Grand Asian Journal of Food and Nutrition (GAJFN)

1st issue & 1st volume

Assessing Awareness and Perceptions of Microplastics in the University Community

Kashaf Nasir[*1], Rashim Yaqub [1], Laraib kiran[2], Mujtaba Nasir[3]*

[1] Department of Environmental Sciences, Quaid-i-Azam University, Islamabad, 45320, Pakistan

[2] Department of Chemistry, Paras campus, University of Agriculture Faisalabad, Pakistan

[3] Department of Pharmacy, University of Sargodha, Punjab, Pakistan

*Corresponding Author: (kashafnasir1610@gmail.com)

Received data: 30 June 2025 Revised date: 26 July 2025 Accepted date: 2 August 2025 Published date: 14 August 2025

 ISSN: 0000-000

Abstract

Plastic pollution has emerged as a pressing global concern, with microplastics (MPs) increasingly detected in ecosystems and human tissues. This study examined awareness, perceptions, and behavioral intentions related to microplastics among 500 undergraduate students at Quaid-i-Azam University, Islamabad. Using a cross-sectional survey design, data were collected via a structured questionnaire and analyzed using descriptive statistics. Results revealed that 64% of participants were aware of microplastics, while 89% expressed concern about plastic pollution. A majority supported banning microplastics (76%) and incorporating related topics into university curricula (72%). Despite strong concern, behavioral contradictions persisted: 67% relied on bottled water and 48% frequently used plastic packaging, though 69% indicated willingness to adopt eco-friendly practices. Findings highlight the gap between awareness and action, underscoring the need for structural interventions alongside educational initiatives. The study concludes that university students represent critical agents of change, but comprehensive strategies integrating education, accessibility of alternatives, and policy enforcement are essential to foster sustainable plastic reduction.

Keywords: Microplastics, Environmental Awareness, University Students, Plastic Pollution, Sustainable Behavior

1. Introduction

Plastics, encompassing thermoplastics such as polystyrene (PS), polypropylene (PP), polyethylene terephthalate (PET), polyethylene (PE), and polyvinyl chloride (PVC), along with thermosets like polyurethane (PU) and epoxy resins, are widely used due to durability, affordability, and versatility (O'Brien et al., 2023; Thacharodi et al., 2024). While these qualities made plastics indispensable in industry and daily life, their environmental persistence has turned them into a global ecological burden (Thacharodi et al., 2024; Yang et al., 2021).

Microplastics (MPs), defined as particles between 1 μm and 5 mm, originate either as intentionally manufactured primary MPs or through fragmentation of larger plastics into secondary MPs (O'Brien et al., 2023; Dissanayake et al.,

2022). First reported in marine environments in the 1970s, MPs are now detected in soils, freshwater, sediments, and the atmosphere (Dissanayake et al., 2022; Zhao et al., 2024). Studies further reveal MPs in human feces, blood, and placental tissue, raising concern over potential health impacts (Zhao et al., 2024).

This crisis is tied to exponential growth in plastic production, rising from 1.7 million tons in the 1950s to more than 335 million tons in 2016, with projections of a fourfold increase by 2050 (Ali et al., 2024; Zhao et al., 2024). Between 1950 and 2015, 4.9 billion metric tons of plastic waste accumulated in landfills and natural environments, the figure expected to reach 12 billion tons by 2050 (Zhao et al., 2024). Non-biodegradability and poor waste management further accelerate the accumulation and fragmentation of plastics into MPs across ecosystems (Ali et al., 2024; Yang et al., 2021).

Pakistan reflects these challenges, producing 624,200 tons of plastic annually for nearly 6,000 industries, with around 164,332 tons entering the Indus River (Mukhtar et al., 2024). Plastic waste in the country increases by 15% each year, and Rawal Lake studies reveal fibers and fragments as dominant MP types (Ahmad et al., 2025). Nationally, 3.3 million tons of plastic waste are generated annually, most disposed untreated in landfills and water bodies (UNDP, 2020; Mukhtar et al., 2024). Additionally, the use of 55 billion single-use, non-biodegradable plastic bags intensifies pollution (Mukhtar et al., 2024).

Mitigating this issue requires both effective waste management and public awareness, as informed individuals are more likely to adopt eco-friendly practices. University students are especially important because they represent future policymakers, educators, and innovators capable of driving sustainable change (Hammami et al., 2017; Kong et al., 2014). International studies highlight that environmental knowledge strongly influences pro-environmental behavior. For example, awareness programs improved litter management in the South Pacific (Eastman et al., 2013). Sharjah students demonstrated strong links between awareness and sustainable practices (Hammami et al., 2017), and similar patterns were observed in Texas (Bradley et al., 1999), Malaysia (Aminrad et al., 2013), and Istanbul (Ergen et al., 2015). In Greece, awareness of marine plastic pollution increased public support for reusable alternatives and policy enforcement (Charitou et al., 2021).

However, awareness does not always translate into action. In Sharjah, students with internet access rarely engaged with environmental content (Hammami et al., 2017), while in Nigeria, limited awareness combined with weak waste management systems worsened plastic pollution (Dumbili & Henderson, 2020). These findings highlight the importance of pairing education with structural interventions to effectively address plastic pollution.

