cheap), affordability, recyclability, and usefulness.	39(10.6)	18(4.9)	22(6)	154(42)	134(36.5)
Alternative materials (such as paper and glass) are more environmentally friendly food packaging materials as compared to plastics.	43(11.7)	17(4.6)	17(4.6)	144(39.2)	146(39.8)
I avoid single-use plastics, such as drinking straws to reduce plastic waste.	108(29.4)	26(7.1)	44(12)	108(29.4)	81(22)
I buy more bulk food and fewer packaged product.	118(32.2)	17(4.6)	45(12.3)	123(33.5)	64(17.4)
I choose to reuse and give some of the packaging a new purpose.	73(19.9)	19(5.2)	29(7.9)	163(44.4)	83(22.6)
I would like to reduce my use of plastics used in long term applications.	37(10.1)	14(3.8)	8(2.2)	187(51)	121(33)
If all plastic packaging reduces food waste, that justifies its increased use.	126(34.3)	42(11.4)	97(26.4)	64(17.4)	38(10.4)
If all plastic recycles, there is no need to reduce my use of it.	81(22.1)	36(9.8)	86(23.4)	107(29.2)	57(15.5)
I am aware of the difference between biobased and biodegradable plastic.	85(23.2)	29(7.9)	54(14.7)	144(39.2)	55(15)
I think about the negative impact of plastic when I buy a plastic product.	105(28.6)	16(4.4)	49(13.4)	126(34.3)	71(19.3)
I am willing to spread awareness about plastic pollution to friends and family members.	43(11.7)	15(4.1)	15(4.1)	143(39)	151(41.1)

Table 3 shows the association between level of knowledge and the following sociodemographic factors: age, gender, nationality, marital status, student, level of education and occupation. Of those factors, gender, marital status, student, level of education, and occupation were statistically significant. Each correct answer was scored 1 point, with a maximum of 19 points; a score ≥16 indicated adequate knowledge. The results revealed that only 84 (63.2%) males had inadequate knowledge whereas only 97 (42.4%) females had inadequate knowledge. It was also found that 73 (57.5%) married and 109 (45.8%) single respondents had insufficient knowledge. Moreover, there were 88 (42.9%) students and 96 (59.3%) respondents who were not students with inadequate knowledge. Lastly, the inadequacy in the level of knowledge was found among 87 (57.6%) employed and 97 (44.9%) unemployed participants.

Table 4 shows the attitude of the participants towards plastic consumption. It revealed that 307 (83.6%) agreed/strongly agreed that these days too many items are made from plastics. Moreover, 114 (31.1%) respondents agreed/strongly agreed that the benefits of the plastics outweigh its disadvantages, with 154 (41.9%) who disagreed/strongly disagreed. Furthermore, 284 (77.4%) agreed/strongly agreed that recycling plastic waste helps reduce its hazards. The study also revealed that 221 participants (60.2%) agreed/strongly agreed that plastic alternatives are easily available with 235 (64%) people who preferred to buy plastic alternatives if the choice presented itself. Additionally, 288 participants agreed/strongly agreed that plastics are used a lot due to their cost, affordability, recyclability, and usefulness. Only 22 people disagreed/strongly disagreed to reduce their use of plastics in long term applications. The results also revealed that 294 (80.1%) of the respondents were willing to spread awareness about plastic pollution to friends and family members.

Table 5 shows the results regarding the association between attitude and sociodemographic factors. Age, nationality, student, level of education, and occupational status were statistically significant among those factors. In terms of age, 140 (54.9%) participants who were 30 years old or younger and 43 (38.7%) participants over the age of 30 showed a negative attitude. Regarding nationality, it was notable that 12 (70.6%) respondents from the African region and 58 (39.7%) from the South-east Asian region showed a negative attitude. Moreover, the results revealed that there were more students (n=112, 54.6%) who showed a negative attitude as compared to those who were not students (n=71, 43.8%). The results also showed that there was a more negative attitude amongst those who had completed their high school degree (n=126, 53.8%) as compared to

those participants who had finished their post-graduate degree (n=12, 32.4%). Lastly, it was shown that 65 (43%) employed and 118 (54.6%) unemployed participants expressed a negative attitude.

