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Consumer awareness, perception, and attitudes toward microplastic contamination in salts

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Abstract

The microplastic pollution in food stuff specifically salt has emerged as a new environmental and health issue on a global level. It was research that evaluated the level of consumer awareness, perception, and attitudes to microplastic contamination in salt products and analyzed the correlation between these variables. Quantitative design was used which is descriptive and correlational, where 281 adult consumers aged 18 and above were sampled in Balaoan, La Union. The survey questionnaire with validated items on demographic characteristics, awareness of microplastics in salt, the perceived risk, and attitude towards consumption or avoidance of potentially contaminated products was used to collect the data. Data analysis was done using descriptive statistics and Spearman rank correlation. It was found that consumers were moderately aware of microplastic contamination in salts, and generally had a high perception of the severity of the problem and perception of avoidance behavior. There was a positive significant relationship between educational attainment and awareness and attitude as compared to age and civil status which had little or no effect on most of the variables. Consumer responses were also not very much connected to employment status. The analysis of the correlation showed a moderate positive and statistically significant correlation between awareness and perception and correlation between perception and attitude, which implies that increased risk perception (because of higher awareness) would contribute to better protective attitudes. The results indicate the significance of improving the awareness of the population as the basis of the perception of risks and the promotion of responsible consumerism. The study recommends community-based education, improved labeling, and policy interventions to reduce exposure to microplastics and promote safer salt consumption practices.

Keywords: consumer awareness, microplastics, perception and attitudes, salt contamination

Consumer awareness, perception, and attitudes toward microplastic contamination in salts

1. Introduction

Microplastics have become increasingly prevalent in terrestrial and aquatic ecosystems, posting a significant challenge to ecological balance, wildlife health, and ultimately, human well-being. Microplastics is an emerging global concern. Several studies have reported on the existence of microplastic pollution, especially in the aquatic environment (Setyo Budi et al.,2021). Friot D. et al. (2017) illustrates the presence of microplastics in the aquatic biosphere stating that microplastics are found globally in the marine environment at all depths- in coastal areas and remote locations. Microplastics can float in the water column, settle into marine sediments, or be consumed by organisms and enter the marine food web. Further, Nkin (2025), claims that minute fragments of decomposed plastics, together with fibers lost from synthetic fibers and microbeads from cosmetics- all categorized as microplastics- have been discovered by scientists lurking in oceans, lakes, soil, and even the air; being consumed by organisms ranging from plankton, to mollusks, to fish, and to people; potentially posing a severe health risk to animals and ecosystems. As plastic production grows exponentially- from two million metric tons yearly in 1950 to more than 300 million metric tons today, and a predicted 33 billion metric tons annually by 2050- the issue is only anticipated to worsen.

The study of Bonifacio, et al., (2022) revealed abundant microplastics in sediments and in the three species of bivalve individuals from the wild. All clams ingested low-density polyethylene (LDPE) microplastic particles in the laboratory. In addition, the study of Ringcodan (2025) about microplastic contamination in selected fish species revealed that tilapia has the highest number of microplastics, 98 microplastic particles. Also, microplastics have been found in 90% of commercial salts obtained from 35 countries across five continents (Peixoto et al., 2019). Worldwide, salt is the most used ingredient in food, as an additive, for taste, preservation and other functional effects (Henney et. al., 2010). On a global scale, salt consumption can reach up to 10 grams exceeding the recommended World Health Organization's (WHO) daily intake of 5 grams (World Health Organization, 2012; Mozaffarian et al., 2014; EFSA, 2019; FDA, 2020) All sea salts assessed in 5 countries coasting the mediterranean basin were contaminated with microplastics (Bou-Mitri et al., 2021; Renzi & Blaskovic, 2018; Ajith et al., 2020; Fadare et al.,2021).

The Philippines had a thriving salt industry in the 1990s at the apex of salt production. Nearly 85% of the annual salt requirement of the country was locally sourced especially in three provinces of Bulacan, Pangasinan, Occidental Mindoro and Cavite (Francisco et al. 2022). In Region I, all provinces are active in the salt production, with a total of 31.93% of the national production. Pangasinan alone accounts for some 95% of such production. The biggest salt farm in Pangasinan produces about 20,000 MT of salt which is a significant contribution to the total annual salt production of about 60,000 MT of Pangasinan. However, after being recently closed, the salt production of the province has drastically reduced to 36,000 MT. The municipality of Dasol dominates the salt production with 39.35% followed by Alaminos with 18.61% and Bani with 17.52%, Infanta with 14.90%, and minimal contribution of other municipalities like Anda, Bolinao, Mangaldan, and San Fabian. Ilocos Norte and Ilocos Sur have low productivity despite the large number of salt producers.In addition, Ilocos is among the few that adopt the traditional leached brine boiling method of salt production (Francisco et al. 2022). Despite the prevalence of salt consumption in the daily diet of Americans, there has been no full-scale study of salt packaged and sold in this area for the occurrence of microplastics in salt. This lack of knowledge represents an opportunity to research the presence of microplastics in salt and evaluate the level of awareness to consumers. As such, the study "Consumer Awareness, Perception, and Attitudes Toward Microplastic Contamination" was conceptualized.

Framework of the Study - This study is guided by the following theories. This study applies the **Knowledge-Attitude-Practice (KAP) Model** to understand the role of consumer awareness in relation to microplastic

contamination in salts. According to the KAP Model, knowledge is one of the underlying factors that shapes the attitude and future behavior (Launiala, 2009). Consumer awareness, in this case, is the level at which people know the origin, availability, and even possible impacts of microplastics in food-grade salt on health. Studies have demonstrated that microplastics are present in a high concentration in a large portion of salt products including sea salt because of the rampant contamination of the oceans (Koelmans et al., 2018). Nevertheless, this does not imply that the problem is well-known to many consumers, which is why they cannot make informed and health-conscious choices (Wang et al., 2021).