In this context, the present study investigates awareness and perceptions of microplastics among university students in Pakistan. Specifically, it seeks to evaluate student's awareness, analyze their perceptions of environmental and health impacts, examine how knowledge influences eco-friendly practices, and assess the role of education in shaping sustainable behaviors.

2. Materials and Methods

2.1. Research Design

This study used a cross-sectional survey design to examine awareness and perceptions of microplastics among undergraduate students. The design allowed for data collection at a single point in time, providing a snapshot of knowledge, attitudes, and practices in the study population.

2.2. Study Setting and Population

The research was conducted at Quaid-i-Azam University, Islamabad, a prominent higher education institution that enrolls students from diverse academic disciplines. The study population included undergraduate students from different faculties and years of study. University students were selected because they are considered a key demographic for environmental awareness, being future policymakers, professionals, and community influencers. Their knowledge, attitudes, and behaviors regarding microplastics can significantly impact environmental sustainability in both academic and societal contexts.

2.3. Sample Size and Sampling Technique

A total of 500 undergraduate students participated in the study. Participants were selected using a random sampling technique, ensuring that every student in the target population had an equal chance of being included. Random sampling reduces selection bias, increases the representativeness of the sample, and enhances the generalizability of the findings. The sample size of 500 was deemed adequate to allow for both descriptive and inferential statistical analyses while remaining practical in terms of data collection logistics and resource constraints.

2.4. Data Collection Instrument

Data were collected using a structured, self-administered questionnaire developed specifically for this study. The questionnaire was designed based on a review of relevant literature on microplastics awareness and environmental perceptions. It consisted of 17 items divided into four sections:

1. Demographic Information (7 items): age, gender, field of study, CGPA, year of study, place of residence, and parent's education level. These items provided contextual information about the participants and allowed examination of potential demographic influences on awareness and perceptions.
2. Knowledge and Awareness (2 items): awareness of microplastics and knowledge about their sources and environmental entry pathways. These items measured the participants' basic understanding of the topic.
3. Perceptions and Concerns (3 items): views on plastic pollution as a global environmental challenge, support for banning microplastics, and inclusion of microplastics in university curricula. These questions explored students' attitudes and level of concern regarding environmental issues.
4. Plastic Use and Lifestyle (5 items): clothing composition (synthetic vs. natural fibers), frequency of using plastic-packaged food and beverages, drinking water type, willingness to change lifestyle practices, and preference for eco-friendly alternatives. These items examined behavioral aspects related to plastic use and sustainability practices.

The questionnaire included a combination of multiple-choice, yes/no, and Likert-scale items, which facilitated quantitative analysis while also capturing nuanced perceptions.

2.5. Data Collection Procedure

The survey was conducted between December 2024 and February 2025. Questionnaires were distributed in classrooms and common areas after obtaining prior permission from faculty members. The purpose of the study was explained to all participants, and informed consent was obtained before participation. Participation was voluntary, and students were informed that they could withdraw at any time without consequences. To maintain confidentiality and privacy, no personal

identifiers were collected, and responses were recorded anonymously.

2.6. Data Analysis

Collected data were coded and entered into SPSS for analysis. Descriptive statistics, including percentages, median, and standard deviations, were calculated to summarize demographic characteristics, levels of awareness, perceptions, and behavioral tendencies.

2.7. Ethical Considerations

The study adhered strictly to ethical principles governing research with human participants. Participation was entirely voluntary, and respondents were free to withdraw at any stage. Anonymity and confidentiality were maintained throughout the data collection process. The research protocol was approved by the relevant authorities at Grand Asian University, and participants were fully informed about the purpose and scope of the study. No identifiable personal information was collected, ensuring compliance with ethical standards.

3. Results

Table 1: Descriptive Statistics of Participants (N = 500)

Variable	Category / Statistic	Count	Percentage
Age (years)	Count	500	100%
	Mean ± SD (95% CI)		19.91 ± 1.52 (95% CI: 19.78-20.04)
	Variance		2.31
	Minimum-Maximum (Range)		18-24 (Range = 6)
	25th Percentile		19
	Median (50th Percentile)		20
	75th Percentile		21
	Mode	20	
Gender	Female	346	69%
	Male	154	31%
Field of Study	Science/Tech	191	38%
	Health/Science	133	27%
	Business	106	21%
	Law	69	14%
Residence	Rural	207	41%
	Urban	202	40%

	Suburban	91	18%
Parents Education	Primary School	10	10%
	Secondary School	22	22%
	Bachelor's Degree	32	32%
	Master's Degree	21	21%
	Doctoral Degree	4	4%
	Prefer not to say	11	11%
CGPA	First Semester/No CGPA	197	39%
	4.0-3.5	43	9%
	3.0-3.5	138	28%
	2.5-3.0	90	18%
	Below 2.5	27	5%
	Other	5	1%
Knowledge of Microplastics	Yes	319	64%
	Maybe	117	23%
	No	64	13%
Belief in Microplastics Creation	Yes	218	44%
	No	181	36%
	Maybe	101	20%
Concern About Plastic Pollution	Yes	447	89%
	Maybe	37	7%
	No	16	3%
Support for Banning Microplastics	Yes	378	76%
	No	69	14%
	Maybe	53	11%
Include Microplastics in Curriculum	Yes	362	72%
	No	85	17%