Table 5: Association between the attitude and sociodemographic factors

Factors	Negative attitude (≤46)#	Positive attitude(>46)#	P - value
Age* (n=366)			
<= 30 years	140 (54.9)	115 (45.1)	0.004
>30 years	43 (38.7)	68 (61.3)	
Gender* (n=362)			
Male	70 (52.6)	63 (47.4)	0.399
Female	110 (48)	119 (52)	
Nationality* (n=363)			
African region	12 (70.6)	5 (29.4)	0.001
South-east Asian region	58 (39.7)	88 (60.3)	
Eastern Mediterranean region	89 (59.3)	61 (40.7)	
European region	9 (69.2)	4 (30.8)	
Western pacific region	7 (30.4)	16 (69.6)	
American region	5 (35.7)	9 (64.3)	
Marital status* (n=365)			
Single	124 (52.1)	114 (47.9)	0.189
Married	57 (44.9)	70 (55.1)	
Student (n=367)			
No	112 (54.6)	93 (45.4)	0.04
Yes	71 (43.8)	91 (56.2)	
Level of knowledge*(n=361)			
High school	126 (53.8)	108 (46.2)	0.03
Undergraduate	40 (44.4)	50 (55.6)	
Post graduate	12 (32.4)	25 (67.6)	
Occupation (n=367)			
Employed	65 (43)	86 (57)	0.029
Unemployed	118 (54.6)	98 (45.4)	

#Median score for attitude was 46 out of 72; *Missing responses were excluded from respective analyses.

Table 6: Association between the level of knowledge and attitude

Knowledge	Attitude		P - value
	Negative attitude	Positive attitude	
Inadequate Knowledge	105 (57.1)	79 (42.9)	0.006
Adequate knowledge	78 (42.6)	105 (57.4)	

Table 7: Adjusted odds ratio for the level of knowledge and sociodemographic variables

Factor	Inadequate knowledge (≤16)	Adequate knowledge (>16)	Adjusted OR (95% CI)	P - value
Gender				
Male	(63.2)	(36.8)	2.219 (1.419 - 3.468)	0.001
Female (R)	(42.4)	(57.6)	1	
Marital status				
Single	(45.8)	(54.2)	1	0.737
Married	(57.5)	(42.5)	0.887 (0.439 - 1.789)	
Student				
Yes	(42.9)	(57.1)	1	0.082
No	(59.3)	(40.7)	1.858 (0.924 - 3.737)	
Occupation				
Employed	(57.6)	(42.4)	0.766 (0.480 - 1.221)	0.262
Unemployed	(44.9)	(55.1)	1	

Table 6 shows the association between the level of knowledge and attitude. Analysis revealed that this association was statistically significant, and the results revealed that amongst those with a negative attitude, 105 (57.1%) had inadequate knowledge whereas 78 (42.6%) had adequate knowledge. Moreover, amongst those with a positive attitude, 79 (42.9%) respondents had inadequate knowledge and 105 (57.4%) were seen to have adequate knowledge.

Table 7 shows the adjusted odds ratio in which only the variables that were statistically significant after simple binary logistic regression analysis were taken for multiple logistic regression analysis. It revealed that only gender was statistically significant, with males 2.219 more likely to have inadequate knowledge as compared to females. Age, nationality and level of education were not significantly associated with knowledge levels (p>0.05).

DISCUSSION

Our study aimed to assess knowledge and attitudes related to plastic consumption and identify associated sociodemographic factors. Conducted on 367 participants, our study found that 49.9% demonstrated adequate knowledge, while 50.1% had insufficient knowledge. Key findings revealed a significant association between knowledge levels and being female, single, a student, or unemployed. Women were 2.2 times more likely to have adequate knowledge compared to men. Students also displayed higher knowledge levels compared to non-students.

Attitude assessment showed a near-equal split, with 50.1% having a positive attitude and 49.9% a negative one. Younger participants (under 30), individuals from the Western Pacific region, non-students, postgraduates, and employed individuals were more likely to have a positive attitude. Notably, younger participants exhibited more favorable attitudes compared to older ones.