In order to determine the consumer perception and reaction to the risk of microplastics in salts, this research relies on the Psychometric Paradigm of Risk Perception. Originally formulated by Slovic (1987), this framework highlights the fact that the perception of risk is influenced by subjective aspects, including the familiarity with the hazard, the amount of dread that it produces, voluntariness of exposure, and the amount of control that individuals perceive over the risk. In the case of microplastics, the risk can be perceived as high when scientific research is not yet fully developed because the perception of the risk in terms of being unnatural or harmful may be perceived (Barrett et al., 2020). Risk perception can be exaggerated or reduced according to the manner in which information is conveyed and the reliability of those who pass the message. Consequently, perception would be an important factor to impact consumer behaviors the ones who perceive the contamination as something serious might avoid specific salt brands or choose others that are positioned as microplastic-free or sustainably processed. This model will be fundamental in the context of psychological aspects of consumer response without clear health outcomes.

This model is based on Theory of Planned Behavior (TPB) that explains that behavioral intentions are the determinants of individual behavior, which is in its turn predetermined by the attitudes towards the behavior, the perceived social norms, and the perceived behavioral control (Ajzen, 1991). In this research, the consumer attitudes concerning salt products that could have microplastics are the point of investigation. The attitudes are perceived as positive or negative evaluative judgments that are developed as a result of knowledge, emotional response and personal beliefs with regard to possible health outcome (Eagly and Chaiken, 1993). Concern about health or environmental sustainability may also be the cause of a negative attitude associated with a preference to purchase safer and more eco-friendly salts, i.e., eco-labeled or refined salts, which in turn can have a direct effect on the choice of purchase (Hermabessiere et al., 2017). The framework enables researchers to determine the levels to which deeply held beliefs and values are converted into consumption patterns in environmental contaminatio context.

The research contains a logical progression that starts with the features of the consumer, then moves to the evaluation of the process analytically, and finally, results that are policy-based. Due to the structure given in the research paradigm (Figure 1), the framework implies that the level of awareness and perception can be analyzed through the analysis of the demographic background of consumers that ultimately affect the attitude toward the microplastic contamination concern. Therefore, the study will go beyond the objective of gauging consumer awareness and perception, but will also transform the findings into policy brief to mitigate the risk of environment and food safety.

Statement of the Problem - This study aimed to assess the level of consumer awareness, perception and attitude regarding the presence and potential health impacts of microplastics contamination in salt products. Specifically, it sought to answer the following research questions:

- What is the demographic profile of the respondents in terms of age. civil status. highest educational attainment and employment status?
- What is the level of awareness among consumers in Balaoan, La Union regarding the presence of microplastics in salt products and their potential health risks?
- What is the level of perception of consumers about microplastic contamination in salts?

- What is the level of attitudes do consumers hold toward the consumption or avoidance of salt products?
- Is there a significant relationship between the profile and level of consumer awareness, perception, and level of attitude?
- Is there a significant relationship between the level of consumers awareness and their perception of microplastic contamination in salts?
- Is there a significant relationship between the consumers perception and level attitude toward microplastic contamination in salts?
- What specific intervention could be developed and validated?

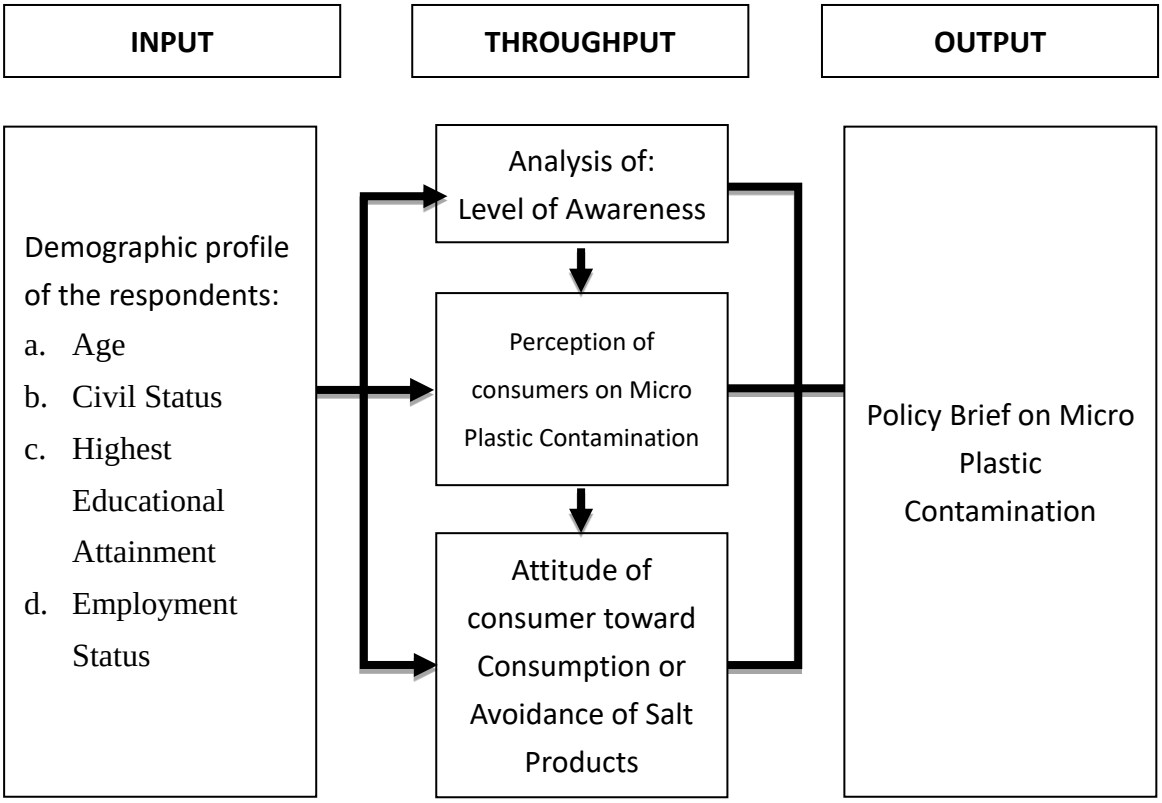


Figure 1. Research Paradigm.

2. Methodology

Research Design - This study employed a **descriptive-correlational quantitative research design**, which is appropriate for exploring the levels of awareness, perception, and attitudes among consumers and determining the relationships among these variables. Descriptive research was employed to gain a broad picture of the characteristics and opinions of respondents whereas correlational research was used to measure the strength and direction of the association of variables (Creswell & Creswell, 2018). The framework was anchored in the Theory of Planned Behavior which explained the ways that knowledge and perception affect behavioral intentions (Ajzen, 1991). Also, the statistical tool of Spearman's rank-order correlation was used to ascertain the relationship between selected variables that are included in the research framework. According to Field (2018), the use of Spearman's correlation is common in the social science and behavioral research in which survey responses are ranked or scaled. Through correlational analysis, the study goes beyond the descriptive statistics and gives deeper understanding of the link between consumer characteristics and awareness and behavioral disposition towards microplastic contamination.