	Maybe	53	11%
Clothing Composition Preference	Natural	293	59%
	Blended	117	23%
	Synthetic	90	18%
Plastic Packaging Usage	Very Frequently	239	48%
	Occasionally	176	35%
	Rarely	85	17%
Water Consumption Source	Plastic Bottles	335	67%
	Tap Water	106	21%
	Glass Bottles	59	12%
Willingness to Change Habits	Yes	346	69%
	Maybe	85	17%
	No	69	14%

3.1. Participant Characteristics

A total of 500 participants were included in the study, with a mean age of 19.91 ± 1.52 years (95% CI: 19.78-20.04). The age range of respondents was 18-24 years, and the median age was 20 years. Among the respondents, 69% were female (n = 346) and 31% were male (n = 154) (Figure 1a). With respect to place of residence, 41% reported living in rural areas, 40% in urban areas, and 18% in suburban areas (Figure 1b). Regarding academic programs, the highest proportion were enrolled in Science/Technology (38%) and Health/Science (27%), followed by Business (21%) and Law (14%) (Figure 2).

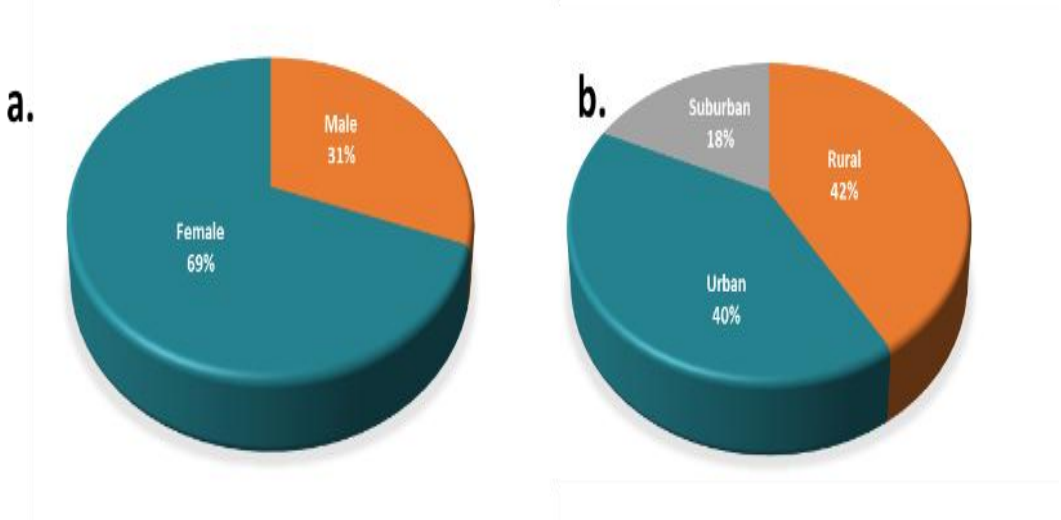

Figure 1: Distribution of respondents by (a) sex and (b) place of residence

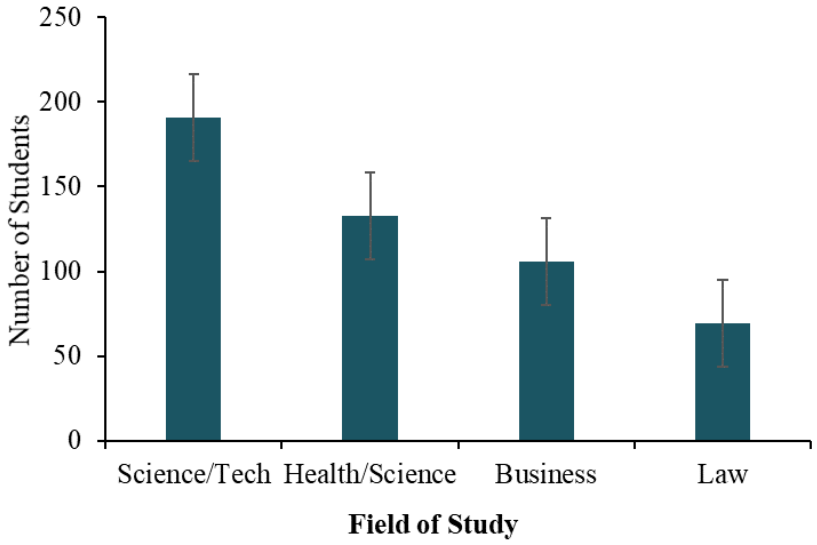

Figure 2: Distribution of respondents by field of study

3.2. Academic Profile

A substantial proportion of participants (39%) were in their first semester and therefore did not report a cumulative grade point average (CGPA). Among those with available CGPA data, 28% reported a CGPA between 3.0 and 3.5, 18% between 2.5 and 3.0, 9% between 3.5 and 4.0, 5% below 2.5, and 1% reported other values (Figure 3a). With respect to parental education, the largest proportion indicated "Others" (45%), followed by secondary school (23%). Smaller proportions reported parents with primary school education (9%), a bachelor's degree (7%), and a master's degree (6%), while 10% preferred not to disclose (Figure 3b).

