
Knowledge, attitude and practices of college students in a public university on microplastics and its health effects: a cross-sectional study

Angela S. Angela, Veronica M. Acejo¹, Nur Haron II A. Adiong,¹ Jerome R. Morgan¹, Gabrielle Alexandra L. Aguilar¹, Bea Camille G. Agustin¹, Dean Lotus C. Alano¹, Alyssa Aindrea S. Alarilla¹, Aelijah Julliane P. Alcantara¹, Ixzi Thia T. Alforque¹, Elyka Charlette E. Antonino¹, Alyanna Teresa Q. Apostol¹, Ainjelou Marie E. Arce¹, Kenneth Von B. Areta¹, Kiara Rossanne F. Aroza¹, Joshua Noel Fernando C. Arzadon¹, Donaliz R. Garcia, MD, DPPS², Milagros B. Rabe, MD, MS, PhD³

Abstract

Background Microplastics pose a significant environmental and health threat, yet the understanding and response of young adults to this issue remain underexplored. There is an increasing amount of microplastics in our environment and as the numbers grow, the danger that comes with it is still not fully understood. This study aimed to explore the knowledge, attitudes, and practices (KAP) of young adults in Muntinlupa, particularly students of a public university regarding microplastics and their health implications.

Methods Employing a quantitative cross-sectional design, the research targeted college students aged 18 and older.

Results Findings revealed that while students were knowledgeable about microplastics—particularly their harmful effects on health—attitudes and practices related to plastic disposal and recycling could be improved. Although the majority engaged in proper garbage disposal, only 41.5% consistently separated plastic waste from biodegradable materials. However, a weak positive correlation between knowledge and attitudes was observed, suggesting that increased awareness may enhance positive attitudes toward reducing microplastic pollution.

Conclusion These results suggest that while students are aware of microplastics and generally responded positively, there remains a gap in the translation of knowledge into practices, highlighting the need for enhanced educational interventions.

Key words: Microplastics, knowledge, attitudes, and practices, young adult

Correspondence:

Ainjelou Marie E. Arce, College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center
Email: arcea1191@uerm.edu.ph

¹College of Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc

²Department of Preventive and Community Medicine, University of the East Ramon Magsaysay Memorial Medical Center, Inc

³Department of Physiology, University of the East Ramon Magsaysay Memorial Medical Center, Inc

The increasing concern on the prevalence of global plastic use has been a rampant issue over the past years as these products do not completely decompose but only turn into very small particles called microplastics. Microplastics can be found everywhere and have been detected in drinking water, livestock, and air that humans breathe^{1,2,3}. In humans, microplastics have been detected in blood, urine,

semen, breast milk, and in organs such as the lungs, placenta, testicles, bone marrow and most recently in the brain which showed plastic accumulation levels 20 times that of other organs⁴.

In 2023, the estimated daily plastic consumption in the Philippines was estimated at around 163 million plastic sachets with only 28% being recycled and the remaining 72% were left to be degraded resulting in an increasing number of microplastics⁵. The presence of microplastics suspended in the ambient air in Metro Manila was found with the highest concentrations above Mandaluyong City and Muntinlupa³. With the increasing level of microplastics deposited in the environment every year, there is an urgent need to study microplastics. The research can raise concerns and awareness regarding microplastics as they are a problem in the community which has potentially major impacts in the future.⁶ It can serve as the foundation for future activities or programs advocating for the lessened use of plastics in the community.

To date, there is a paucity of research in the Philippines regarding the knowledge and awareness of Filipinos in relation to microplastics and its possible health impacts. With this, the study focused on determining the relationship of knowledge, attitude, and practices (KAP) of students from a public university regarding microplastics and their health effects, specifically (a) to determine the level of knowledge of students regarding microplastics and its health effects, (b) to determine the attitude of students regarding microplastics use, (c) to determine the practice of students regarding microplastics use, (d) to correlate the knowledge and the practices of students on microplastics, and (e) to correlate the practices and attitudes of students on microplastics.