Population and Locale of the Study - The study was conducted at Balaoan, La Union, a coastal municipality in the province of La Union especially at barangay Bulbulala. The target population was male and female aged 18 and above who are available on the time of data gathering and are willing to participate in the research and regularly use salt in household food preparation. The participants in this study, which is about consumer awareness, perception, and attitude towards the microplastic contamination in salts are highly relevant as they are the main users and decision makers in salt consumption. As direct consumers they are the group that is most exposed to potential microplastic contamination through daily dietary intake. The researcher used the purposive sampling technique to select respondents as adult ages 18 years and above who consumed salt frequently in their household. This method enabled the researcher to select those participants that were most relevant to the objectives of the study. Based on local demographics, an estimated sample size of 281 respondents was deemed sufficient for statistical analysis and generalization within the locality.

Research Instrument - In collecting the needed data, a survey questionnaire was developed by the researcher. It was divided into four sections: (1) demographic profile, (2) awareness of microplastic contamination in salts, (3) perceived risks, and (4) consumer attitudes. The instrument used to validate the questionnaire was adapted from the study of Lucina (2025). The content validity and face validity of the questionnaires were validated by five expert validators who were graduates of Doctor of Philosophy programs at Don Mariano Memorial State University, Mid-La Union campus wherein they gave a rating of 4.4 which is highly valid for the content and a rating of 5.0, very highly valid for the face validity.

The researcher followed the succeeding steps. First, Prior to data collection, the researcher sought approval from the **Research Ethics Committee of Ilocos Sur Polytechnic State College (ISPSC).** The research proposal, survey questionnaire, informed consent form, and data privacy provisions were submitted for ethical evaluation. This step ensured that the study was conducted in ethical standards relating to voluntary participation, confidentiality and protecting the rights of the respondents. Second, following the ethical clearance, the researcher sought consultation from the research adviser for review and approval of the finalized questionnaire and data collection procedures. The adviser made sure that the research instrument was consistent with the activities of the research and appropriate to be administered to the target respondents. Third, a formal letter asking for permission to conduct the study was prepared and presented to the Barangay Captain of the selected community. The purpose, scope, and procedures of the research were clearly explained in order to obtain cooperation and support from the local authorities in identifying the eligible respondents within the barangay. Fourth, on approval, the researcher duplicated the validated questionnaires and prepared informed consent forms. Instructions for answering the questionnaire were clearly indicated in order to ensure uniformity in understanding among respondents. Fifth, qualified respondents were identified based on inclusion criteria of the study. Before distributing the questionnaires, the researcher explained the purpose of the study, assured confidentiality of responses, and said that participation was voluntary. Respondents were asked to sign the informed consent form before participating in the study. Sixth, personal administration of the survey questionnaires by the researcher was carried out among the respondents. There was sufficient time for the respondents to read and respond to all the items honestly and independently. The researcher was still available to clarify instructions without affecting the answers of the respondents. Seventh, after completion, the questionnaires were immediately gathered for the sake of high retrieval rate and to avoid loss or incomplete response. Each retrieved questionnaire was checked for completeness before acceptance. Eighth, all accomplished questionnaires were properly coded, organized, and securely stored to maintain confidentiality. The collected data were then prepared for tabulation, statistical analysis, and interpretation. Lastly, the policy brief was developed and evaluated by expert validators. The gathered data were tallied, tabulated, analyzed, and interpreted objectively.

Treatment of Data - Data gathered was encoded and analyzed using descriptive statistics such as frequency, percentage, and mean to describe the demographic profile. Mean was used to determine the level of awareness, perception, and attitudes. Inferential statistics, specifically Spearman design was used to determine the relationships among awareness, perception, and attitudes. The validity of the policy brief was assessed using a validity tool adapted from the study of Walt, G., et.al (2019) based on expert ratings.

Data Categorization - Responses were categorized into the following levels for clearer interpretation: For awareness level, it was categorized into very highly aware (4.21- 5.00), highly aware (3.41-4.20), moderately aware (2.61-3.40), low aware (1.81-2.60), and very low aware (1.0-1.80). Likewise, for perception level, it was categorized into very strong perception (4.21- 5.00), positive perception (3.41- 4.20), neutral perception (2.61–3.40), limited perception (1.81-2.60), and poor perception (1.0-1.80). Also. For attitude level, it was categorized into highly favorable attitude (4.21- 5.00), positive attitude (3.41- 4.20), neutral attitude (2.61–3.40), (1.81-2.60), less favorable and negative (1.0-1.80).

Ethical Consideration - This study adheres strictly to ethical research standards to protect the rights, privacy, and welfare of all participants. Before the commencement of data collection, informed consent was obtained from each participant. The purpose of the study, voluntary nature of participation, and assurance of confidentiality were clearly explained through a consent form. Participants had the right to decline or withdraw from the study at any point without any penalty or consequences (Israel & Hay, 2006). All data collected were kept confidential and anonymous. No personally identifiable information was collected or disclosed. Responses were coded and stored securely, accessible only to the researcher for academic purposes. The results were presented in aggregate form to ensure that no individual respondent can be identified (Sieber, 1992). This study also ensures minimal risk to participants. Since the research involved answering a questionnaire on environmental and health perceptions, no physical, emotional, or psychological harm was anticipated. Moreover, the language used in the survey is neutral, non-invasive, and free of bias. The research also respects the principles of autonomy, beneficence, non-maleficence, and justice, which are foundational to ethical human-subject research (Beauchamp & Childress, 2013).