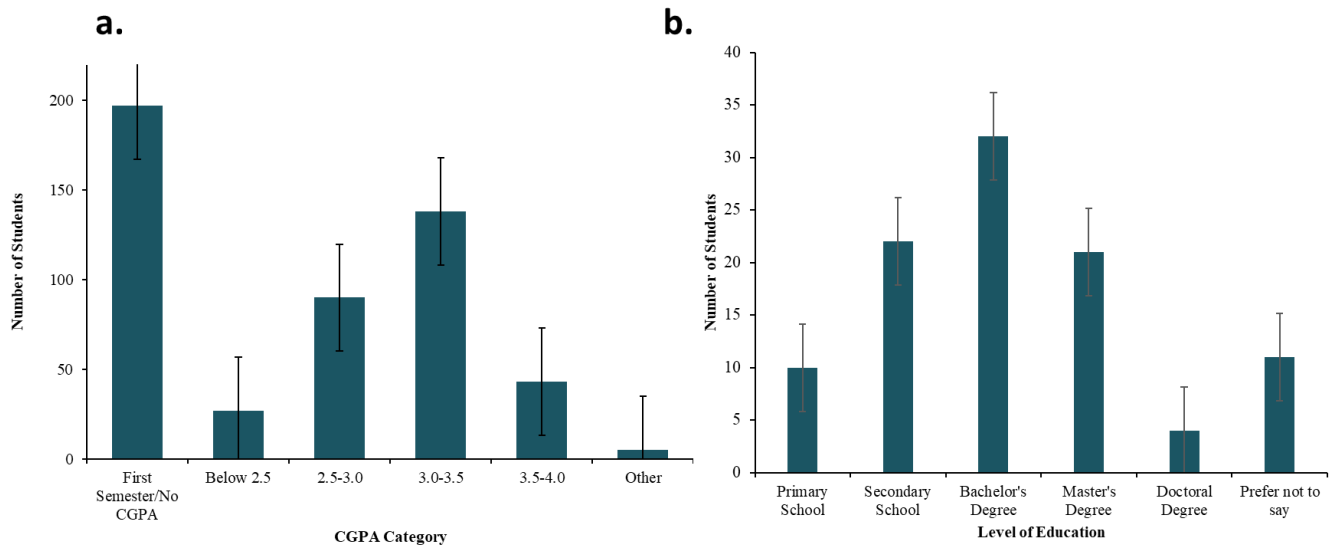

Figure 3: Distribution of respondents by (a) cumulative grade point average (CGPA) and (b) parental level of education

.

3.3. Knowledge and Perception of Microplastics

Most participants (64%) reported being aware of microplastics, while 23% were unsure and 13% reported no knowledge (**Figure 4a**). When asked about the creation of microplastics, 44% believed they are being generated, 36% disagreed, and 20% were uncertain (**Figure 4b**). Concern about plastic pollution was widespread, with 90% expressing concern, 7% being uncertain, and only 3% reporting no concern (**Figure 5**).

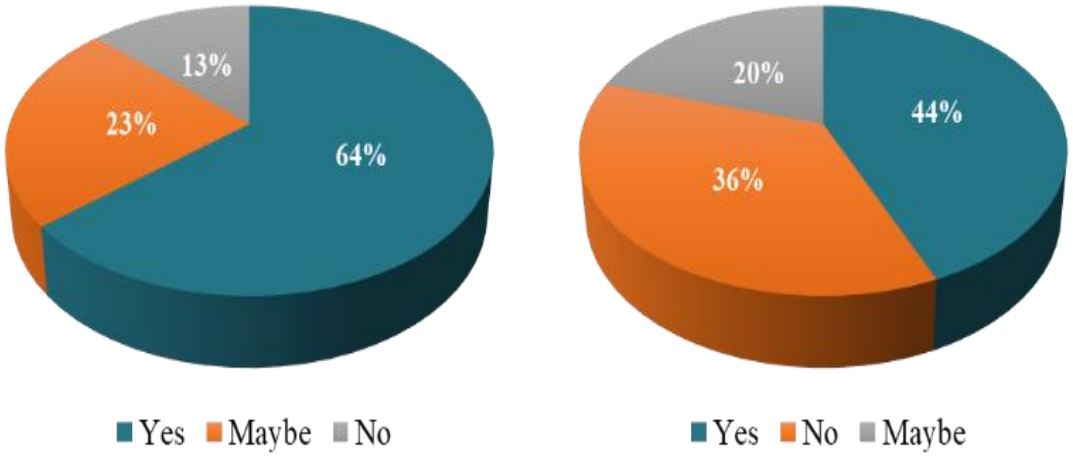

Figure 4. Distribution of respondents by (a left side) knowledge of microplastics and (b right side) belief in microplastic generation.

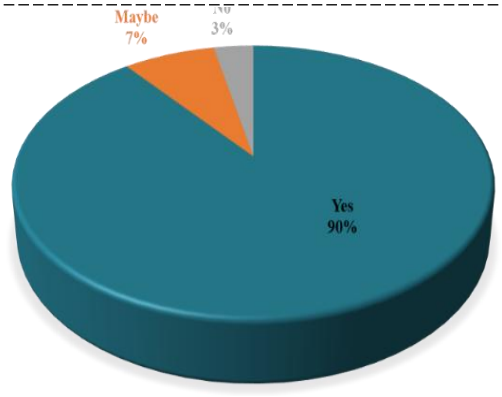

Figure 5. Distribution of respondents by level of concern about plastic pollution.