Methods

This study was approved by the UERM RIHS Ethics Review Committee (RIHS ERC Code: 1691/C/2024/058). A cross-sectional design was utilized and an online questionnaire was used to collect the data from the eligible, 18 years and older college students of a public university, to evaluate their knowledge, attitudes and practices regarding the use of microplastics and its effects on their overall health. The students should also reside in that city.

The students were chosen for this study because the city has one of Metro Manila's highest microplastic

concentrations. As a public university, its varied student body offered a variety of perspectives and experiences that could inform the study. Purposive sampling was used in this investigation.

The survey questionnaire included questions derived from earlier studies, along with additional questions developed by the researchers.^{7,8} Before distribution, these supplementary questions were validated. The questionnaire was structured with an initial section that encompassed profiling questions and informed consent. Demographic data collected include age, course, sex and current year level. The subsequent section was divided into three distinct parts. The initial section comprised five questions designed to evaluate participants' understanding of microplastics. The second part comprised six questions aimed at examining participants' attitudes towards microplastics. The final section comprised seven questions pertaining to practices associated with microplastics. The options available for each question included 'Strongly Disagree', 'Disagree', 'Undecided/Neutral', 'Agree' and 'Strongly Agree'. This section ought to analyze individuals' perceptions and practices regarding microplastics.

Ten questions on a five-point Likert scale assessed knowledge of microplastics. All responses on each item were tallied according to its frequency. Responses categorized as Strongly Disagree was assigned a weight of 1, Disagree was assigned a weight of 2, Undecided/Neutral was assigned a weight of 3, Agree was assigned a weight of 4, and Strongly Agree was assigned a weight of 5. Weighted mean was computed for each item together with the standard deviation to assess which statements they were knowledgeable about. An overall mean and standard deviation were computed based on the scores for each item. Respondents were classified as "knowledgeable" regarding microplastics and their health effects if their overall mean scores were 3 or above, and as "not knowledgeable" if their scores fell below 3.

With regards to the attitude of participants regarding microplastics, 5 questions with five-point Likert's scale were utilized. Weighted mean, and standard deviation were computed for each item and as well as the overall scores for the attitude questions. Respondents were categorized as having "good attitude" on microplastics and their health effects if the overall mean score was 3 or above, while "poor attitude" if scores were below 3.

Lastly, the practice level of participants towards microplastics was determined where the weighted mean below 3 are considered as “poor practice” while a score of 3 and above meant “good practice”.

Descriptive analysis was utilized to summarize participants’ socio demographic characteristics, knowledge on microplastics and its health effects, attitude towards microplastics, and perception to prevent increased microplastic exposure.

Results

Demographics

A total of 429 responses were collected but only 424 participants were eligible and completed the study. Shown below is the demographics of the population. Out of the total number of respondents, 55% are female. The 20-year-olds made up about a quarter of the total respondents. Majority were second- and third-year students (Table 1).

The largest group of respondents, making up 30.4%, were BS Criminology students followed by Bachelor in Elementary Education students, who represented 19.3% of the respondents (Figure 1).

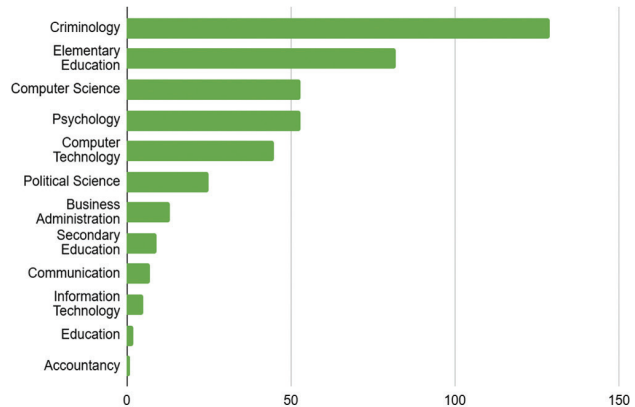


Figure 1. Degree program of participants

Knowledge on Microplastics

The sample was “knowledgeable” with a mean knowledge score of 3.41. More than half of participants agreed that microplastics are “tiny pellets made of plastics and small pieces formed during the breakdown of plastics” and “synthetic polymers used in cosmetic products. When given claims about microplastics’ common sources, such as being dissolved in water, only 38.7% agreed while the majority were undecided to disagree. In response

Table 1. Demographics of participants.

