



# Unveiling Microplastic Ignorance: A Study on Knowledge and Awareness Among Pune's Urban Population – A Mixed Method Approach

Manisha Mistry† and S. G. Joshi

Symbiosis College of Nursing, Symbiosis International University, Maharashtra, Pune, India

†Corresponding author: Manisha Mistry; manishamistry@scon.edu.in

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## ABSTRACT

Microplastic pollution has become a global concern with potentially severe environmental and health implications. This research explores the level of knowledge and awareness about microplastics among the urban population of Pune, a busy city in India. A mixed-methods approach was employed using a sequential explanatory design. In the first phase, qualitative data were gathered through semi-structured interviews with 18 participants selected via purposive sampling. In the second phase, quantitative data were collected from 100 participants using a survey and convenience sampling. By combining insights from surveys, interviews, and existing literature, the study analyzed the extent to which residents of Pune are informed about microplastic pollution and their willingness to take action. The findings highlight the need for increased awareness campaigns and educational initiatives to address the growing microplastic problem in urban areas. The study concludes that plastics have become an integral part of our lives, necessitating robust mechanisms to eliminate them from daily use.

## INTRODUCTION

Microplastics, those minuscule plastic particles measuring less than 5mm, have become pervasive in ecosystems globally, presenting a formidable environmental challenge (Thacharodi et al. 2023). Their origin is diverse, stemming from the breakdown of larger plastic items, industrial processes, and even personal care products (Ghosh et al. 2023). This ubiquity, however, is not without consequences, as microplastics pose significant threats to ecosystems, wildlife, and potentially human health, as highlighted by Blackburn and Green (2022).

Even in urban landscapes like Pune, the microplastic crisis has found a foothold. The combination of high population density, industrial activities, and prevalent lifestyle patterns significantly contributes to microplastic pollution in such urban areas (Mondal et al. 2023). Understanding the extent of awareness and knowledge about microplastics among the residents of selected urban areas in Pune becomes crucial in formulating strategies to combat this pervasive issue.

Larger plastic items, products of our convenience-driven lifestyles, succumb to the relentless forces of degradation, fragmenting into minuscule particles that persist in the environment (Li et al. 2023). Industrial processes, the backbone of modern economies, release these particles into the air and water, further disseminating them across vast landscapes (Prasittisopin et al. 2023). Even seemingly benign personal care products, laden with microplastics for texture and exfoliation, contribute to this environmental drama, adding to the complexity of the issue (Gomez-Gonzalez et al. 2023).

These minute invaders, invisible to the naked eye, traverse ecosystems with alarming ease, finding their way into terrestrial and aquatic realms alike (Surendran

et al. 2023). As they infiltrate these environments, they pose a potent threat to the delicate balance that sustains diverse ecosystems. From the depths of oceans to the heart of urban landscapes, microplastics have become unwelcome guests, disrupting natural processes and threatening the biodiversity that depends on them (Thacharodi et al. 2023).

Wildlife, from the tiniest organisms to majestic creatures, faces unforeseen challenges as microplastics become intertwined with their habitats (Sarkar et al. 2023). Moreover, as microplastics traverse the trophic levels, they become an inadvertent part of the human food chain (Al Mamun et al. 2023). Recent research has begun shedding light on the potential implications for human health, introducing a new dimension to the microplastic crisis. As these particles make their way into the food we consume, questions about the long-term consequences on human well-being and health are becoming increasingly urgent (Sun & Wang 2023).

This exploration into the microplastic conundrum seeks not only to unravel the complexities of its genesis and dispersion but also to underscore the urgency of collective action (Ghosh et al. 2023). It is a call to arms to address this silent threat that has permeated the very essence of our interconnected world. Through a deeper understanding of microplastics, their sources, and their far-reaching consequences, we can pave the way for informed strategies and collaborative efforts to mitigate their impact on ecosystems, wildlife, and human health. The journey into the heart of the microplastic challenge is not just an exploration; it is an imperative step toward safeguarding the delicate equilibrium that sustains life on our planet (Sharma et al. 2023).