3.4. Attitudes Toward Regulation and Education

A substantial proportion of respondents (76%) expressed support for banning microplastics, compared to 14% who opposed and 11% who were undecided (Figure 6a). Similarly, 72% supported the inclusion of microplastics-related content in academic curricula, while 17% opposed and 11% were uncertain (Figure 6b).

3.5. Consumption Patterns and Behavioral Intentions

With respect to clothing preferences, 59% of participants reported favoring natural fabrics, 23% blended fabrics, and 18% synthetic fabrics (**Figure 7a**). The frequency of plastic packaging use varied, with 48% using it very frequently, 35% occasionally, and 17% rarely (**Figure 7b**). Regarding drinking water, 67% primarily consumed bottled water, followed by 21% using tap water and 12% consuming water from glass bottles (**Figure 7c**). In terms of behavioral change, 69% indicated willingness to modify their habits to reduce plastic usage, 17% were uncertain, and 14% expressed unwillingness (**Figure 7d**).

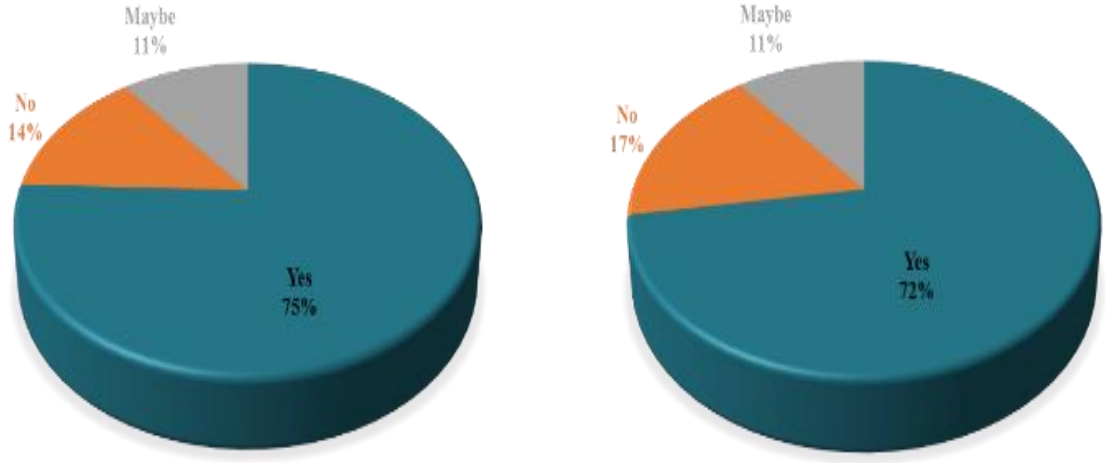

Figure 6. Distribution of respondents by (a) support for banning microplastics and (b) support for inclusion of microplastics-related content in academic curricula.