Participants	Frequency	Percentage (%)
Male	191	45
Female	233	55
Age		
18	44	10.4
19	89	21
20	104	24.5
21	81	19.1
22	46	10.8
23	24	5.7
24 and older	36	8.5
Year level		
1st year	51	12
2nd year	192	45.3
3rd year	158	37.3
4th year	22	5.2
5th year and above	1	0.2
Total	424	100

to “microplastics cannot be found on food”, 36% disagreed, 20.3% were undecided, and 43.6% agreed. Finally, 45.3% agreed that “microplastics can be found on the air that we breathe”.

On the health effects of microplastics, 44.8% agreed that “microplastics do not accumulate in internal organs” while 25.9% were undecided. Majority (66.2%) agreed that “disorders of the immune system are one of the effects of microplastics”. When given a statement that “microplastics can be detected in our blood”, there were 37.5% that agreed while 32.1% were undecided. Lastly, 62.5% agreed that “microplastics can cause cancers in the long run” but there were still 27.6% that were undecided on this statement (Table 2).

In the “knowledgeable” group, 366 out of 424 respondents were included, while the “non-knowledgeable” group consisted of only 58 respondents. A significant difference was observed between the mean scores of the “knowledgeable” and “non-knowledgeable” groups (Table 3).

Table 3. Knowledge scores of the group

	N	Mean	Standard deviation	p value
Knowledgeable	366	3.53	0.37	P = <0.001*
Non-knowledgeable	58	2.65	0.27	

*T Test

Attitude on Microplastics

The sample’s mean attitude score was 3.74, indicating “Good Attitude.” The majority (61.4%) said that they were less concerned about where plastic waste ended, which is related to 84.2% of participants agreeing that “I want to learn more about microplastics”. Finally, 62.3% denied contributing to microplastic contamination (Table 4).

Table 5 shows a substantial difference between the sample’s “good attitude” and “poor attitude” averages.

Table 2. Knowledge on microplastics

	Strongly Disagree n (%)	Disagree n (%)	Undecided n (%)	Agree n (%)	Strongly Agree n (%)
Microplastics are tiny pellets made of plastics and small pieces formed during breakdown of plastics.	15 (3.5)	11 (2.6)	61 (14.4)	209 (49.3)	126 (29.7)
Microplastics are synthetic polymers used in cosmetic products.	17 (4.0)	48 (11.3)	120 (28.3)	181 (42.7)	58 (13.7)
Microplastics are soft polymers of various shapes that dissolve in water.	39 (9.2)	129 (30.4)	90 (21.2)	111 (26.2)	53 (12.5)
Plastic marine debris will eventually become Microplastics.	17 (4.0)	40 (9.4)	127 (30.0)	175 (41.3)	60 (14.2)
Microplastics CAN NOT BE found in food.*	54 (12.7)	99 (23.3)	86 (20.3)	103 (24.3)	82 (19.3)
Microplastics are present in the air that we breathe.	45 (10.6)	58 (13.7)	126 (29.7)	147 (34.7)	45 (10.6)
Microplastics DO NOT accumulate in internal organs.*	25 (5.9)	97 (22.9)	110 (25.9)	118 (27.8)	72 (17.0)
Microplastics can be detected in our blood.	49 (11.6)	73 (17.2)	136 (32.1)	126 (29.7)	33 (7.8)
Disorders of the immune system are one of the health effects of Microplastics.	22 (5.2)	33 (7.8)	86 (20.3)	205 (48.3)	76 (17.9)
Microplastics can cause cancers in the long run.	12 (2.8)	29 (6.8)	117 (27.6)	175 (41.3)	90 (21.2)

*These statements are negatively-framed thus reverse scoring where the disagree scores were put on the agree and vice-versa was utilized to find out the accurate overall mean score of the data.