The first step in addressing the microplastic challenge in urban areas is understanding the level of awareness among residents (Wani et al. 2023). Many may not be fully cognizant of the implications of microplastic pollution, assuming it to be a distant concern. This lack of awareness may stem from a limited understanding of the sources and consequences of microplastics (Ghosh et al. 2023). Consequently, educational initiatives are paramount to enlighten the public about the pervasive nature of these particles and their detrimental effects on the environment (Araújo et al. 2023).

Building awareness could involve implementing educational campaigns through various mediums, such as workshops, community events, and online platforms (Dittmann et al. 2023). Collaborating with schools, universities, and local community organizations can be instrumental in disseminating information about microplastics. Workshops can delve into the sources, impact, and potential solutions to microplastic pollution (Danopoulos et al. 2023). Furthermore, educational materials, such as

brochures and videos, can be distributed to reinforce the knowledge gained during these sessions (López 2023).

However, awareness alone may not suffice. Concrete strategies are needed to combat microplastic pollution actively (Tian et al. 2023). One effective approach involves reducing the sources of microplastics in urban areas. This could involve tighter regulations on industrial discharges, promoting the use of eco-friendly materials in manufacturing processes, and encouraging the development of sustainable alternatives to common products that contribute to microplastic pollution. Additionally, waste management practices play a crucial role in mitigating microplastic pollution (Hettiarachchi & Meegoda 2023). Enhancing recycling facilities, implementing strict waste disposal regulations, and encouraging responsible consumer behavior are essential steps. Municipal authorities can work towards implementing efficient waste collection systems and promoting the segregation of plastic waste at its source (Subashini et al. 2023).

### Need for the study

**Global environmental challenge:** Microplastics, originating from diverse sources such as the breakdown of larger plastic items, industrial processes, and personal care products, have become ubiquitous in ecosystems globally. Their presence poses significant threats to ecosystems, wildlife, and potentially human health (Klingelhöfer et al. 2020).

**Urban Contribution:** Urban landscapes, exemplified by cities like Pune, face a heightened microplastic crisis due to factors such as high population density, industrial activities, and prevalent lifestyle patterns. Understanding the extent of awareness among urban residents is crucial in formulating effective strategies to combat this issue (Sugiura et al. 2021).

**Consequences of microplastics:** Larger plastic items break down into minuscule particles that persist in the environment. These particles, released into the air and water through industrial processes, infiltrate ecosystems with alarming ease, disrupting natural processes and threatening biodiversity (Van Tran et al. 2023).

**Wildlife and human impact:** Microplastics pose challenges to wildlife as they become intertwined with habitats and enter the human food chain. Recent research suggests potential implications for human health, raising urgent questions about the long-term consequences of microplastic consumption (Gündogdu et al. 2023).

Studying the level of knowledge among urban populations regarding microplastics is imperative due to the profound environmental impact of these minuscule plastic particles. Microplastics, measuring less than 5mm, have become

pervasive in urban ecosystems, stemming from various sources such as the breakdown of larger plastic items, industrial processes, and personal care products. The concentration of these particles is exacerbated in urban areas due to high population density, industrial activities, and prevalent lifestyle patterns.

Understanding the knowledge levels of urban residents is crucial for several reasons. Firstly, awareness acts as a catalyst for informed decision-making. Many individuals may not comprehend the implications of microplastic pollution, assuming it to be a distant concern. This lack of awareness may hinder collective efforts to address the issue. Secondly, informed citizens are more likely to actively participate in mitigation strategies. By understanding the sources and consequences of microplastics, urban dwellers can contribute to reducing their environmental footprint.

Moreover, as microplastics infiltrate ecosystems and the food chain, studying urban knowledge levels becomes a key component in addressing potential health risks for the population. In essence, studying the level of knowledge among urban people regarding microplastics is essential for fostering a sense of responsibility, promoting informed decision-making, and mobilizing collective action to combat the pervasive environmental challenge posed by these microscopic pollutants.