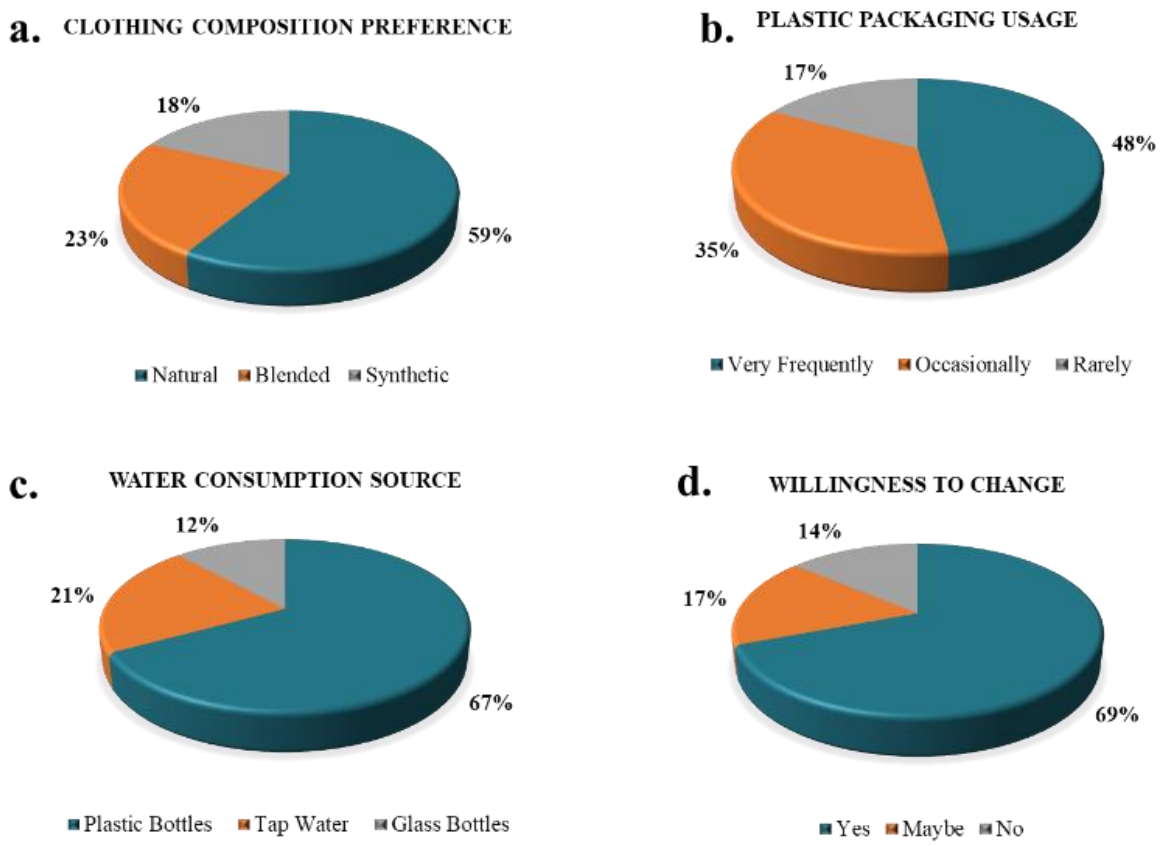

Figure 7. Distribution of respondents by (a) clothing composition preferences, (b) frequency of plastic packaging use, (c) drinking water sources, and (d) willingness to change habits to reduce plastic usage.

4. Discussion

This study aimed to investigate young adult's awareness, perceptions, attitudes, and behaviors toward microplastics and plastic pollution, with a focus on university students as emerging leaders in shaping sustainable futures. The findings provide a comprehensive understanding of how this cohort conceptualizes microplastics and engages with plastic-related behaviors, offering insights into both individual-level attitudes and broader policy implications.

The sample of 500 university students, predominantly aged 18-24 years (mean age = 19.91 ± 1.52 years) and skewed toward females (69%), reflects a typical higher education cohort and aligns with prior research on youth environmental engagement (Dunlap & Van Liere, 2008). Emerging adults are recognized as pivotal drivers of sustainable behavior due to their educational exposure and future societal roles (Arnett, 2000). The academic distribution was STEM-oriented, with Science/Technology (38%) and Health/Science (27%) students forming the majority. This profile may partly explain the relatively high awareness of microplastics (64%), consistent with findings that STEM students have greater exposure to environmental topics (Vicente-Molina et al., 2013).

The sample included a substantial proportion of first-semester students (39%) without CGPA data, highlighting its transitional nature. Reported CGPAs suggested strong academic performance,

with 28% clustered between 3.0-3.5. Parental education data reflected socioeconomic diversity: while the broader sample was dominated by "Others" (45%) and secondary school (23%), the subset with detailed responses (n = 100) reported higher proportions of bachelor's (32%) and master's (21%) degrees. This divergence may reflect response bias or regional variation. Lower parental education has been linked to limited intergenerational transfer of environmental knowledge, reinforcing the need for targeted educational interventions (Rosa et al., 2018).

Overall, 64% of students reported awareness of microplastics, while 23% were unsure and 13% were unaware, figures comparable to awareness levels among Italian youth (60-70%) (Righi et al., 2024). However, misconceptions persisted, particularly regarding whether microplastics are actively created (44% agreed, 36% disagreed), mirroring limited conceptual clarity observed among German students.

Concern about plastic pollution was widespread (89%), exceeding levels reported in U.S. adult populations (75-80%) (Funk & Hefferon, 2019). Similar patterns were observed in a Malaysian study, where students demonstrated only moderate knowledge (mean = 4.66) and attitudes (mean = 5.42) toward microplastic pollution. Importantly, demographic factors such as age, gender, CGPA, and academic program showed no significant associations with knowledge or attitudes (Rajan, 2023). Both the Malaysian findings and our results highlight the same gap: students may be concerned about plastic pollution but lack deeper understanding of microplastics. Addressing this deficiency requires structured education, media-based awareness campaigns, strict policy enforcement, and the replacement of conventional plastics with sustainable alternatives (Rajan, 2023).

Further parallels can be drawn with studies among pre-service teachers, where 91% advocated for greater education on microplastic pollution (Ervik & Taylor, 2024), and among Italian public health students, where awareness increased after exposure to an informative brochure (Cammalleri et al., 2020). Together, these findings underscore the effectiveness of targeted education and the role of young people as multipliers of environmental awareness.

Despite high concern (89%) and willingness to change habits (69%), reliance on single-use plastics persisted, with 67% frequently consuming bottled water and 48% using plastic packaging. Similar contradictions between awareness and behavior have been noted globally, where convenience and availability perpetuate plastic use despite widespread concern (Heidbreder et al., 2019). This tension highlights the influence of situational and habitual drivers, suggesting that educational strategies must be paired with structural interventions to reduce plastic dependency.

The findings are consistent with the Theory of Reasoned Action (TRA), which emphasizes attitudes as predictors of behavioral intentions. Recent evidence confirms that student's environmental concern significantly shapes their intentions to reduce plastic use, while subjective norms play little role (Zainudin et al., 2024). In line with this, our data revealed strong personal concern and willingness to act, but persistent reliance on single-use plastics indicates barriers beyond attitudes alone.

