

Microplastic Awareness and Household Consumption Adaptation

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Abstract

Microplastic pollution has become an increasingly visible environmental concern despite the particles themselves often remaining invisible within ordinary household consumption. Households contribute directly and indirectly to microplastic release through plastic-intensive purchasing, synthetic textiles, laundering practices, disposable packaging, bottled beverages, personal-care products, and waste-generating consumption routines. However, awareness of microplastics does not automatically translate into sustained behavioral adaptation.

This conceptual–methodological study develops a household consumption adaptation framework that connects microplastic awareness with knowledge specificity, perceived personal contribution, behavioral feasibility, consumption substitution, and routine stabilization. Existing evidence indicates that public familiarity with microplastics has historically been lower than general awareness of plastic pollution, while greater knowledge and perceived environmental impacts are associated with stronger willingness to adopt pro-environmental behaviors.

The paper distinguishes general environmental concern from actionable microplastic literacy and examines adaptation across five household domains: reduction of single-use plastics, adoption of reusable packaging and containers, textile and laundry decisions, bottled-water consumption, and screening of personal-care products. Because no household survey or experimental dataset was supplied, quantitative values used in the analytical section are explicitly simulated and do not represent empirical findings.

The analysis suggests that effective household adaptation requires more than risk awareness: households must understand relevant emission pathways and have affordable, convenient, and socially practical alternatives. The study concludes that microplastic communication should move from generalized pollution warnings toward source-specific behavioral guidance while avoiding unsupported claims about individual health risks.

Keywords: microplastic awareness, household consumption, sustainable consumption, consumer behavior, plastic reduction, microfiber pollution, environmental awareness, behavioral adaptation

1. Introduction

Microplastic pollution has complicated conventional understandings of household plastic consumption because environmental release does not arise only from visibly discarded plastic items. Microplastics

can be intentionally manufactured at a small size or generated through fragmentation, abrasion, weathering, washing, and degradation of larger plastic materials. Their small dimensions make them difficult for consumers to observe directly, which creates a distinctive environmental communication problem. Henderson and Green found that many participants had limited knowledge of microplastics and often failed to connect personal plastic consumption with wider microplastic pollution. This disconnect is particularly important at household level because everyday decisions concerning products, packaging, clothing, water consumption, personal care, and waste collectively shape plastic demand and potential release pathways.

Public concern regarding plastic pollution is generally stronger than detailed knowledge concerning the mechanisms through which microplastics enter environmental systems. Research on public attitudes toward microplastics has shown relatively low prior familiarity among respondents, while increased knowledge and concern are positively associated with willingness to reduce microplastic emissions. Broader behavioral research on plastic consumption reaches a related conclusion: environmental awareness may coexist with continued plastic use because convenience, routine, social norms, and situational conditions strongly influence actual behavior. Heidbreder and colleagues' review of a large body of social-scientific research demonstrates that awareness alone does not resolve the plastic-consumption problem and that habits and contextual factors remain particularly influential. Household adaptation should therefore be examined as a behavioral transition rather than a simple consequence of receiving environmental information.

Microplastic-relevant consumption also extends beyond commonly discussed shopping bags and disposable packaging. Conventional washing of synthetic garments can release microfibers, making textile purchasing and laundering an important household pathway. Hartline and colleagues experimentally demonstrated microfiber release from synthetic garments during machine washing, while related research has identified polyester textiles as a household source of microplastic fibers. Personal-care products provide another pathway. Anderson and colleagues found limited initial awareness of plastic microbeads among several participant groups but substantial concern when participants were shown the quantities contained in familiar products. Such evidence illustrates why source-specific knowledge is more useful for behavioral adaptation than generalized concern about ocean plastic.

Drinking-water choices introduce a more complex behavioral issue because consumer response can be influenced by perceived personal exposure as well as environmental concern. The World Health Organization has reviewed evidence concerning microplastics in both tap and bottled drinking water and has emphasized substantial scientific uncertainty and the need for stronger evidence regarding occurrence and health implications. Responsible household communication should therefore avoid presenting bottled-water avoidance as a medically proven personal microplastic-protection strategy. Where safe and acceptable tap-water systems are available, reduced dependence on single-use bottled water can instead be framed primarily within broader plastic-demand and waste-reduction objectives.

Against this background, the present study investigates how microplastic awareness may be translated into feasible household consumption adaptation. The paper distinguishes awareness, meaning recognition that microplastic pollution exists, from actionable literacy, meaning an understanding of specific household sources and realistic reduction options. It then proposes an adaptation pathway in

which awareness influences concern, concern becomes behaviorally relevant through source knowledge, feasible alternatives enable trial, and repeated practice stabilizes into household routine. Because no primary household dataset was provided, the study is explicitly conceptual and simulation-based rather than an empirical survey. Its contribution lies in integrating microplastic public-perception research with household consumption practices to develop a framework suitable for future behavioral testing.