**MATERIALS AND METHODS**

**Sequential Explanatory Design**

To assess the knowledge and awareness of microplastics among urban residents of Pune, a structured questionnaire was designed. The survey contained multiple-choice questions, Likert scale statements, and open-ended questions, covering topics such as the definition of microplastics, sources, effects on the environment, and personal behaviors related to plastic use.

**Sample Selection**

Residents of three diverse urban areas in Pune were selected as the study population: Shivajinagar and Pimpri-Chinchwad. For the first phase (qualitative), the purposive sampling technique (sampling till saturation) was used to select 18 samples. In the second phase (quantitative), Convenience sampling was used to select 100 samples.

**Data Collection**

In the first phase, a semi-structured questionnaire was used to collect data from 18 samples, and the survey was administered to 100 participants from various age groups, professions, and educational backgrounds. The participants

Table 1: Demographic data of the participants (Phase 1).

n=18

S.No.	Demographic variables (Phase 1)	f	%
<b>Age (Yr)</b>			
a	18-24	0	0
b	25-34	4	22
c	35-44	8	44
d	45-54	4	22
e	55-64	2	11
f	65 and over	0	0
<b>Gender</b>			
a	Male	12	67
b	Female	6	33
<b>Education Level</b>			
a	Profession or honors	1	6
b	Graduate	8	44
c	Intermediate or diploma	6	33
d	High school certificate	3	17
e	Middle school certificate	0	0
f	Primary school certificate	0	0
g	Illiterate	0	0
<b>Occupation</b>			
a	Professionals	9	50
b	Technicians & Associate Professionals	1	6
c	Clerks	0	0
d	Skilled Workers and Shop & Market Sales Workers	3	17
e	Craft & Related Trade Workers	0	0
f	Plant & Machine Operators and Assemblers	0	0
g	Elementary Occupation	0	0
h	Unemployed	5	28
<b>Household Income</b>			
a	≥ 20482	1	6
b	10,241-20,481	4	22
c	7681-10,240	5	28
d	5120-7680	6	33
e	3072-5119	2	11
f	1034-3071	0	0
g	≤ 1033	0	0
<b>Marital Status</b>			
a	Single	1	6
b	Married	15	83
c	Divorced	1	6
d	Widowed	1	6

Table Cont....

S.No.	Demographic variables (Phase 1)	f	%
<b>Number of Household Members</b>			
a	1	0	0
b	2	4	22
c	3	9	50
d	4	4	22
e	5 or more	1	6
<b>Length of Residence in Urban Area</b>			
a	Less than 1 year	0	0
b	1-5 years	1	6
c	6-10 years	12	67
d	11-15 years	3	17
e	16-20 years	2	11
f	Over 20 years		
<b>Access to Information Sources (Can have more than one response)</b>			
a	Internet access at home	14	78
b	Smartphone	18	100
c	Regularly watch TV	11	61
d	Read newspapers/magazines	6	33
e	None of the above	0	0
<b>Do you have Environmental Awareness?</b>			
a	Yes	18	100
b	No	0	0
c	Never	0	0

were approached in public spaces, parks, and residential neighborhoods. Additionally, interviews with key informants, such as environmentalists and educators, were conducted to gain deeper insights into the issue. The demographic data of the participants is presented in Tables 1 and 2.

## RESULTS

### Qualitative Analysis

Qualitative analysis was done using thematic analysis, where we identified recurring themes based on the responses provided by 15 participants to the four questions concerning microplastics and their potential impact on health and the environment.

#### Question 1: Explain how microplastics can enter the human body and potentially affect health.

##### Themes:

**Ingestion as the primary route:** The majority of participants emphasized that microplastics can enter the human body primarily through ingestion. They highlighted that consumption of contaminated food and water is the main

pathway for exposure. This theme underlines a common understanding among participants about the ingestion route.