The Theory of Planned Behavior (TPB) further contextualizes these results. Evidence from Thai students indicates that attitudes drive intentions primarily in early stages of change, while perceived behavioral control consistently predicts behavior, and subjective norms matter only in pre-contemplation phases (Oludoye & Supakata, 2024).

Similarly, in our sample, practical barriers such as convenience and limited access to alternatives likely constrained students' ability to act on their intentions. Thus, interventions must integrate structural support with education to effectively shift behavior.

Qualitative evidence from German students indicates that microplastics are often conceptualized narrowly as small plastic particles linked to packaging, with mass media and the internet dominating as sources of knowledge (Raab & Bogner, 2021). Our findings mirrored these conceptions, including misconceptions about creation processes. This suggests a global pattern of partial understanding shaped by informal sources, reinforcing calls for formal curriculum integration (Pahl & Wyles, 2017).

A psychosocial review further emphasizes that knowledge is central to pro-environmental behavior, outweighing risk perception or perceived control (García-Vázquez & García-Ael, 2021). Our results support this: students who were aware of microplastics also demonstrated stronger willingness to change habits (69%). Importantly, 72% supported the integration of microplastics education into curricula, underscoring education's role in shaping long-term behavior.

The strong willingness to change habits (69%) and support for bans and curriculum integration highlight youth as key advocates for regulatory frameworks, echoing global momentum such as the UN's plastic treaty negotiations (Dreyer et al., 2024). However, as awareness alone is insufficient, comprehensive strategies are needed combining structured education, mass media campaigns, policy enforcement, and access to sustainable alternatives.

Future studies should employ longitudinal designs to assess behavior change post-intervention and broaden the scope to include diverse socioeconomic groups across cultural contexts. This would enhance understanding of how education, structural supports, and contextual factors interact to shape sustainable plastic use behaviors globally.

Conclusion

This study found that university students in Pakistan display moderate awareness and strong concern about microplastics, coupled with willingness to adopt eco-friendly practices. However, reliance on bottled water and plastic packaging reveals a persistent awareness–behavior gap driven by convenience and structural barriers. While education enhances concern and intention, it must be supported by accessible alternatives and effective policy measures. Universities can play a vital role by integrating microplastics education into curricula and modeling sustainable practices, while policymakers must provide affordable alternatives and enforce regulations. By empowering students as informed advocates and equipping them with knowledge and resources, both institutions can foster sustainable behaviors, bridge the gap between concern and action, and strengthen national responses to plastic pollution.

Data Availability Statement: Not Applicable.

Author Contributions: Each author contributes equally.

Informed Consent Statement: Not applicable on all context but for the infographics and review sought some help of advance generative AI.

Supplementary Materials: Not Applicable.

Funding: Not Applicable.

Institutional Review Board Statement: Not Applicable

Conflicts of Interest: No conflict of interest.

References

Ahmad, I., Ali, A., & Shabbir, K. (2025). Plastic Pollution, Treatment and Management Strategies in Pakistan: A Review. *Combating Plastic Pollution in Terrestrial Environment: Challenges and Strategies for a Sustainable Future*, 209-235.

Ali, N., Khan, M. H., Ali, M., Ahmad, S., Khan, A., Nabi, G., ... & Kyzas, G. Z. (2024). Insight into microplastics in the aquatic ecosystem: Properties, sources, threats and mitigation strategies. *Science of the Total Environment*, *913*, 169489.

Aminrad, Z., Zakariya, S. Z. B. S., Hadi, A. S., & Sakari, M. (2013). Relationship between awareness, knowledge and attitudes towards environmental education among secondary school students in Malaysia. *World Applied Sciences Journal*, *22*(9), 1326-1333.

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American psychologist*, *55*(5), 469.

Bradley, J. C., Waliczek, T. M., & Zajicek, J. M. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *The Journal of environmental education*, *30*(3), 17-21.

Cammalleri, V., Marotta, D., Antonucci, A., Protano, C., & Fara, G. M. (2020). A survey on knowledge and awareness on the issue" microplastics": a pilot study on a sample of future public health professionals. *Annali di Igiene, Medicina Preventiva e di Comunita*, *32*(5).

Charitou, A., Aga-Spyridopoulou, R. N., Mylona, Z., Beck, R., McLellan, F., & Addamo, A. M. (2021). Investigating the knowledge and attitude of the Greek public towards marine plastic pollution and the EU Single-Use Plastics Directive. *Marine pollution bulletin*, *166*, 112182.

Dissanayake, P. D., Kim, S., Sarkar, B., Oleszczuk, P., Sang, M. K., Haque, M. N., ... & Ok, Y. S. (2022). Effects of microplastics on the terrestrial environment: A critical review. *Environmental Research*, *209*, 112734.

Dreyer, E., Hansen, T., Holmberg, K., Olsen, T., & Stripple, J. (2024). *Towards a global plastics treaty: Tracing the UN negotiations*. Lund University.

Dumbili, E., & Henderson, L. (2020). Chapter 22-The challenge of plastic pollution in Nigeria, Editor (s): Trevor M. Letcher, Plastic Waste and Recycling.

Dunlap, R. E., & Van Liere, K. D. (2008). The" new environmental paradigm". *The journal of environmental education*, *40*(1), 19-28.