A significant relationship was identified between knowledge and attitude; participants with adequate knowledge were 57.4% more likely to exhibit a positive attitude towards reducing plastic consumption.

A further breakdown of the individual components of our research is discussed below.

A. Sociodemographic: Prior studies have shown that socio-demographic factors are closely linked to pro-environmental attitudes and behaviors. While younger individuals often express greater environmental concern, older generations are more likely to adopt sustainable practices such as waste reduction. Additionally, research suggests that women are generally more inclined than men to engage in environmentally friendly behaviors, such as opting for reusable shopping bags.[3,6,8-11] Given these established trends, our study sought to examine the demographic composition of participants and how these factors may influence environmental attitudes and behaviors.[12]

Our research sample reflected some of these demographic patterns, with women comprising 63.3% of participants, nearly twice the male population (36.8%). The majority of responses came from individuals under the age of 30 (69.7%), with a significant proportion of students (55.9%) taking part in the study. This was largely due to the study being conducted in Thumbay Medicity, a hub for educational institutions and teaching hospitals, where students were both easily accessible and more eager to participate. The study also captured a diverse range of nationalities, with participants from South-East Asian regions such as Pakistan, India, and Bangladesh (40.2%) and the Eastern Mediterranean region (41.3%) contributing nearly equal responses. Individuals from Europe, the Western Pacific, the Americas, and Africa were also represented, reflecting the multicultural demographic of the UAE. Additionally, a large proportion of respondents were single (69.7%), unemployed (58.9%), and held a high school diploma as their highest level of education (64.8%). This is consistent with the significant student representation in our study, as many were in the process of completing their undergraduate degrees. By analyzing this diverse sample, our research provides valuable insight into how demographic factors shape environmental awareness and behaviors.

B. Knowledge: The escalating use of plastic bags has become a significant environmental concern.[13,14] Annually, approximately 500 billion plastic bags are consumed worldwide, equating to over one million bags per minute.[15] In the United States alone, over 100 billion plastic bags are used each year, averaging more than 300 bags per person.[16] This widespread usage contributes to substantial environmental pollution, as plastic bags are used for an average of 12 minutes but can persist in the environment for over 1,000 years, releasing toxic substances into soil and water as they degrade.[17]

Plastic, extensively utilized for packaging and bags, is widely regarded as an environmental concern due to its substantial contribution to pollution and waste.[13,14,18-20] Its durability and convenience have fueled its pervasive use, yet these very attributes render it persistently resilient in the environment, accumulating in landfills, waterways, and oceans.[13,21] The ecological repercussions are profound, with marine life suffering from ingestion and entanglement, ecosystems facing disruption, and microplastics infiltrating the food chain.[7,8,13,21-23] Additionally, the production and disposal of plastic significantly contribute to greenhouse gas emissions, intensifying the global climate crisis and underscoring the urgency for sustainable alternatives and waste management solutions.

Due to the severe environmental impact of persistent plastic pollution, many regions have implemented bans or restrictions on single-use plastic bags, while others have opted for economic policy instruments such as fees, levies, or taxes imposed on either the retail industry or consumers to mitigate the damage.[3,13,16,24]

Denmark became the first country to implement mandatory levies on plastic bag manufacturers in 1994. This policy has been widely regarded as a major success, as it led to a 66% reduction in plastic bag usage.[25]

The harmful environmental impact of plastic use has been recognized globally, prompting several countries to take action. In 2006, South Australia implemented a ban on single-use polyethylene plastic bags with handles that are less than 35 microns thick, effectively removing them from the retail sector.[11]

In North America, cities such as San Francisco (2007), Oakland (2010), and Mexico City (2010) have enforced plastic bag bans, while New York and Toronto introduced tariffs on plastic bags in 2008

and 2009, respectively.[3]