**Inhalation and skin contact:** Some participants mentioned lesser-known pathways, such as inhalation of airborne microplastics and skin contact, but these were less frequently discussed. The theme of inhalation and skin contact highlighted participants' awareness of alternative routes of exposure.

**Health concerns:** Many participants expressed concerns about the potential health effects of microplastic ingestion. Themes included worries about digestive system issues, inflammation, and the possibility of microplastics carrying harmful chemicals. This theme reflected the participants' recognition of the potential risks associated with microplastics.

#### Question 2: Describe the impact of microplastic pollution on marine ecosystems and its indirect effects on human health.

##### Themes:

**Marine ecosystem impact:** A prevalent theme in participants' responses was their understanding of the detrimental effects of microplastics on marine ecosystems. They emphasized the ingestion of microplastics by marine life, bioaccumulation, entanglement, and disruptions in the marine food chain as primary impacts.

**Transfer to human health:** Participants consistently recognized the indirect effects on human health through the consumption of contaminated seafood. This theme highlighted participants' understanding of the potential transfer of toxins from marine organisms to human consumers.

**Connectedness of ecosystems:** Some participants highlighted the interconnectedness of marine and human health, emphasizing the importance of protecting the oceans to safeguard human well-being. This theme revealed participants' awareness of the broader ecological consequences of microplastic pollution.

#### Question 3: Suggest practical steps individuals can take to reduce their exposure to microplastics in their daily lives.

##### Themes:

**Avoid single-use plastics:** The most common theme in participants' responses was the recommendation to avoid single-use plastics. Participants emphasized reducing plastic waste through responsible consumption, indicating a strong emphasis on individual actions.

**Choose microplastic-free products:** Many participants suggested choosing products labeled as "microplastic-free" or "microbead-free" to minimize exposure. This theme underscored the role of informed consumer choices in reducing exposure.

**Eco-friendly habits:** Several participants advocated for eco-friendly habits, including recycling, using reusable containers and bags, and supporting policies that reduce plastic pollution. This theme reflected participants' recognition of the broader behavioral changes needed to address microplastic pollution.

**Question 4: Explain the challenges associated with measuring the exact health impacts of microplastics on humans, considering their prevalence in the environment.**

**Themes:**

**Complex causality:** Participants consistently acknowledged the complexity of establishing direct causality between microplastic exposure and health impacts. They recognized that various confounding factors make it challenging to attribute health issues solely to microplastics.

**Tracing origins and long-term effects:** Some participants highlighted the difficulty in tracing the origins of microplastics and assessing their long-term effects on human health. They emphasized the need for long-term studies. This theme demonstrated participants' awareness of the intricacies of studying microplastic health impacts.

Table 2: Demographic data of the participants (Phase 2).

n=100

S.No.	Demographic variables (Phase 2)	f	%
<b>Age (Yr):</b>			
a	18-24	12	12
b	25-34	32	32
c	35-44	13	13
d	45-54	32	32
e	55-64	6	6
f	65 and over	5	5
<b>Gender:</b>			
a	Male	26	26
b	Female	74	74
<b>Education Level:</b>			
a	Profession or honors	6	6
b	Graduate	18	18
c	Intermediate or diploma	15	15
d	High school certificate	12	12
e	Middle school certificate	33	33
f	Primary school certificate	14	14
g	Illiterate	2	2
<b>Occupation:</b>			
a	Professionals	9	9
b	Technicians & Associate Professionals	6	6

Table Cont....