3. Results and findings

Research Question1: What is the demographic profile of the respondents in terms of age, civil status, highest educational attainment, and employment status

Table 1 presents the demographic profile of the respondents in terms of age, civil status, highest educational attainment, and employment status. Understanding the respondents' background allows for clearer interpretation of variations in consumer responses toward environmental and food safety concerns. As shown in table 1, majority of respondents were 31 years old and above (65.8%), while only 33.5% belonged to the 18–30 age group. In terms of educational attainment, 50.9% were high school graduates and 47.7% were college graduates, indicating a nearly equal distribution between the two groups. As for civil status, 53.7% were married, 39.9% were single and 5.0% were widowed. In terms of workers, most of the respondents were unemployed (60.9%), while only 37.0% were employed. This demographic pattern indicates that most of the respondents are likely household decision makers in salt consumption and responsible for food preparation and purchasing.

Table 1
Demographic Profile of Respondents

Variable		Frequency	Percent
Age	18-30 years old	96	34.2
	31 and above	185	65.8
Total		281	100.0
Civil Status	Single	114	40.6
	Married	153	54.4
	Widow/er	14	5.0
Total		281	100.0
Highest Educational Attainment	Elementary	4	1.4
	High School	143	50.9
	College Graduate	134	47.7
Total		281	100.0
Employment Status	Employed	110	39.1
	Unemployed	171	60.9
Total		281	100

Results of the study confirm the view of Basha, et. al (2015) that older and married persons often exhibit more concern for food safety due to their responsibility for food health and nutrition of the household. Similarly,

education level is involved in the influence on the environmental awareness and health-related perception (Wang et al., 2021). The proximity between the high school and college graduates implies the diversity in knowledge base among the respondents, which may have an impact on the differences in awareness and attitudes. From the point of view of the Knowledge -Attitude-Practice (KAP) Model, demographic characteristics, in particular education, represent background factors that would impact on the acquisition of knowledge. These levels of knowledge, in turn, have an effect on the attitude and intentions for behavior. The Theory of Planned Behavior (TPB) also implies that social roles, such as that of a parent or household decision-making may strengthen behavioral intention for safer consumption practices. Overall, the demographic profile provides critical context to the interpretation of findings of the study as social-demographic characteristics may affect the level of awareness and risk perception of consumers and also their attitude towards the consumption or avoidance of products containing salt that may be contaminated with microplastic.

Research Question 2: What is the level of awareness among consumers in Balaoan, La Union regarding the presence of microplastics in salt products and their potential health risks?

Table 2 shows the level of consumer awareness about microplastics contamination in salts. Awareness was evaluated by means of indicators that measure the respondents' knowledge about the presence, sources and possible health and environment effects of microplastics in salt products. The calculated average scores and descriptive equivalents were used to determine how informed consumers are regarding this developing food safety concern. As reflected from table 2, the overall mean for awareness was 2.821, which indicated that the respondents are "moderately aware" of microplastics in salt. While participants demonstrated a higher level of awareness with respect to the presence of microplastics in the environment in general (Mean = 3.67), and were rather uncertain about specific contamination pathways, such as the contamination pathways of microplastics into the salt production process (Mean = 2.53). This means that although some consumers are aware of the problem, knowledge is not complete or consistent.

Table 2
Level of Consumers' Awareness Regarding the Presence of Microplastics in Salt Products and their Potential Health Risk

Statement	Mean	Descriptive Rating
I have heard about microplastics in food products such as salts.	2.65	MA
I am familiar with the term "microplastics.	2.77	MA
I am aware that salt can contain microplastics.	2.53	FA
I first learned about microplastics in food products in school as well as in social media.	2.61	MA
I know the potential health risks associated with the consumption of microplastics such as inflammation, and gut microbiome disruption.	3.33	MA
I have come across any reports or studies mentioning microplastics in the salts sold in the Philippines.	2.64	MA
I think microplastics in salts are more common in a specific type of salt. (e.g., sea salt, table salt)	2.71	MA
I have read advertisements about the dangers of microplastics in food such as social media ad.	2.63	MA
I often checked the sources of salt I used at home	2.68	MA
I believe that more should be done to inform the public about microplastics in food products such as salts.	3.67	A
OVER ALL MEAN	2.821	Moderately aware

Legend: DR- Descriptive Rating, MA- Moderately aware, FA- Fairly Aware, A- Aware

These findings were aligned with the studies by Henderson and Green (2020), which reported that many consumers are aware of microplastics in water but have limited knowledge of their presence in food products like salt. Similarly, Oleksiuk et al (2022) found that awareness of microplastics in water is higher than awareness in food commodities such as salt. Deng et al., 2020 further explained that awareness is largely influenced by media exposure, which often focused on marine pollution instead of food chain contamination. This could perhaps explain the general familiarity yet the lack of technical understanding of respondents. Under the KAP framework, awareness is the first level of behavioral change. The moderate level of awareness means there are still gaps in

knowledge which could potentially limit the capacity to make fully informed decisions about salt consumption and microplastics exposure. However, if awareness is in the moderate level, this means there is insufficient awareness spread about microplastics among the masses. Previous studies emphasize that despite the fact that microplastics have attracted attention from the scientific community on a global scale, public understanding of the presence of microplastics in food systems is still limited due to the technical nature of the issue and the lack of risk communication (Wright & Kelly, 2017). This gap identifies the need for enhanced environmental education programs and public health campaigns that emphasise food contamination pathways.

Research Question 3. What is the level of perception of consumers about microplastic contamination in salts?

Table 3 shows the level of consumer perception about microplastic contamination in salts. Perception is the interpretation, beliefs and degree of concern of respondents towards the presence of microplastics in salt products and their potential impact on human health and the environment. Mean scores and descriptive equivalents were utilized to determine how consumers evaluate the seriousness and risks associated with microplastic contamination. As shown in table 3, respondents exhibited a positive perception with an overall mean of 3.471, indicating that they viewed microplastic contamination as a serious environmental and health issue. The strongest belief held by respondents is that microplastics in salt have a negative impact on health (mean: 3.85). Also, there is a high likelihood (mean: 3.84) that consumers would switch salt brands of their current choice was found to contain microplastics. In addition, respondents expressed high agreement that manufacturers should be responsible for testing (mean: 3.65) and that public awareness should be increased (mean: 3.71)