Table 4. Attitude of participants towards microplastics

	Strongly Disagree n (%)	Disagree n (%)	Undecided n (%)	Agree n (%)	Strongly Agree n (%)
I am less concerned about where plastic waste generated ends.*	40 (9.4)	79 (18.6)	44 (10.4)	130 (30.7)	130 (30.7)
I am NOT willing to tell my family and friends about the issue of Microplastics in my city.*	18 (4.2)	24 (5.7)	51 (12.0)	142 (33.5)	189 (44.6)
I am willing to participate in the cleanup efforts of Microplastics in my community.	12 (2.8)	22 (5.2)	52 (12.3)	175 (41.3)	162 (38.2)
I am willing to encourage the government to work on the issue of Microplastics in my city.	13 (3.1)	11 (2.6)	44 (10.4)	171 (40.3)	184 (42.4)
I want to learn more about Microplastics.	12 (2.8)	14 (3.3)	38 (9.0)	156 (36.8)	201 (47.4)
I live a lifestyle that may contribute to Microplastic pollution.*	98 (23.1)	166 (39.2)	93 (21.9)	46 (10.8)	17 (4.0)

*These statements are negatively-framed thus reverse scoring was utilized to find out the accurate overall mean score of the data

Table 5. Attitude scores of the group

	N	Mean	Standard deviation	P value*
Good Attitude	397	3.82	0.49	p-value <0.001
Poor Attitude	27	2.62	0.38	

*Mann-Whitney

Practices on Microplastics

About 59.7% of respondents said they always disposed of garbage properly. As shown, 41.5% reported they always segregated their plastic garbage from other biodegradable products. For plastic usage, 31.1% of respondents said they generally used reusable takeout containers and 42.7% said they always do. Eco-friendly substitutes were used by 66.5% of respondents. A third of respondents occasionally would bring recyclables when buying food outside, while half always did. The remaining 14.3% never/rarely brought the stuff. About half of respondents chose products with less packaging and participate in community plastic waste reduction programs (Table 6).

The sample's "good practices" and "poor practices" mean differences are considerable (Table 7).

Correlation Between Knowledge, Attitudes and Practices

Knowledge on microplastics and attitude towards microplastics has a significant but weak relationship. There was a weak relationship between knowledge and practice towards microplastics, and attitude and practices towards microplastics but they were not statistically significant (Table 8).

Discussion

Knowledge on Microplastics

The participants understood microplastics. They responded with the highest weighted mean to "Microplastics are tiny pellets made of plastics and small pieces formed during breakdown of plastics", demonstrating they understood microplastics are degradation products. This matches the criteria of

Table 6. Practices on microplastics

	Strongly Disagree N (%)	Disagree N(%)	Undecided N(%)	Agree N(%)	Strongly Agree N(%)
I dispose garbage in the right place.	5 (1.2)	4 (0.9)	45 (10.6)	117 (27.6)	253 (59.7)
I choose products with less packaging.	4 (0.9)	28 (6.6)	163 (38.4)	125 (29.5)	102 (24.1)
I bring recyclable items when buying food outside.	14 (3.3)	48 (11.3)	143 (33.7)	100 (23.6)	118 (27.8)
I use eco-friendly substitutes.	4 (0.9)	27 (6.4)	107 (25.2)	140 (33.0)	142 (33.5)
I use reusable container(s) in takeaways.	6 (1.4)	21 (5.0)	82 (19.3)	132 (31.1)	181 (42.7)
I separate my plastic waste from other biodegradable products.	5 (1.2)	22 (5.2)	107 (25.2)	111 (26.2)	176 (41.5)
I participate in activities to reduce plastic waste in my community.	19 (4.5)	70 (16.5)	123 (29.0)	91 (21.5)	120 (28.3)

Table 7. Practices scores of the group

	N	Mean	Standard deviation	Standard error mean	p-value*
Good practices	397	4.0150	0.57192	0.2888	1 <0.0001
Poor practices	32	2.5029	0.44722	0.07905	

* Mann Whitney U-test

Table 8. Pearson correlation of knowledge, attitude, and practices

	Knowledge	Attitude	Practice
Knowledge_		0.315**	0.059
Attitude	0.315**		0.062
Practice	0.059	0.062	

**Correlation is significant at the 0.01 level (2-tailed)

“secondary microplastics,” which are generated by UV radiation from sunlight wave action and wind abrasion⁹. Microplastics are synthetic polymers in cosmetics and marine debris, according to participants.