S.No.	Demographic variables (Phase 2)	f	%
c	Clerks	4	4
d	Skilled Workers and Shop & Market Sales Workers	19	19
e	Craft & Related Trade Workers	21	21
f	Plant & Machine Operators and Assemblers	17	17
g	Elementary Occupation	9	9
h	Unemployed	15	15
<b>Household Income:</b>			
a	≥ 20482	15	15
b	10,241-20,481	12	12
c	7681-10,240	37	37
d	5120-7680	25	25
e	3072-5119	9	9
f	1034-3071	2	2
g	≤ 1033	0	0
<b>Marital Status:</b>			
a	Single	14	14
b	Married	78	78
c	Divorced	0	0
d	Widowed	8	8
<b>Number of Household Members:</b>			
a	1	12	12
b	2	45	45
c	3	21	21
d	4	9	9
e	5 or more	13	13
<b>Length of Residence in Urban Area:</b>			
a	Less than 1 year	2	2
b	1-5 years	19	19
c	6-10 years	32	32
d	11-15 years	26	26
e	16-20 years	9	9
f	Over 20 years	12	12
<b>Access to Information Sources (Can have more than one response)</b>			
a	Internet access at home	61	61
b	Smartphone	80	80
c	Regularly watch TV	56	56
d	Read newspapers/magazines	43	43
e	None of the above	0	0
<b>Do you have Environmental Awareness:</b>			
a	Yes	100	100
b	No	0	0
c	Never	0	0

**Research rigor and collaboration:** There was a consensus on the importance of rigorous scientific research and the standardization of analysis methods to address challenges in measuring health impacts. Participants also recognized the need for interdisciplinary collaboration. This theme highlighted the participants' understanding of the need for a comprehensive and well-coordinated scientific approach.

### Outcome

The thematic qualitative analysis of participants' responses to the four questions on microplastics revealed clear

and recurring themes. Participants displayed a solid understanding of how microplastics can enter the human body and the potential health effects. They also recognized the impact of microplastic pollution on marine ecosystems and understood the practical steps individuals can take to reduce exposure. Moreover, participants acknowledged the complexity of studying health impacts and the need for rigorous research and collaboration.

This analysis underscores the importance of informed individual actions and rigorous scientific research in addressing the challenges posed by microplastic pollution. Participants' responses reflect a general awareness of the

Table 3: Knowledge level of participants regarding microplastics (Phase 2).

n=100

Section	Items	f	%
<b>I</b>	<b>Understanding Microplastics:</b>		
1.	What are microplastics?	23	23
2.	What are some potential sources of microplastics in the environment?	27	27
3.	Which type of microplastic is typically more harmful to marine life due to its smaller size and ease of ingestion?	25	25
4.	In which of the following products can microplastics be commonly found?	34	34
5.	How can individuals reduce their exposure to microplastics in their daily lives?	45	45
6.	What is one potential risk of microplastic contamination in seafood?	19	19
7.	What is one way to minimize the release of microplastics from synthetic clothing during washing?	20	20
<b>II</b>	<b>Health Concerns and Effects:</b>		
1.	How do microplastics primarily enter our bodies?	33	33
2.	What health concerns are associated with the ingestion of microplastics?	27	27
3.	How can individuals reduce their exposure to microplastics from personal care products?	50	50
4.	What are some potential health concerns associated with the ingestion of microplastics?	14	14
5.	How can individuals reduce their exposure to products containing microplastics?	40	40
<b>III</b>	<b>Common Sources and Products:</b>		
1.	Which of the following is NOT a common source of microplastic pollution in the environment?	52	52
2.	In addition to personal care products, where else can microplastics be found in our daily lives?	49	49
3.	Which of the following personal care products may contain microplastics?	59	59
4.	What is one potential health concern associated with the ingestion of microplastics?	43	43
5.	What precautionary steps can individuals take to reduce their exposure to products containing microplastics?	58	58
<b>IV</b>	<b>Regulatory and Research Bodies:</b>		
1.	Which organization plays a significant role in researching and regulating microplastic pollution?	28	28
2.	What role can individuals play in reducing the release of microplastics into the environment?	18	18
3.	What is one-way individuals can reduce their exposure to microplastics from personal care products?	25	25
4.	How can microplastics be removed from water sources and the environment?	27	27
<b>V</b>	<b>Public Awareness and Education:</b>		
1.	How can individuals reduce their exposure to microplastics in their daily lives?	71	71
2.	What are some potential health concerns associated with the ingestion of microplastics?	46	46
3.	How can individuals reduce their exposure to microplastics from personal care products?	52	52
4.	What is one way to minimize the release of microplastics from synthetic clothing during washing?	19	19
<b>VI</b>	<b>True or False Statements:</b>		
1.	Microplastics are only found in the ocean and not in freshwater sources.	57	57
2.	Inhaling airborne microplastics poses no potential health risks to humans.	38	38
3.	Microplastics in seafood cannot be transferred to humans who consume them	40	40
4.	Synthetic clothing does not contribute to the release of microplastics into the environment during washing	59	59
5.	Microplastics are easily biodegradable and do not persist in the environment for long periods.	50	50
6.	Microplastics are only a concern for marine ecosystems and do not affect terrestrial environments	67	67
7.	Microplastics are only a concern for marine ecosystems and have no impact on human health	52	52
8.	Microplastics are easily biodegradable and do not persist in the environment for long periods	59	59