In Asia, Taiwan, Japan and China have mandated retailers to charge for plastic bags, leading to significant results. China experienced a 49% reduction in new plastic bag use and increased reuse of old bags, while Taiwan and Japan observed a decline in overall household waste.[26,27] Bangladesh and Bhutan also introduced bans, but their initial success faltered due to weak enforcement. Nepal's Pokhara city banned plastic bags in 2010, and Indian states such as Chandigarh, Delhi, and Rajasthan implemented similar policies between 2008 and 2010. However, these measures often fell short due to insufficient legal backing and lack of consumer support.[24]

The effectiveness of plastic bag bans depends on strong legislation, public awareness, and consumer participation, emphasizing the need for well-structured policies and proactive community engagement to achieve lasting environmental benefits. This importance is further underscored by the high level of awareness demonstrated by our study participants regarding plastic consumption and its environmental impact. A significant 83.9% recognized the rising use of plastic bags, while 95.9% acknowledged the detrimental effects of plastic on the environment. Participants were particularly knowledgeable about the impact of plastic on marine ecosystems, with 95.1% agreeing that plastic pollution harms these ecosystems and 93.5% recognizing that marine animals often mistake plastic for food. Moreover, most participants disagreed with the notion that oceans are suitable sites for plastic disposal, reflecting their understanding of the severe consequences of plastic pollution on marine life, including entanglement, ingestion, intestinal blockage, strangulation, and other fatal effects.[6-8,13,17,21-23,28-30] This heightened awareness can be attributed to widespread coverage by news media, academic research, and social media, all of which continually highlight the devastating impact of plastic on marine ecosystems. Consequently, many individuals view plastic pollution in marine environments as a pressing issue that demands immediate attention and action.[3,6,17,21,23,29,31-35]

However, despite this overall awareness, variations in environmental knowledge were observed based on demographic factors such as gender, marital status, and regional background. Our study found that women demonstrated higher knowledge scores than men, a finding consistent with previous research suggesting that women are generally more environmentally aware and more likely to adopt pro-environmental behaviors.[3,6,8-11] Similarly, single participants exhibited higher knowledge levels than their married counterparts, likely due to the fact that many were students, a trend also observed in a Kenyan study where the most knowledgeable respondents were single and held a high school diploma.[28] Regional differences further highlighted disparities in environmental awareness, with participants from African regions scoring lower (70.6% below the standard) compared to their European counterparts, where 76.9% demonstrated satisfactory knowledge.

Lower knowledge among African participants may reflect limited exposure to environmental education in their home countries, language barriers, or differing national priorities concerning plastic waste management. It may even be due to governmental policies in their home countries. As stated in the study in Kenya, the onus of action is on the government to reduce single-use plastic wastes through an appropriate incentive framework.[28] Such governmental actions have been implemented in some European countries leading to an increased public knowledge about the topic.

It is interesting to note that our study affirms information other studies have put forward. Especially those pertaining to knowledge. The aforementioned studies conducted in Kenya and Malaysia both highlight the importance of knowledge with regards to awareness and behaviour of individuals. ie., individuals with higher knowledge tend to have a positive awareness about plastic and its environmental consequences.[3,28] Our study further solidifies this statement by finding a statistically significant (P = 0.006) relationship between knowledge and attitude similar to the findings in the Malaysian and Kenyan studies.[3,28] Moreover, in the study conducted in Malaysia, it is found that positive attitudes toward activities that are pro-environmental often translate to pro-environmental behaviours.[3]

Unlike the Sharjah study, where only 52.11% of students had multifaceted knowledge, Ajman's general population showed broader awareness (49.9% adequate). This suggests a relative parity in general environmental awareness in Ajman compared to other emirates, although the source and depth of this knowledge may vary.[6] Globally, studies in Western Europe report significantly higher levels of plastic knowledge, often exceeding 70%, highlighting potential gaps in local education efforts.[8] It is interesting to note that individuals with higher levels of education consistently demonstrate greater knowledge on environmental issues.[3,6,8,28,33] This suggests that enhancing general education may also lead to improved understanding of specific topics, such as plastic use and recycling. Therefore, efforts to raise overall educational standards, alongside targeted awareness campaigns on plastic pollution, could be an effective strategy to promote more informed and responsible environmental behavior.