Table 3
Level of Consumers' Perception About Microplastic Contamination in Salts

Statement	Mean	Descriptive Rating
I believe that the presence of microplastics in salt can have a negative impact on health.	3.85	PP+
I think that the salt we currently use contains microplastics.	2.78	NP
In my opinion, manufacturers should be responsible for testing salt for the presence microplastics.	3.65	PP+
I am confident that the salt sold in our locality is free from microplastics.	3.17	NP
I think the occurrence of microplastics in salt is a global issue or concern.	3.66	PP+
I am very likely to switch to a different brand of salt if I found out that the one, we currently use contains microplastics.	3.84	PP+
I believe that the Philippine government is doing enough to regulate and prevent microplastics in food products.	2.92	NP
My perception of the environmental impact of microplastics on marine ecosystems and salt production is very significant.	3.48	PP+
I think public awareness campaigns about microplastics in salt should be increased.	3.71	PP+
OVER ALL MEAN	3.471	Positive Perception

Legend: DR- Descriptive Rating, VSP- Very strong perception, PP +- Positive perception, NP- Neutral Perception, LP- Limited Perception, PP-- Poor perception

The result was also consistent with findings by Barrett et al. (2020), who noted that consumers may perceived environmental contaminants as highly risky when associated with food and health. The finding likewise supported the Psychometric Paradigm of Risk Perception, which explained that risk perception is influenced not only by knowledge but also by emotional responses, perceived severity, and lack of control over exposure. Microplastic as an invisible and involuntary contaminant can be perceived as being very risky despite moderate awareness level.

Research Question 4. What is the level of attitudes do consumers hold toward the consumption or avoidance of salt products?

Table 4 presents the level of consumer attitudes toward the consumption or avoidance of salt products in relation to microplastic contamination. Attitude means behavioral disposition, willingness, and readiness of the respondents to take precautionary measures based on their awareness and perception of the risks of contamination. As reflected in table 4, results showed a positive consumer attitude towards avoidance or being cautious of salt products that could be contaminated with microplastics. The results showed that the respondents have

(positive/moderately favorable/limited) attitude in adopting preventive consumption behaviors. Higher mean scores indicate a willingness among consumers to support safer food practices, consider the safety of products or reduce exposure to potentially contaminated salt products. However, relatively less responses in some indicators could suggest the possibility that behavioral change is still affected by habitual consumption patterns, products availability or economic considerations.

Table 4

Level of Consumers' Attitude towards the Consumption or Avoidance of Salt Products

Statement	Mean	Descriptive Rating
If I knew the salt, I was using contained microplastics, I would stop immediately.	4.58	HFA
I would be willing to pay more for salt if it was guaranteed to be free of microplastics.	4.46	HFA
It is very important that the salt we buy is tested for microplastics.	4.17	PA
I always check labels or certifications on salt products to ensure they are safe from contaminants.	3.53	PA
I will strongly support stricter government regulations on microplastics in food products like salt.	3.94	PA
If a brand of salt openly disclosed that they test their product for microplastics, I would be more inclined to buy it.	4.26	HFA
I would consider reducing salt consumption in my diet to minimize potential exposure to microplastics.	3.62	PA
I think consumers should be more proactive in learning about the presence of microplastics in their food.	3.96	PA
I am willing to participate in local efforts to raise awareness about the impact of microplastics in food products like salt.	3.96	PA
OVER ALL MEAN	4.073	PA

Legend: DR- Descriptive Rating, HFA- Highly favorable attitude, PA- Positive attitude, NP- Neutral attitude, LFA- Limited favorable attitude, NA-- Negative attitude

The finding was consistent with Hermabessiere et al. (2017), who found that consumers will tend to form negative attitudes towards products that have environmental or health risks. Wang et al. (2021) also reported that when people are more aware of microplastic contamination, they are more cautious about consumption. The results also supported the Theory of Planned Behavior which says that attitudes strongly influence behavior intentions. The high scores on attitude suggest that consumers tend to be engaging in protective or preventive behaviors if they perceived health risks.

5. *Research Question 5.* Is there a significant relationship between the profile and level of consumer awareness, level of perception, and level of attitude?

Table 5 presents the results of the Spearman's rho correlation analysis applied to investigate the correlation between the different profiles of the respondents in terms of age, civil status, the level of education and the level of employment with the respective levels of awareness, perception, and attitude towards microplastics in salt. This analysis has been done using a sample size of 281 and examines if selected demographic factors have a significant impact on how people understand and react to this food safety concern. As indicated in Table 5, the correlation test (Spearman) showed negligible and non-significant results between age and consumer awareness, perception and attitude to contamination of microplastics in salts. Specifically, age was not significantly associated with consumers' knowledge of contamination (rho = 0.006, p = 0.915), evaluation of risk (rho = -0.045, p = 0.458) or attitudinal orientation (rho = 0.087, p = 0.149). These results show that generational differences do not play a significant role in the way consumers understand, perceive or respond to microplastic contamination in salt.

The lack of substantial correlations may be explained by ubiquitous access to information about the environment across age cohorts through media, social networks and learning programs (Gifford & Nilsson, 2014; Jiang et al., 2022). As microplastic pollution is becoming a socially salient topic, exposure to microplastic pollution-related content is not limited to any specific generation, resulting in a relatively even level of awareness and attitudinal engagement.

Table 5

Spearman's Correlation Between Age, Civil Status, Educational Attainment and Awareness, Perception, and Attitude

Variables	N	Spearman's rho	p-value	Remarks
Age – Awareness	281	0.006	0.915	Not Significant
Age – Perception	281	-0.045	0.458	Not Significant
Age – Attitude	281	0.087	0.149	Not Significant
Civil Status-Awareness	281	0.038	0.529	Not Significant
Civil Status- Perception	281	-0.126	0.037	Significant
Civil Status-Attitude	281	0.375	≤0.001	Significant
Educational Attainment- Awareness	281	0.102	0.089	Not significant
Educational Attainment-Perception	281	0.189	0.002	Significant
Educational Attainment- Attitude	281	0.026	0.664	Not Significant
Employment Status- Awareness	281	0.153	0.011	Significant
Employment Status-Perception	281	-0.011	0.858	Not Significant

Note. **p < .05 indicates statistical significance (2-tailed).