multifaceted nature of this issue and the interconnectedness of environmental and human health.

### Quantitative Analysis

The semi-structured questionnaire was divided into 6 sections viz: Understanding Microplastics, Health Concerns and Effects, Common Sources and Products, Regulatory and Research Bodies, Public Awareness and Education (Table 3).

**Understanding microplastics:** The responses from participants in the urban area of Pune to questions about microplastics reflect a notable level of awareness and concern about environmental issues. Regarding the fundamental question of “What are microplastics?” 23% of participants responded, indicating a basic understanding of the concept. The question on potential sources of microplastics saw a slightly higher engagement, with 27% of participants offering insights into environmental origins. Notably, 25% of participants demonstrated awareness of the specific types of microplastics that pose greater harm to marine life due to their smaller size and ease of ingestion. A substantial 34% of respondents recognized the common products where microplastics are found, indicating a heightened awareness of their prevalence in everyday items. The question on individual actions to reduce exposure to microplastics garnered the highest response rate, with 45% of participants contributing, showcasing a keen interest in adopting practices to minimize personal impact. The potential risk of microplastic contamination in seafood saw responses from 19% of participants, suggesting a moderate level of concern for the impact on the food chain. Lastly, 20% of participants provided insights into minimizing the release of microplastics from synthetic clothing during washing, reflecting a reasonable level of awareness about preventive measures. Overall, the responses suggest a moderate level of environmental awareness among urban participants in Pune regarding microplastics and a willingness to engage in practices that contribute to reducing their environmental footprint.

**Health concerns and effects:** The responses from participants in the urban area of Pune to questions regarding the entry of microplastics into our bodies and associated health concerns reveal a significant level of awareness and concern. A notable 33% of participants provided insights into how microplastics primarily enter our bodies, indicating a heightened awareness of the pathways of exposure. When asked about health concerns associated with the ingestion of microplastics, 27% of participants demonstrated knowledge of the potential risks, showing a commendable understanding of the implications for human health. A particularly high engagement was observed in the question about reducing

exposure to microplastics from personal care products, with 50% of participants providing responses suggesting a strong interest in adopting practices that minimize exposure through daily routines. However, for potential health concerns associated with microplastic ingestion, the response rate was comparatively lower at 14%, indicating a need for increased awareness of this specific aspect. The question on reducing exposure to products containing microplastics saw a substantial 40% participation, highlighting a significant level of awareness and interest in adopting measures to minimize the use of such products. Overall, the responses reflect a commendable level of understanding among urban participants in Pune regarding the pathways of exposure, health concerns, and proactive measures to mitigate the impact of microplastics on personal well-being.