Eastman, L. B., Núñez, P., Crettier, B., & Thiel, M. (2013). Identification of self-reported user behavior, education level, and preferences to reduce littering on beaches–A survey from the SE Pacific. *Ocean & Coastal Management*, *78*, 18-24.

Ergen, A., Baykan, B. G., & Turan, S. G. (2015). Effect of materialism and environmental knowledge on environmental consciousness among high school students: A study conducted in Istanbul province. *International Journal of Human Sciences*, *12*(1), 511-526.

Ervik, H., & Taylor, S. (2024). Pre-service teachers' attitudes to and knowledge of marine plastic pollution and its impacts on the natural environment. *Journal of Cleaner Production*, *478*, 143950.

Funk, C., & Hefferon, M. (2019). US public views on climate and energy. *Pew Research Center*, *25*.

Garcia-Vazquez, E., & Garcia-Ael, C. (2021). The invisible enemy. Public knowledge of microplastics is needed to face the current microplastics crisis. *Sustainable Production and Consumption*, *28*, 1076-1089.

Hammami, M. B. A., Mohammed, E. Q., Hashem, A. M., Al-Khafaji, M. A., Alqahtani, F., Alzaabi, S., & Dash, N. (2017). Survey on awareness and attitudes of secondary school students regarding plastic pollution: implications for environmental education and public health in Sharjah city, UAE. *Environmental Science and Pollution Research*, *24*(25), 20626-20633.

Hammami, M. B. A., Mohammed, E. Q., Hashem, A. M., Al-Khafaji, M. A., Alqahtani, F., Alzaabi, S., & Dash, N. (2017). Survey on awareness and attitudes of secondary school students regarding plastic pollution: implications for environmental education and public health in Sharjah city, UAE. *Environmental Science and Pollution Research*, *24*(25), 20626-20633.

Heidbreder, L. M., Bablok, I., Drews, S., & Menzel, C. (2019). Tackling the plastic problem: A review on perceptions, behaviors, and interventions. *Science of the total environment*, *668*, 1077-1093.

Kong, D., Ytrehus, E., Hvatum, A. J., & Lin, H. (2014). Survey on environmental awareness of Shanghai college students. *Environmental Science and Pollution Research*, *21*(23), 13672-13683.

Mukhtar, S., Asad, A., Mumtaz, M., Saeed, A. U., Qadir, A., Ahmad, S. R., & Saeed, H. F. U. (2024). Role of knowledge and attitude of public and private school students for plastic pollution awareness, usage, and management in Lahore, Pakistan. *Journal of Material Cycles and Waste Management*, *26*(1), 175-183.

O'Brien, S., Rauert, C., Ribeiro, F., Okoffo, E. D., Burrows, S. D., O'Brien, J. W., ... & Thomas, K. V. (2023). There's something in the air: a review of sources, prevalence and behaviour of microplastics in the atmosphere. *Science of the Total Environment*, *874*, 162193.

Pahl, S., & Wyles, K. J. (2017). The human dimension: how social and behavioural research methods can help address microplastics in the environment. *Analytical Methods*, *9*(9), 1404-1411.

Raab, P., & Bogner, F. X. (2021). Conceptions of university students on microplastics in Germany. *Plos one*, *16*(9), e0257734.

RAJAN, S. (2023). A Preliminary Survey on Knowledge and Attitudes of University Students Regarding Microplastic Pollution and Its Impact on the Environment. *Malaysian Journal of Medicine and Health Sciences*.

Righi, S., Bergami, E., Simonini, R., & Prevedelli, D. (2024). Level of Awareness and Attitudes towards Plastic Contamination by Students of an Italian University. *Sustainability*, *16*(11), 4637.

Rosa, C. D., Profice, C. C., & Collado, S. (2018). Nature experiences and adults' self-reported pro-environmental behaviors: The role of connectedness to nature and childhood nature experiences. *Frontiers in psychology*, *9*, 1055.

Thacharodi, A., Meenatchi, R., Hassan, S., Hussain, N., Bhat, M. A., Arockiaraj, J., ... & Pugazhendhi, A. (2024). Microplastics in the environment: a critical overview on its fate, toxicity, implications, management, and bioremediation strategies. *Journal of Environmental Management*, *349*, 119433.

United Nations Development Programme (2020) The good, the bad and the ugly of plastics in Pakistan. Available at: https://www.undp.org/pakistan/blog/good-bad-and-ugly-plastics-pakistan (Accessed: 08 September 2025).

Vicente-Molina, M. A., Fernández-Sáinz, A., & Izagirre-Olaizola, J. (2013). Environmental knowledge and other variables affecting pro-environmental behaviour: comparison of university students from emerging and advanced countries. *Journal of Cleaner Production*, *61*, 130-138.

Yang, L., Zhang, Y., Kang, S., Wang, Z., & Wu, C. (2021). Microplastics in soil: A review on methods, occurrence, sources, and potential risk. *Science of the Total Environment*, *780*, 146546.

Zhao, B., Rehati, P., Yang, Z., Cai, Z., Guo, C., & Li, Y. (2024). The potential toxicity of microplastics on human health. *Science of The Total Environment*, *912*, 168946