Most of the respondents did not know microplastics came from food, drink, or the air. Studies have shown that microplastics are present in a variety of food sources, including fish sold at wet markets and bodies of water and most especially in suspended

atmospheric microplastics (SAMPs) at high levels in the respondents’ city.^{5,10} Lack of information about microplastic sources may increase exposure. This suggests that microplastic awareness and expertise in our country are lacking.

Participants agreed that microplastics can cause cancer. Microplastics may boost cell migration and metastasis, which promotes tumor growth, according to a study.¹¹ Similar to a study that found

microplastics produce an inflammatory response, causing respiratory symptoms as coughing, sneezing, and dyspnea, participants agreed that microplastics can cause immune system illnesses. Since participants were not from healthcare-related courses, they were unsure if these compounds might be detected in the blood and accumulate in key organs.¹² However, recent studies have revealed microplastics in the lungs, blood and brain, where they may cause oxidative stress, inflammation and other health concerns.¹³

Attitudes on Microplastics

On the other hand, attitudes are considered a vital determinant of behavior because they affect the intention of a person to act or affect the action itself.¹⁴ The overall mean attitude score of participants indicated that they have a good attitude towards microplastics as it involved self-awareness and proactive behavior regarding their impact on the environment and health of microplastic pollution. Participants in this study wanted to learn more about microplastics similar to a previous study that showed that students were typically interested in identifying the current shortcomings and effects of their education on attitudes towards plastic pollution.¹⁵ Moreover, there was generally a good response from the students towards the control of plastic pollution as exemplified by their concern about where the generated plastic waste ended which is similar to a previous study where those living around Lagos Lagoon, a polluted lagoon in Nigeria, were also concerned with the ecological impact of not knowing where the generated plastic waste ended.¹⁶ This study's respondents were also concerned that their lifestyle may have contributed to microplastic pollution as seen in a study in Arizona where students were willing to change their lifestyle by using biodegradable bags for shopping and reject plastic bags.¹⁷

The students demonstrated readiness to raise awareness, engage in cleanup efforts, and encourage the government to address microplastic pollution. These results are consistent with a previous review article.¹⁷ A high percentage of the participants showed willingness to discuss microplastics with their family and friends, indicating an awareness of the issue within the community. However, in a study done in Shanghai, it was found that lack of public knowledge

and awareness was one of the major difficulties one might encounter in reducing microplastic pollution. This finding shows the importance of deepening the public's understanding and awareness regarding the issue to be able to influence their willingness to take action.¹⁸ Encouraging the government to address microplastic pollution, on the other hand, indicates the awareness of the respondents that political decision-makers and communicators have an impact on the issue at hand, which is why government officials must empower the community to take action and make informed decisions that may contribute to reducing microplastic pollution.¹⁹

Practices on Microplastics

The overall practice score of these students indicated that they exercised good practices towards the use of plastics. From the responses, it was observed that most of the participants practiced disposing garbage in the right place, however, fewer participants mentioned that they always practice waste segregation of plastic waste from biodegradable products. A study suggested that waste segregation practices are affected by four factors, namely, recycling bin accessibility, waste segregation information, waste segregation incentives, and waste segregation reminders. In addition to this, participants were also shown to have good practice towards using eco-friendly substitutes and reusable materials.²⁰ Aside from knowledge and attitudes, a study on Western and Asian consumers emphasized that there were cultural differences which may have impacted consumers' behavior towards sustainable options. In Asian culture, consumers' motivations influence their consumption of reusable containers.²¹ Moreover, in the current study, the participation of the students to activities to reduce plastic waste in the community was a representation of good practice. These activities included disposal of garbage in the right place, use of products with less packaging, use of recyclable items when buying food, use of eco-friendly substitutes, use of reusable containers, separation of plastic waste from biodegradable, and participation in plastic waste reduction in the community. Reduction is defined as one of the preferred ways in solid waste management as it decreases the toxicity of waste. At the same time, it reduces costs attributed to cleaning up wastes.²²