**Common sources and products:** The responses from participants in the urban area of Pune to questions about microplastic sources, their presence in daily life, health concerns, and preventive measures indicate a commendable level of awareness. A significant 52% of participants correctly identified which option is NOT a common source of microplastic pollution, showcasing a strong understanding of potential environmental contributors. The question about the presence of microplastics in daily life, beyond personal care products, saw a notable 49% engagement, indicating a broad awareness of the diverse sources of microplastics in our surroundings. A high 59% of participants accurately identified personal care products that may contain microplastics, reflecting a keen awareness of specific items contributing to environmental pollution. When asked about potential health concerns associated with microplastic ingestion, 43% of participants provided insights, highlighting a noteworthy understanding of the potential risks to human health. The question on precautionary steps to reduce exposure to products containing microplastics witnessed an impressive 58% participation, showcasing a proactive attitude among participants in adopting measures to minimize personal impact. Overall, the responses suggest a robust level of knowledge and awareness among urban participants in Pune regarding the sources, presence, health implications, and preventive strategies related to microplastics in the environment.

**Regulatory and research bodies:** The responses from participants in the urban area of Pune to questions related to microplastic research, regulation, individual responsibilities, and environmental remediation reflect a varying degree of awareness. About 28% of participants correctly identified an organization playing a significant role in researching and regulating microplastic pollution, indicating a moderate level of awareness regarding entities engaged in addressing

this environmental concern. The question about the role individuals can play in reducing the release of microplastics into the environment saw an 18% participation rate, suggesting that there may be room for increased awareness and understanding of personal responsibilities in mitigating microplastic pollution. Inquiring about ways individuals can reduce their exposure to microplastics from personal care products garnered a 25% response rate, highlighting a moderate interest in adopting practices to minimize personal impact. Finally, the question on the removal of microplastics from water sources and the environment saw a 27% participation rate, indicating a fair level of awareness regarding potential methods for mitigating the presence of microplastics in ecosystems. Overall, the responses suggest a weaker understanding in the context of microplastic research, individual roles, and environmental remediation.

**Public awareness and education:** The responses from participants in the urban area of Pune to questions addressing microplastic exposure and associated health concerns reveal a strong awareness among the community. A substantial 71% of participants provided insights into how individuals can reduce their exposure to microplastics in their daily lives, indicating a high level of interest and understanding in adopting practices that mitigate personal impact. However, the question on minimizing the release of microplastics from synthetic clothing during washing had a lower response rate of 19%, suggesting a potential area for increased awareness and education on specific preventive measures. Overall, the responses reflect a commendable level of awareness and a proactive attitude among urban participants in Pune regarding strategies to reduce personal exposure to microplastics and an understanding of the associated health concerns. The responses from participants in the urban area of Pune to the true/false questions on microplastics indicate a varied level of understanding and awareness. The majority, 57%, correctly recognized that microplastics are not exclusive to the ocean and can also be found in freshwater sources, demonstrating a solid understanding of the ubiquitous nature of microplastic pollution. However, a significant 38% believed that inhaling airborne microplastics poses no potential health risks, suggesting a potential area for increased awareness regarding the potential health implications of airborne microplastics. Regarding synthetic clothing and microplastics released during washing, a substantial 59% incorrectly believed that synthetic clothing does not contribute to environmental microplastic pollution, suggesting a misconception in this specific area. Finally, 67% of participants incorrectly believed that microplastics are only a concern for marine ecosystems and do not affect terrestrial environments, while 52% incorrectly thought that microplastics have no impact on human health, highlighting areas for improved

education on the broader implications of microplastics across ecosystems and human health. Overall, the responses suggest a need for targeted awareness campaigns to address specific misconceptions and enhance understanding regarding microplastics and their multifaceted impact.

## DISCUSSION

The findings from our study reveal a significant level of awareness and understanding of microplastic pollution among Pune's urban population. Notably, 34% of respondents demonstrated good awareness by recognizing common products where microplastics are frequently found. This level of awareness mirrors the findings of Rahman et al. (2023), who observed similar awareness levels in their study. Additionally, the question addressing individual actions to reduce exposure to microplastics received the highest response rate, with 45% of participants actively contributing ideas. This trend aligns with the study by McMullen et al. (2023), where participants also showed a high level of engagement in reducing their microplastic exposure.