2. Objectives of the Study

2.1 To Examine the Transition from Microplastic Awareness to Actionable Household Knowledge

The first objective is to explain why general awareness of microplastic pollution may not produce consistent changes in household consumption. Existing research indicates that people can recognize plastic pollution as an environmental problem while possessing limited knowledge of microplastic sources, pathways, and feasible responses. Henderson and Green show that the invisibility and scientific complexity of microplastics can make the issue difficult to integrate into everyday understanding. Garcia-Vazquez and Garcia-Ael similarly identify knowledge as a central psychosocial factor connected with willingness to adopt more sustainable consumption behavior.

The study therefore distinguishes generalized concern from source-specific literacy. Households require practical knowledge concerning which purchasing and use practices are plausibly connected with microplastic release, which responses produce broader plastic-reduction benefits, and where scientific uncertainty remains. This distinction protects environmental communication from becoming either too abstract to influence behavior or too categorical to remain scientifically credible.

2.2 To Develop a Framework for Feasible Household Consumption Adaptation

The second objective is to develop a structured model describing how household routines may adapt across several microplastic-relevant consumption domains. The framework examines single-use plastics, reusable packaging, synthetic textiles and laundering, bottled beverages, and personal-care product selection. These domains differ in behavioral difficulty, economic cost, availability of alternatives, visibility of environmental effects, and degree of consumer control.

The study further considers how perceived behavioral control can mediate the awareness–action relationship. A household may strongly support reducing plastic pollution yet fail to change behavior when alternatives are expensive, unavailable, inconvenient, poorly labeled, or incompatible with existing routines. Consequently, responsible microplastic interventions should evaluate not only whether consumers care but also whether they possess practical opportunities to act.

3. Review of Literature

3.1 Public Knowledge, Risk Perception, and Behavioral Intention

Research examining public understanding of microplastics repeatedly demonstrates a knowledge gap between general concern about plastics and detailed awareness of microplastic pollution. Henderson and Green's qualitative investigation showed that microplastics were unfamiliar to many participants and that media representations often focused attention on highly visible macroplastic pollution rather than less

visible household pathways. This matters because consumers cannot intentionally modify behaviors that they do not recognize as relevant to the environmental problem.

Deng and colleagues provide complementary quantitative evidence. Their investigation of public attitudes showed relatively low prior familiarity with microplastics but stronger willingness to reduce emissions among people with greater knowledge and concern. Garcia-Vazquez and Garcia-Ael's review reaches a similar conclusion, identifying microplastic knowledge as a central factor connected with willingness to adopt pro-environmental consumption behavior. Knowledge should therefore be treated as an enabling condition for adaptation, although not as a sufficient explanation of behavior.

Evidence from broader plastic-pollution research reinforces this interpretation. Soares and colleagues found strong associations between awareness of plastic-pollution impacts and pro-environmental behavior. At the same time, Heidbreder and colleagues demonstrate that routine, norms, convenience, and situational factors can substantially influence plastic use even when environmental awareness is comparatively strong. The behavioral challenge is consequently not simply to increase concern but to integrate environmental knowledge into ordinary consumption environments.

3.2 Household Sources and Opportunities for Consumption Adaptation

Households interact with microplastic pollution through multiple material pathways. Synthetic textiles represent one particularly important example because fiber shedding can occur during ordinary laundering rather than through deliberate disposal. Hartline and colleagues recovered microfiber masses from machine washing of synthetic garments, demonstrating that routine clothing maintenance can contribute to environmental releases. Complementary experimental work on polyester textiles further supports the identification of household washing as a source of microplastic fibers.

Consumer adaptation in this domain is more complex than simply avoiding plastic packaging. Households may influence textile-related emissions through purchasing preferences, garment longevity, washing frequency, washing-machine practices, and the use of appropriate filtration or capture options where available. However, environmental advice should remain proportionate to available evidence because fiber release varies according to fabric construction, garment age, washing conditions, and other technical factors. The behavioral objective should be informed reduction rather than implying that one household practice completely eliminates microfiber emissions.

Personal-care products historically provided a more direct example of consumer-visible primary microplastics. Anderson and colleagues found that participants who initially knew little about microbeads expressed substantial concern when the plastic content of familiar products became visible and understandable. This finding is behaviorally important because it demonstrates that source-specific information can transform an abstract environmental issue into a recognizable consumption decision. Product labeling, ingredient knowledge, regulatory measures, and availability of alternatives can therefore operate together to support adaptation.