Relationship Between Knowledge and Practices on Microplastics

A study in Poland among university students, focused on the knowledge and awareness of microplastic contamination among consumers, particularly those with higher education levels.²³ Their findings are consistent with our findings, as it highlighted that while participants were generally aware of microplastics in water, their knowledge about its presence in other areas was limited. Despite growing awareness, this knowledge did not translate directly to behavioral change for the following possible reasons: 1) insufficient knowledge, 2) perceived inefficacy of individual action, 3) lack of feasible alternatives and 4) economic constraints. This was supported by a review that showed that there was a gap between increasing knowledge and effective action regarding microplastics due to the challenges of consumer behavior, particularly the lack of accessible and affordable alternatives to plastic products.²⁴

Contrary to the results obtained, a study performed in Malaysia among its residents showed that individuals who have good knowledge about plastic pollution and its harmful effects also did good practices such as recycling and purchasing fewer plastic products. Additionally, it showed that the level of education and age were predictors of good practices.²⁵

One other intervening factor could be the level of perception. Another Malaysian study found that the predictive factor of good practice was the level of perception which is indirectly influenced by a person's knowledge level of the problem. They suggested that the higher level of knowledge a person has about microplastics enabled one to have a better perception of its health implications eventually leading to better practices in preventing microplastic contamination. Although knowledge in itself could make people be aware of the issue and act accordingly, it would not change the person's willingness to act. They suggested that the incorporation of one's knowledge and information is key to helping lessen the microplastic problem.²⁶

Relationship Between Attitudes and Practices on Microplastics

Practice and attitudes of students towards microplastics were weakly correlated, though not statistically significant. This finding was similarly seen in a Nigerian study.¹⁵ There is a need to probe regarding

how they think and behave concerning microplastics and the actions that they are doing to prevent increased exposure to microplastics. It is possible that other intervening factors influence the student's attitudes and practices.

Other possible intervening factors are sociodemographic factors. In a study among Malaysian adults, they found out that age, gender, educational level and even marital and employment status have a relationship with perception level about microplastic contamination in the human body.²⁶ Their study revealed that females had more good and moderate behavior than males. These sociodemographic factors were shown to have a positive relationship with the level of practice. Although these factors were not directly explored in this study, they may have influenced the attitudes and practices of students regarding microplastics, as reflected in the results.

Individuals with a background in environmental sciences were seen to be more likely to use reusable plastic.²⁵ This aligns with a study in Europe where a positive correlation between education in environmental discipline and sustainable behavior was observed.²⁶ Similarly, a Malaysian study noted that while people generally have favorable attitudes toward recycling, they often lacked the motivation to act on it. Factors such as convenience, social norms, moral values, environmental awareness and access to recycling facilities played a crucial role in determining recycling behaviors, regardless of demographics, such as education, gender, income or age.²⁷

A study done in Europe determined that respondents between the ages 18 and 25 and 36 and 45 were more likely to choose products with less plastic.²⁸ Consumer behavior toward plastic reduction was seen to be impacted by the availability of alternatives, cost, convenience, habits and accessibility. Educational background has been seen to significantly increase the likelihood of reducing single-use plastics, with more educated individuals exhibiting higher engagement in plastic recycling.

In summary, the findings showed that this study's respondents were generally knowledgeable about the definition and presence of microplastics and exhibited positive attitudes and practices related to their environmental and health impacts. However, there is insufficient evidence to indicate significant correlations between "knowledge and practices" or "practices and attitudes" regarding microplastics,

likely due to sample limitations. Nonetheless, a weak positive relationship between “knowledge and attitudes” suggests that students with greater knowledge of microplastics and their effects may be more inclined to adopt favorable attitudes, including promoting awareness and reducing exposure.

The study is limited to assessing the knowledge, attitudes, and practices on microplastics among college students from one university. Specifically, it focused on the student’s general awareness of microplastics and exposure, their potential effects on health, and behaviors related to their use and disposal. It did not incorporate direct observations.

The study was confined to college students of just one city, which may not reflect the experiences and awareness levels of students residing in other regions. The study’s purposeful sample of 424 students may not fully represent the student population. Data collection relied on self-answered questionnaires, which made the findings susceptible to response bias. Finally, this study aimed to educate people about microplastics. Partnering with NGOs or LGUs would boost this advocacy and improve microplastic understanding, attitudes and practices.

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