These results indicate that interventions to influence consumer knowledge, risk perception, or positive attitudes need not be age specific. Broad-based strategies, such as public awareness campaigns, educational programs, social media programs, and community outreach, can be effective in reaching all age cohorts. Making information simple, relevant and accessible is likely to have more impact than demographic targeting based just on age. The data suggest that age is not an important determinant of consumer responses to microplastic contamination in salts. As shown in Table 5, the results of the correlation analysis by Spearman showed that civil status has a limited influence on the response of consumers to microplastic contamination in salts. Awareness (rho = 0.038, p = 0.529) and attitude (rho = 0.030, p = 0.616) had negligible and statistically non-significant correlations, indicating a statistically weak dependence of knowledge and attitudinal orientation on marital or household status. Perception, on the other hand, showed a weak but statistical significant negative correlation (rho = -0.126, p = 0.037) indicating that some civil status groups such as married people perceived the risks of microplastic contamination slightly lower than others.

This small difference in perception may reflect the difference in daily responsibility, household priorities or time availability, which may affect attention to the emerging environmental risks in a very subtle way (Deng et al., 2020; Xu et al., 2021). For example, people with family or care obligations may prioritize short-term household issues, and see less urgency in environmental health issues such as microplastics contamination. These results imply that civil status is not a key factor in determining awareness, perception or attitude. For this reason, campaigns for environmental education, risk communication and consumer awareness do not need to be segmented by marital or household status. Broad-based strategies that emphasize clarity, relevance and accessibility are likely to be effective in reaching all civil status groups. The findings show that the context of civil status has a small impact on the perception, whereas awareness and attitude are not influenced, which reveals the need for outreach approaches that are universal and accessible to all.

As seen in Table 5, there is a significant positive relationship between educational attainment and awareness (rho = 0.375, p < 0.001) and a relationship between educational attainment and attitude (rho = 0.189, p = 0.002) while the relationship between educational attainment and perception (rho = 0.102, p = 0.089) is weak and is not significantly related. This suggests that the more educated the individual, the more knowledgeable they are about microplastic contamination and the more they tend to have a more favorable, concerned and proactive attitude about mitigating its effects. Higher education probably contributes to the acquisition of environmental knowledge, critical thinking and understanding of complicated risks, which provides the cognitive basis for informed attitude and responsible consumer behavior (Li et al., 2022; Zeng et al., 2023; Lieberknecht & Davies, 2014). However, the absence of a substantial correlation with perception indicates that formal education alone may not directly increase the perception of risk. Perception seems to rely additionally on factors including personal relevance, media exposure, emotion-bringing and trust in information sources.

As seen in table 5, employment status has little effect on consumer awareness and attitude as there are negligible and non-significant correlations (rho = 0.026, p = 0.664 and rho = -0.011, p = 0.858 in case of awareness

and attitude respectively). This means that the consumers being employed, unemployed, self-employed or any other type of employment does not significantly influence the knowledge or attitudinal orientation towards microplastic contamination. A weak but statistically significant positive correlation was found between the employment status and the perception (rho = 0.153, p = 0.011) which suggests that there may be some employment groups that tend to perceive higher microplastic contamination. This might reflect subtle variations in occupational exposure to information in the environment, learning at work, or access to professional networks for discussion of health and sustainability issues. However, the size of this correlation is small, which means that employment status alone is not a major determinant of the risk perception.

These findings are consistent with previous studies finding that certain demographic variables such as occupational category may not have much impact in shaping awareness and attitudes, whereas perception may be (modestly) affected by contextual factors such as information exposure (Zeng et al., 2023; Li et al., 2022; Deng et al., 2020). From a practical point of view, public awareness and behavior campaigns addressing microplastic contamination should be based on broad-based ways, which address the general population instead of narrow focus on employment categories. Inclusive communication strategies, via mass media, social media, and community initiatives are likely to be more effective in creating awareness, attitudinal change, and a stronger perception among diverse occupational groups. Employment status plays a minor role in the consumer response, which highlights the domination of cognitive, informational, and environmental factors rather than the occupational features in building awareness, perception, and attitude toward microplastic contamination.

Research Question 6. Is there a significant relationship between the level of consumers' awareness and their perception of microplastic contamination in salts?

Table 6
Spearman's Rank Correlation Between Consumer Awareness and Perception of Microplastic Contamination in Salts

Variables	N	Spearman's rho	p-value	Remarks	Interpretation
Awareness Mean – Perception Mean	279	0.441	<0.001	Significant	Moderate positive correlation; higher consumer awareness is associated with stronger perception of microplastic contamination

Note. **p < .01 indicates statistical significance (2-tailed).

Table 6 shows the degree of correlation using the Spearman's rank correlation analysis, which was performed to assess the correlation between the awareness of consumers and their perception concerning the issue of microplastic contamination in salts. This statistical test determines whether a significant association exists between the amount the consumer knows about microplastics and the way he/she perceives the risks and presence of the contaminants in his/her food. As presented in table (6) the Spearman's rank order correlation indicated that there was a moderate positive and statistically significant correlation between consumer awareness and perception of microplastic contamination in salts (rho= 0.441, p <0.001). This result suggested that consumers with more awareness about microplastic contamination are likely to consider the problem more serious and worrying. In other words, the more awareness, the more serious the perceived potential health and environmental impacts of the microplastics in salts.

This finding suggested that awareness plays an important role as a determinant of consumers' perception of risk. It documents the role of informed knowledge in the interpretation and assessment of environmental hazards by individuals. In terms of behavior, the result is consistent with the Knowledge-Perception-Attitude (KPA) model, which states that knowledge acquisition will lead to perceptual and attitudinal change and ultimately to responsible behavior. The significant correlation noted in this study supported the previous empirical evidence showing the role of awareness in the perception of environmental and food related risks. For example, researchers Siddique et al. (2023) determined that commercially available sea salts tested in the study all measured at least trace amounts

of microplastics signifying a need for further consumer education in order to reduce potential exposure risks. Similarly, Saad et al. (2024) found that the education level of consumers has a significant impact on the consumption behavior towards salt, with people with higher education being more likely to buy refined or branded salts, possibly because they were more aware of the risks of contamination.

The current findings also suggested that raising public awareness could be a good way to change perceptions of seeing the microplastic contamination as a serious environmental and health concern. Educational programs, public information campaigns, and the transparent disclosure of contamination data can help to promote informed consumer behavior and advocacy for environmental policy reforms. Such initiatives are especially important in developing contexts where access to good environmental information is currently limited. The statistically significant and moderate positive correlation between awareness and perception suggested that the improvement of consumer knowledge was a key to support the promotion of risk-conscious behavior and environmental responsibility. Strengthening awareness through education and communication strategies can therefore be one step to efficiently reduce exposure to microplastics and to the wider goals of health protection of the environment.