3.3 The Awareness–Behavior Gap in Sustainable Consumption

The literature on plastic consumption makes clear that environmental attitudes and reported intentions should not be treated as equivalent to repeated behavioral performance. Heidbreder and colleagues'

synthesis shows that consumers may acknowledge plastic-related environmental problems while continuing established consumption practices because those practices are convenient, normalized, and structurally supported. Microplastic behavior is likely to face an even greater challenge because the pollutant is largely invisible and many emission mechanisms are technically complex.

This gap can be conceptualized through three stages. First, consumers must recognize that a particular household activity is environmentally relevant. Second, they must perceive a feasible alternative within their available resources. Third, the alternative must be repeated sufficiently to become integrated into normal household routine. Failure at any stage can interrupt adaptation. Information campaigns that explain environmental risks without identifying realistic responses may increase concern while producing little sustained behavioral change.

4. Research Methodology

4.1 Conceptual Research Design and Evidence Synthesis

The study adopts a conceptual–methodological design integrating peer-reviewed research on microplastic awareness, plastic-consumption behavior, synthetic textile emissions, personal-care products, and environmental risk communication. The objective is theory development rather than statistical generalization from an original sample. Empirical findings from previous studies are used to establish the plausibility of relationships between knowledge, concern, perceived behavioral control, and pro-environmental behavior.

The analytical unit is the household consumption adaptation domain, defined as a recurring consumption or product-use context in which household choices can plausibly influence plastic demand or microplastic release. Five domains were selected because they represent recognizable consumer decisions while capturing different mechanisms through which households encounter the microplastic issue.

4.2 Household Adaptation Coding Framework

Each domain was coded according to its principal microplastic or plastic-related pathway, the knowledge required for behavioral recognition, a feasible household response, and a major barrier to sustained adaptation. This approach avoids treating every household behavior as equally easy or equally consequential.

Table 1: Conceptual Framework for Household Microplastic-Related Consumption Adaptation

Household Domain	Environmental Relevance	Actionable Knowledge Requirement	Potential Adaptation	Principal Behavioral Barrier
Single-use plastics	Demand for disposable plastic contributes to downstream fragmentation and waste	Understand connection between repeated disposables and plastic leakage	Reduce avoidable disposable purchases	Convenience and established retail routines

Reusable packaging and containers	Substitution can reduce repeated demand for disposable items	Identify situations where reuse is practical and hygienically appropriate	Use durable bags, bottles, and containers	Forgetfulness, portability, and cleaning effort
Textiles and laundering	Synthetic garments can release microfibers during washing	Recognize clothing and laundering as potential emission pathways	Extend garment use and adopt informed laundry practices	Limited product information and habitual washing
Bottled beverages	Packaging contributes to plastic consumption and waste	Distinguish environmental reduction arguments from uncertain health claims	Reduce unnecessary single-use bottled-water consumption where suitable	Trust, convenience, and local water conditions

The framework deliberately separates evidence about environmental release from claims concerning human health. The WHO review of microplastics in drinking water emphasizes significant evidence gaps and the need for further research. Household adaptation should consequently be justified through defensible environmental objectives rather than exaggerated personal-health messaging.

4.3 Scenario Construction and Analytical Index

A simulated Household Adaptation Readiness Index was developed to illustrate the proposed relationship between knowledge and consumption change. Conceptually, readiness can be represented as the analytical importance assigned to household domain (i). The equation is not presented as a validated psychometric measure. It merely formalizes the proposition that awareness must combine with feasibility and routine formation before stable consumption adaptation is likely to occur.

The scenario analysis uses hypothetical values to compare stages of awareness and consumption adaptation. No respondents were recruited, and no statistical significance tests are reported. This design preserves methodological transparency and avoids presenting fabricated household behavior as empirical observation.

5. Analysis

5.1 Awareness Intensity and Behavioral Adaptation

The conceptual analysis indicates that broad environmental awareness is likely to produce only modest adaptation where consumers cannot identify specific household sources. A household may understand that plastics damage environmental systems but still view microplastic pollution as geographically distant, scientifically obscure, or primarily attributable to industry. This interpretation is consistent with

evidence showing that people may struggle to connect personal plastic consumption with microplastic pollution.

The expected behavioral response becomes stronger when awareness moves from abstract concern toward source-specific literacy. Understanding that synthetic garments may release fibers during laundering or that particular consumer products can contain intentionally added plastic particles creates recognizable decision points. The value of such knowledge is not that households become solely responsible for solving microplastic pollution, but that they can distinguish areas of meaningful consumer agency from problems requiring manufacturer, infrastructure, or regulatory action.