However, it is important to acknowledge that the sample sizes for both European and African participants in our study were relatively small, which may limit the generalizability of these findings. These disparities in environmental knowledge emphasize the need for targeted educational initiatives that address demographic and regional gaps, ensuring that awareness translates into meaningful action across diverse populations.

Furthermore, participants were also aware of the

term 'Microplastics' and answered affirmatively to questions regarding them. These questions included whether degradation of plastic products resulted in the formation of microplastics (85%), and if they were used in cosmetic products (87.7%). A high level of knowledge towards plastic and their products such as microplastics is integral to stopping plastic consumption and is correlated with the willingness of the individual to engage in plastic-avoiding behaviour.[7,9,12,13,22,23,28,29,31-34] On the topic of plastic disposal, it should be noted that the majority of our population were unaware of the best method to dispose of plastic materials with 64% answering incorrectly.

This study demonstrated that participants possess substantial awareness of marine litter, plastic pollution, and its environmental impacts. Respondents exhibited a high level of general knowledge about pollution, particularly regarding the environmental threat posed by plastics. Specific knowledge of plastic pollution was also notable, with many participants aware of the prolonged degradation process of plastics and their breakdown into microplastics. Additionally, participants recognized the environmental hazards associated with plastics, including their persistence and fragmentation into microplastics. However, while awareness of microplastics was high, knowledge of their size range remained limited, indicating that the full spectrum of microplastic pollution is not yet fully understood by the public. This highlights the need for further educational efforts to enhance understanding of the various dimensions of plastic pollution and its long-term environmental consequences.

C. Attitude: Attitudes toward plastic consumption and waste management are shaped by various factors, including education, environmental awareness, and public perception. As a psychological construct, attitude is a latent socio-psychological process that represents a valanced response toward performing a behavior, influenced by personal experiences, external factors, and social norms and when individuals encounter specific objects, situations, or worldviews.[9,28] However, while education and awareness campaigns can influence attitudes, they are often insufficient in driving behavioral change. Studies indicate that although many individuals claim to be environmentally conscious, only a fraction actively take steps to reduce plastic waste in their daily lives. Similarly, while most people acknowledge that plastic pollution is a major environmental issue, only a minority consistently refuse single-use plastics when offered. To bridge this gap, government intervention is necessary, particularly through well-structured incentives that encourage individuals to adopt sustainable practices.[28] Without systemic support, even those with strong environmental attitudes may struggle to implement meaningful behavioral changes, reinforcing the need for policies that facilitate and reward responsible plastic consumption.

Research suggests that individuals, particularly women, with stronger environmental attitudes and higher education levels, are more likely to avoid disposable plastic packaging and adopt pro-environmental initiatives. Studies show that women, compared to men, make a conscious effort to avoid plastic packaging.[3,6,8-11,36] However, awareness alone does not necessarily translate into action. A study found that although many students believed awareness influences behavior, no significant relationship existed between knowledge levels and daily plastic consumption. However, students with higher environmental knowledge demonstrated a greater willingness to reuse plastic bags, spread awareness, and take personal responsibility rather than rely on government action.[6] Moreover, only a small proportion of respondents actively participated in plastic reduction programs despite widespread concern over plastic waste.

This disconnect between awareness and behavior has been widely recognized in environmental research. While attitudes serve as key indicators of engagement, they do not always translate into behavioral change and are subject to change due to various factors such as the behaviour of their peers and family.[3,6-13,17,23,26,29,31-33,35,37-39]

A prime example of this attitude-behavior gap is recycling. Although many participants expressed positive attitudes towards reusing (67%), recycling (77.4%), and reducing (84%) plastic use, these attitudes often did not translate into consistent actions. Despite widespread awareness such as in Malaysia, where survey respondents acknowledged the significance of recycling many individuals fail to engage in consistent recycling practices.[3] This is often due to an inability to connect the benefits of recycling with its environmental consequences. Similarly, our study found that while participants expressed positive attitudes towards reusing, recycling, and reducing plastic use, many still disposed of plastic items in regular trash bins rather than utilizing recycling facilities.[10,22] This suggests that while attitudes toward plastic consumption have likely evolved over time, behavioral change remains a challenge.