Research Question 7. Is there a significant relationship between the consumers' perception and level attitude toward microplastic contamination in salts?

Table 7

Spearman's Rank Correlation Between Consumer Perception and Attitude Toward Microplastic Contamination in Salts

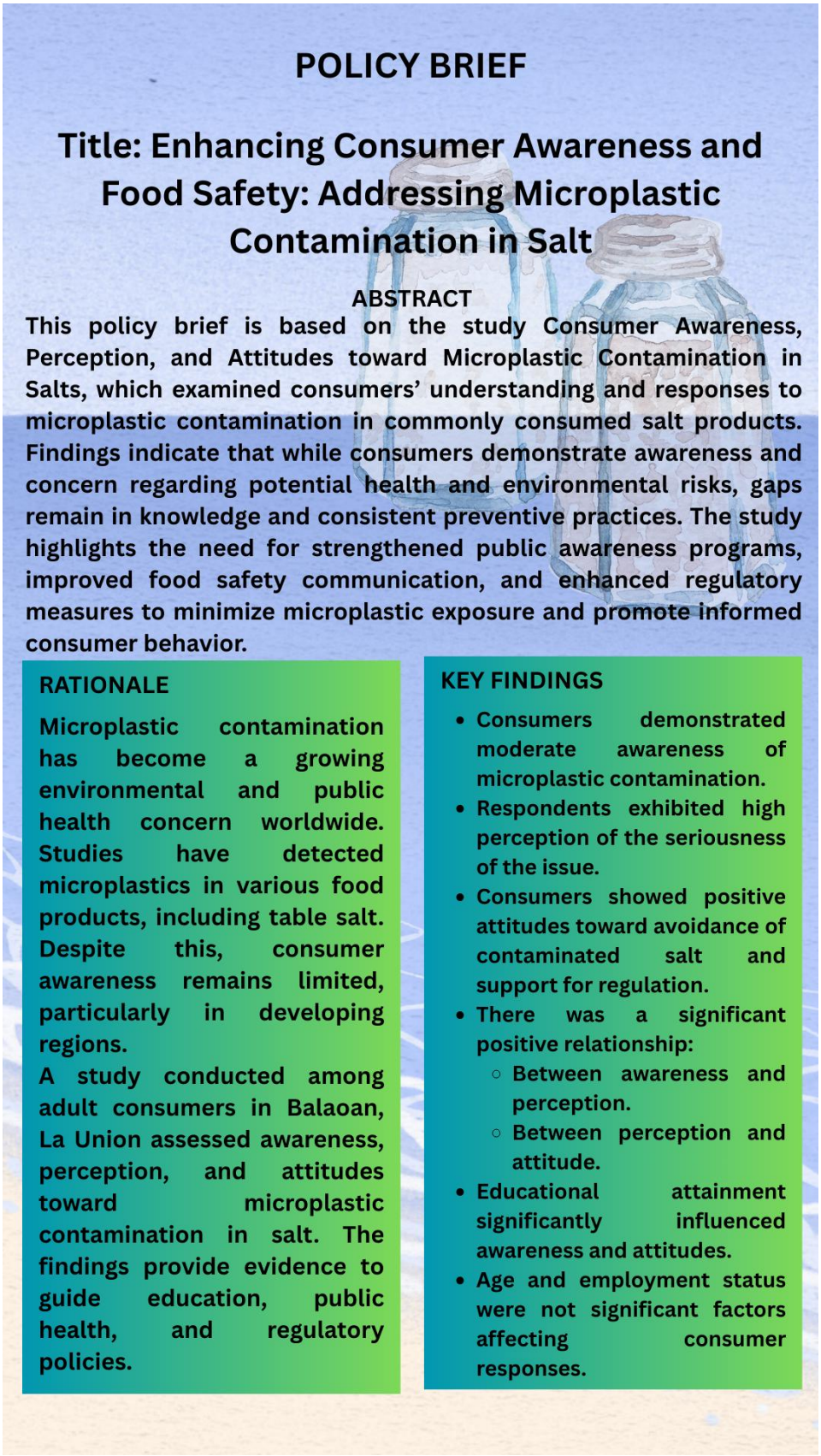
Variables	N	Spearman's rho	p-value	Remarks	Interpretation
Perception Mean – Attitude Mean	279	0.474	<0.001	Significant	Moderate to strong positive correlation; stronger perception is associated with more favorable attitudes toward microplastic contamination

Note. **p < .01 indicates statistical significance (2-tailed).

Table 7 shows the results of Spearman's rank correlation analysis conducted to assess the correlation between consumer's perception and consumer's attitude towards microplastics contamination in salts. This analysis is intended to ascertain whether an individual's belief and awareness about the risks of microplastics makes a large difference to his/her intentions to behave and to support safety regulations. As presented in Table 7, the results showed that there was a moderate to strong positive and statistically significant relationship between consumer perception and attitude towards microplastic contamination in salts (rho = 0.474 and $p < 0.001$). This showed that those individuals who perceived microplastic contamination to be a serious and imminent problem were likely to form positive and proactive attitudes towards mitigating or preventing the effects of microplastic contamination.

This finding provided support for the Knowledge-Perception-Attitude (KPA) framework that proposed that cognitive understanding and perceived risk are informative of behavioral orientation. In this context consumers who were aware of the environmental and health risks of microplastics contamination were more likely to have positive attitudes such as support for environmental regulations, preference for cleaner salt brands or reduction of plastic usage. These results were consistent with previous studies highlighting the relationship between risk perception and pro-environmental attitudes. For example, people who had higher levels of awareness about microplastic pollution showed higher levels of willingness to reduce the use of plastic and engage in sustainable behaviors, according to Deng et al. (2020). Similarly, Righi et al. (2024) found that the perceived environmental risk of plastic contamination of the environment was positively related to more environmentally responsible attitudes and actions among university students in Italy. Moreover, Moon, Wang and Hao (2023) demonstrated that the increased perception of microplastic contamination in seafood was associated with increased willingness to pay for safer, microplastic-free alternatives, which reflects a positive attitudinal change that is linked to perceived environmental risk.

Research Question 7. What specific intervention could be developed and validated?