Our findings also concur with those of Thornton Hampton et al. (2022), indicating a commendable understanding of the potential health risks associated with the ingestion of microplastics, with 27% of participants demonstrating knowledge in this area. This understanding is crucial in driving public health initiatives and policy changes to mitigate the adverse effects of microplastic consumption. Furthermore, 52% of participants correctly identified an option that is not a common source of microplastic pollution. This highlights a robust understanding of potential environmental contributors among the surveyed population. A similar observation was made in the study conducted by Kneel et al. (2023). Moreover, an impressive 71% of participants provided insightful responses regarding how individuals can reduce their daily exposure to microplastics. This indicates both a high level of interest and a comprehensive understanding of practical measures to mitigate personal impact. The study by Wu et al. (2023) also found that participants exhibited an extraordinary understanding of plastic pollution and its effects on health.

These findings underscore the importance of continued awareness campaigns and educational initiatives to further enhance the public's understanding of microplastic pollution and encourage proactive measures to reduce its impact. By fostering a well-informed populace, we can better address the growing microplastic problem in urban areas and implement effective strategies for sustainable living.

## CONCLUSION

The survey results underscore a concerning gap in the understanding of microplastics among Pune's urban



population. While participants were familiar with the term, their knowledge about the sources and consequences of microplastic pollution was notably limited. This revelation indicates a critical need for targeted educational programs to dispel misconceptions and enhance awareness about the intricate nature of microplastics.

Particularly troubling is the lack of awareness regarding microplastics originating from personal care products, which are extensively used by urban residents. This oversight is significant as personal care products contribute substantially to microplastic pollution. Raising awareness about the presence of microplastics in these commonly used items becomes imperative to mitigate their release into the environment. Educational initiatives should, therefore, specifically address the overlooked aspect of personal care products to bridge this awareness gap.

Furthermore, the research highlights a disconcerting inconsistency between knowledge and behavior among urban residents. While there is a recognition of microplastic pollution, this awareness often fails to translate into responsible actions. This disparity emphasizes the complexity of behavioral change and underscores the need for more comprehensive efforts to promote environmentally responsible practices. Strategies should encompass reducing single-use plastic consumption and improving recycling habits.

The overall findings illuminate a larger challenge-limited knowledge and awareness persist despite the evident presence of microplastic pollution in the urban surroundings of Pune. This knowledge-behavior gap accentuates the urgency for extensive awareness campaigns and educational initiatives. These efforts should not only aim to clarify misconceptions about microplastics but also emphasize the adoption of responsible practices and the reduction of microplastic sources.

In conclusion, addressing the microplastic crisis in urban areas like Pune requires a multifaceted approach. Comprehensive awareness campaigns and educational initiatives are essential to close the knowledge gap, correct misconceptions, and instigate behavioral change. By taking significant steps in these directions, urban communities can actively contribute to combating the microplastic crisis, thereby safeguarding the environment and public health.

## RECOMMENDATIONS

### Public Awareness Campaigns

Local authorities, environmental organizations, and educational institutions should collaborate to launch public awareness campaigns focusing on microplastic pollution.

These campaigns can include workshops, seminars, and informational materials targeting residents of urban areas like Pune.

### Integration into Educational Curriculum

Microplastic education should be integrated into the school curriculum to ensure that children are educated about this issue from a young age. This will help create a future generation that is more aware and responsible.

### Regulation of Personal Care Products

Government bodies should regulate the use of microplastics in personal care products, ensuring that manufacturers disclose the presence of such particles in their products. Simultaneously, consumers should be educated about choosing micro-plastic-free alternatives.

### Recycling and Plastic Reduction Initiatives

Encouraging residents to reduce their plastic consumption and adopt sustainable waste disposal practices is critical. Local authorities should implement recycling programs and incentivize responsible plastic use through policies and incentives.

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