Participants' attitudes towards plastic consumption closely mirrored their knowledge levels, with 49.9% exhibiting negative attitudes and 50.1% positive attitudes, based on a median cut-off score of 46 out of 72. The absence of a more dominant positive attitude could be attributed to limited knowledge and insufficient awareness of the environmental hazards associated with plastic use. Age and employment status also influence pro-environmental behavior. Our study found that individuals over 30 demonstrated more favorable attitudes toward sustainable practices, actively reducing plastic waste compared to those under 30 which is similar to findings in other studies.[37,38] This may be due to their direct experiences with environmental decline and greater financial resources to support sustainable choices.[31,38] Meanwhile, younger participants, primarily students under 30 and often unemployed, displayed less com-

mitment to reducing plastic consumption. Employed individuals exhibited stronger support for minimizing plastic use, aligning with research showing that older, educated, and higher-income groups are more inclined toward eco-friendly initiatives, such as no-plastic-bag campaigns.[21]

However, even among employed individuals, only a fraction consistently use reusable alternatives, suggesting that financial stability alone does not ensure sustainable behavior.

Another key issue is public understanding of plastic alternatives. Participants were evenly split in their awareness of the difference between biobased and biodegradable plastics. Those with negative attitudes toward these alternatives lacked knowledge of the terms, reflecting poor understanding of the subject. A similar trend was observed in an Australian study, which found that while the public generally perceived bioplastics and biodegradable plastics favorably, only a portion could correctly distinguish between the two.[28] However, J. Soares et al. (2021)[7] noted that within specific knowledge on plastic pollution, understanding alternatives to conventional plastics, such as biodegradable plastics, was negatively related to pro-environmental behaviors [3]. This suggests that simply promoting bioplastics as a solution is not enough; raising awareness, ensuring cost-effective availability, and reinforcing pro-environmental behavior are vital steps toward a greener future. Furthermore, many respondents stated they would switch to biodegradable plastics if they were the same price as conventional plastic, while only a small percentage were willing to pay a premium for eco-friendly alternatives.

Despite the persistence of the attitude-behavior gap, there is clear evidence that increased knowledge can foster pro-environmental attitudes. Our study found that participants were highly aware of the environmental impact of plastic, particularly when purchasing plastic products, and that a majority were willing to spread awareness among friends and family. Additionally, many respondents expressed willingness to pay more for plastic alternatives if they were easily accessible, while others believed stricter policies on plastic use should be enforced. However, only a small proportion actively participated in environmental advocacy groups or initiatives. This willingness to engage in environmental advocacy suggests that cultivating a pro-environmental culture in the community is possible with the right interventions. Furthermore, our research concluded that the relationship between knowledge and attitude was statistically significant, reinforcing the need to enhance public education on plastic pollution and sustainable practices. Increasing overall knowledge within the population is not just an academic endeavor but a necessary step toward fostering lasting, meaningful change in environmental behavior.

It is worth noting that the Ajman Municipality and Planning Department (AMPD) has introduced methods for recycling of waste. However, a lack of awareness of these facilities still exists as highlighted by our study.

Introducing incentivized recycling programs, such as deposit-return schemes for plastic bottles and containers, can motivate residents by offering financial rewards. A similar project was implemented as explained in the study in Malaysia.[3] Mobile apps or smart recycling bins that track usage and offer discounts or vouchers may further encourage consistent participation. Community engagement is crucial, and organizing neighborhood clean-up drives, recycling competitions, and awareness events can foster collective responsibility. Public-private partnerships could fund and support these initiatives while promoting sustainability in local businesses. Moreover, integrating environmental education into school curricula can instill long-term habits in younger generations. Enhancing access to recycling infrastructure, such as placing clearly labeled bins in public spaces and residential areas, is equally important. Ajman could also adopt a plastic bag levy, similar to Denmark's successful 1994 policy, which led to a significant reduction in single-use plastic consumption.[25] Educational campaigns, school curricula reforms, and improved access to recycling infrastructure are also recommended.

Lastly, sustained government-led media campaigns in multiple languages can raise awareness about recycling options and reinforce the importance of environmentally responsible behavior.