The policy brief created from the study Consumer Awareness, Perception, and Attitudes to Microplastic

Contamination in Salts is a short and evidenced document that aims to communicate the research findings and suggests solutions to decision-makers and stakeholders. A properly organized policy brief is an effective way to ensure that the scientific information is converted into practical recommendations to aid in environmental protection and public health initiatives.

The major parts and contents of the policy brief are discussed as follows: The abstract gives a brief description of the policy brief, including the purpose of the study, methodology, major findings, and recommended policy directions. It gives a policymaker and reader a quick idea of the problem of microplastic contamination in salt and the need for immediate intervention without having to read the entire document. The next part is the rationale which explains why it is necessary to develop the policy brief. It covers the emerging concern about the microplastic pollution and its introduction into the human food chain through the use of marine products, including sea salt. This section determines the need for remedial action to the indicated gaps in consumer awareness and perception and attitudes as revealed by the study. It provides the rationale for the need for policy intervention, public education, and environmental management strategies to mitigate potential health and environmental risks. The third part is the key findings section which shows the major result of the study in a simplified and easy-to-read language. The fourth part is the policy issues which identify the major concerns arising from the findings of the study connection of research evidence to existing gaps in governance, environmental management, and consumer protection systems. The fifth part is the policy recommendations which provide some specific and actionable strategies that have been derived from the study findings.

Table 8

Level of Validity of the Developed Policy Brief

Indicators	Validator's Rating			Total	Average
	1	2	3		
1. Relevance of Content	4	5	5	14	4.7
2. Clarity of Objective	5	5	5	15	5
3. Evidence-Based Information	3	5	5	13	4.3
4.Audience Appropriateness	5	5	5	15	5
5. Feasibility of Recommendations.	3	5	5	13	4.3
6. Accessibility of Communication.	4	5	5	14	4.7
7.Cultural Sensitivity.	5	5	5	15	5
8. Consistency with Study Findings.	3	5	5	13	4.3
9. Conciseness and Focus	5	5	5	15	5
					4.7
10. Strength of Call to Action	4	5	5	14	
General Average	4.1	5	5	47	4.7
Over-all Validity Index					4.7
Descriptive Equivalent		Outstanding Validity			

Table 8 shows the evaluation results in terms of the level of validity of the developed policy brief, which is entitled to "Enhancing Consumer Awareness and Food Safety: Addressing Microplastic Contamination in Salt". The evaluation was performed by a team of three validators who measured the document against ten specific indicators, such as content relevance, clarity of objectives and feasibility of recommendations. The ratings were computed to find the General Average and Overall Validity Index in order to make sure the brief is technically sound and ready for stakeholder distribution. The "Outstanding Validity" rating suggests that the policy brief represents a highly credible and professional structured tool to deal with microplastic contamination. The perfect scores in audience appropriateness and cultural sensitivity suggest that the material is well-tailored for the different demographics of the Philippines-this time the focus is on local consumers in Balaoan, La Union, in line with the study.

Furthermore, the high ratings for relevance and the strength of the call to action suggest that the brief succeeds in taking complex scientific data and translating it into an urgent call to action for policymakers and educators. With a validity index of 4.7, the document is considered good to go for implementation as a strategic guide to mitigate the risks of microplastics in the food supply by the Department of Education (DepEd), the Commission on Higher Education (CHED) and the Local Government Units (LGUs).

4. Conclusions

Based on the findings the following are the conclusions drawn by the researcher:

1. The respondents of the study represent diverse demographic characteristics in terms of age, civil status, educational attained, and employment status in such a way that consumers coming from different socio-economic backgrounds are in household salt consumption and decision-making practices

2. Consumers exhibit a general awareness of microplastic contamination as an environmental and food safety problem; however, there is some variation in the level of understanding, suggesting the need for increased dissemination of scientific information concerning exposure to microplastics.

3. Consumers view microplastic pollution as a timely environmental issue with potential hazards to health and food safety, which reflects the increase in public awareness of pollution associated issues related to daily consumption.

4. Consumers have generally positive attitudes towards adopting precautionary practices with respect to salt consumption, however behavioural responses may be affected by accessibility, habits and economic consideration.

5. The demographic characteristics play a selective role in the influence on the way consumers interact with issues of microplastics contamination. While awareness is mostly uniform in most demographics, civil status, education and employment are among the primary driving forces shaping how a consumer views the threat of micro plastic, and how favorably they live toward taking preventive action.

6. As consumers grow more educated about the existence and characteristics of microplastics, the perception of the severity and danger of said contaminants increases. This relationship corroborates the idea that awareness is a fundamental block in the correct assessment of risk.

7. A greater sense of the threat results in more positive attitudes towards food safety, such as being willing to endorse food safety regulations or have to pay more for safer products. This seems to indicate that how a consumer perceives the seriousness of the situation is a direct cause of their behavioral intent and acceptance for change.

8. The developed Policy Brief is a very valid instrument that successfully provides conversion of scientific findings into strategies that could be implemented by stakeholders.

Recommendations **-** From the findings of this study and the conclusions drawn, the following recommendations were formed;

1. The topics on microplastics and environmental health can be integrated by the Department of Education (DepEd) and Commission on Higher Education (CHED) into the Science, Health, and Public Health curricula. The findings may also benefit teachers in creating research-based activities and awareness campaigns that encourage students to consider food safety and responsible consumptions. Likewise, the local Government Units (LGUs) can conduct information campaigns at the barangay level and distribute educational materials in public markets and health centers to make sure that the information reaches all sectors of the community.

2. Salt manufacturers can adopt transparent labeling and "Microplastic-Free" certification systems in order to offer the guarantees of safety for which consumers are prepared to pay.

3. Public health interventions and ways of communication may be aimed at different backgrounds in education and employment, recognizing that these factors will affect how people process risk and make purchasing decisions.

4. The primary catalyst policymakers may focus on increasing baseline knowledge (Awareness). By enhancing factual understanding, the authorities can naturally enhance risk perception, which lead to the more proactive behaviors and attitudes found in the study.

5. Stakeholders, particularly health agencies and environmental regulators, may adopt the strategies outlined in the "Enhancing Consumer Awareness and Food Safety" policy brief to modernize food safety standards and environmental protections.

Declaration of Conflicting interest - The authors declare that there is no conflict of interest in this work.

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