LIMITATIONS

The results of this research cannot be generalised as the sample size was obtained from the general population in Thumbay Medicity, Ajman, which doesn't reflect the United Arab Emirates' entire population. Moreover, the study population is prone to sampling bias as it was chosen by convenience sampling. Additionally, the use of self-reported questionnaires may be subject to bias due to social desirability, with participants potentially overstating their knowledge or environmentally friendly behaviors. Due to social desirability bias, self-reported data may therefore overestimate actual knowledge levels, potentially inflating positive responses.

Furthermore, the questionnaire design may have presented additional limitations. The complexity of some questions or the phrasing used might not have been easily understood by all participants, potentially affecting response accuracy. Moreover, the questionnaire may not have fully captured the cultural nuances in plastic use perceptions among Ajman's diverse population.

The study also relied solely on quantitative data, which limits the ability to explore the underlying reasons for the observed knowledge gaps and negative attitudes. Qualitative methods, such as inter-

views or focus groups, could provide richer insights into the behavioral and social drivers of plastic consumption.

Finally, as the primary objective was to assess knowledge and attitudes, actual behaviors were not evaluated. This limits the ability to determine whether increased awareness translates into tangible behavioral changes. As such, the findings may not fully reflect how participants apply their knowledge or attitudes in real-life situations.

CONCLUSION

The study revealed that knowledge regarding plastic consumption was nearly evenly distributed among participants, with 49.9% demonstrating adequate knowledge and 50.1% displaying insufficient knowledge. Similarly, attitudes towards plastic consumption were also assessed, and the responses were divided, with 50.1 % exhibiting a positive attitude and 49.9% holding a negative stance. The results demonstrated that knowledge and attitudes are evenly distributed, indicating a need for enhanced public education. These findings underscore the necessity of targeted educational initiatives to enhance awareness and encourage sustainable plastic consumption behaviors across diverse demographic groups.

A statistically significant association was observed between knowledge levels and demographic factors such as gender, marital status, student status, and employment status. Specifically, higher knowledge levels regarding plastic consumption were found among female participants, those who were single, students, and individuals who were unemployed. Multiple logistic regression analysis revealed that only gender was statistically significant, with males being 2.219 times more likely to have inadequate knowledge as compared to females. These findings highlight the need for gender-targeted environmental education to address knowledge gaps and foster sustainable behaviors in Ajman.

Recommendations

To address the identified knowledge gaps and promote sustainable plastic consumption, it is recommended to establish structured environmental education initiatives within the community, with a particular emphasis on middle-aged adults and the male population, who were found to have lower levels of awareness. For example, conducting workshops in male-dominated workplaces can help improve environmental knowledge among men.

Public awareness should also be increased through interactive and accessible platforms. For example, developing mobile applications or launching social media campaigns, such as adapting Dubai's #PlasticFreeUAE for Ajman, can effectively engage young adults in Ajman and promote positive attitudes towards reducing plastic use.

In addition to general awareness efforts, a 6-month environmental education campaign in Ajman schools is proposed, with effectiveness evaluated through pre- and post-intervention surveys to test knowledge improvement. This approach would provide measurable outcomes and inform the development of broader, evidence-based strategies.

Local governments should implement and promote effective ways to dispose of plastic waste and promote recycling. This could include community recycling initiatives, educational campaigns on proper plastic disposal, and the introduction of stricter regulations, including fines for landfilling and incineration.

Recommendations for Future Research

This research relied solely on quantitative data, which limited the understanding of underlying reasons behind the observed knowledge gaps and negative attitudes. Future research should incorporate qualitative methods such as semi-structured interviews or focus group discussions. These approaches can provide greater insights into cultural perceptions, and barriers that could influence public attitudes, thereby adding to the quantitative findings.

While this study effectively measures knowledge and attitudes, it does not assess actual behaviors related to the topic, such as the frequency or patterns of plastic use. Future studies should include behavioral outcome measures in order to establish clear links between attitudes and real-world actions. Adding survery items on behavior will allow researchers to better understand how knowledge and attitudes can translate into practice.

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