5.2 Simulated Household Adaptation Profile

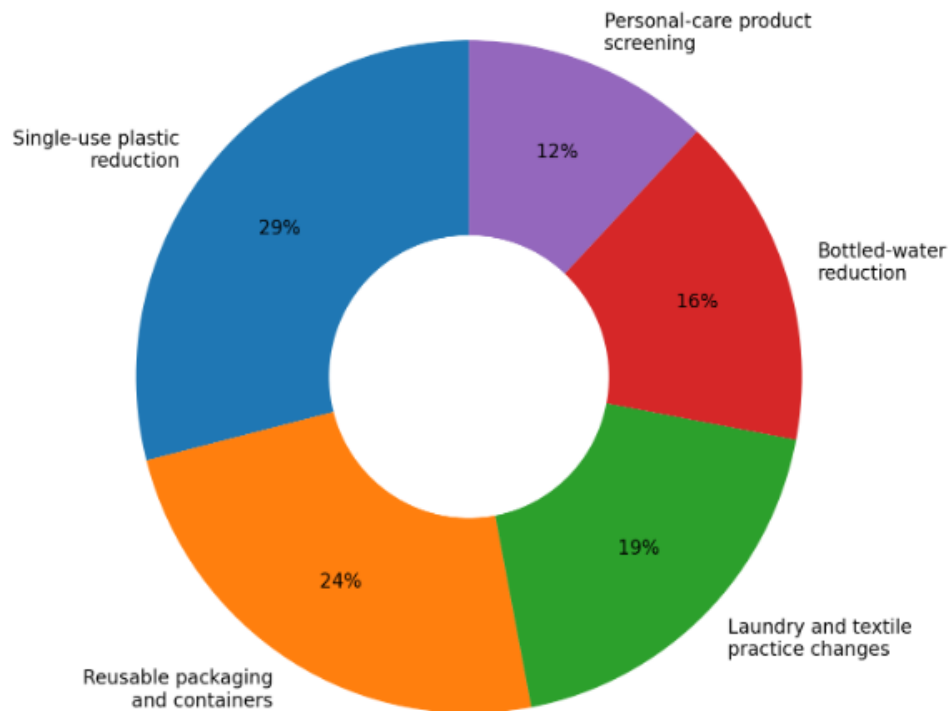
The analytical scenario distributes household adaptation across five behavioral domains. The values represent an illustrative composition of adaptation effort rather than measured prevalence.

Table 2: Simulated Distribution of Household Microplastic-Reduction Adaptations

Consumption Adaptation	Simulated Share of Household Adaptation Effort (%)	Behavioral Interpretation
Single-use plastic reduction	29	Most immediately recognizable form of plastic-demand reduction
Reusable packaging and containers	24	Reinforces repeated substitution for disposable consumption
Laundry and textile practice changes	19	Requires greater source-specific microplastic knowledge
Bottled-water reduction	16	Relevant where local water conditions make substitution appropriate
Personal-care product screening	12	More specialized behavior dependent on product information
Total	100	Illustrative household adaptation portfolio

The simulated distribution assigns the greatest share to single-use reduction and reusable substitutions because these behaviors are comparatively visible and widely associated with plastic-pollution prevention. Textile and laundry adaptation receives a lower share because the microfiber pathway is less visually apparent and often requires more detailed environmental knowledge. Personal-care screening receives the smallest simulated share because it represents a more product-specific behavior.

Graph 1: Simulated Distribution of Household Microplastic-Reduction Adaptations



The graph emphasizes that household adaptation should be understood as a portfolio of behaviors rather than a single consumer action. A family that stops purchasing one disposable product but makes no other changes may achieve a limited form of adaptation. Broader environmental learning can distribute behavioral effort across shopping, product reuse, clothing, laundering, beverage consumption, and product selection.

5.3 From Behavioral Trial to Household Routine

Initial behavioral change is likely to be unstable when it depends entirely on active environmental motivation. Consumers may purchase reusable containers but forget to carry them, intend to reduce disposable packaging but encounter few alternatives, or learn about textile microfibers without knowing which purchasing or laundering decisions are practical. Such failures should not necessarily be interpreted as lack of environmental concern. They often indicate weak behavioral infrastructure.

Sustained adaptation therefore requires routine stabilization. Environmental choices become more durable when they are easy to repeat, integrated into shopping and household-management practices, supported by clear product information, and reinforced by available alternatives. This interpretation aligns with broader plastic-consumption evidence showing the importance of habitual and situational factors.

A central analytical implication is that effective interventions should reduce the cognitive burden of sustainable consumption. Consumers should not be expected to independently investigate complex polymer science before every purchase. Product design, labeling, retail choice architecture, washing-

machine technology, waste infrastructure, and public policy should support rather than merely request household adaptation.

6. Discussion

6.1 Awareness Is Necessary but Behavioral Specificity Determines Usefulness

The first major implication is that microplastic awareness has limited behavioral value when it remains conceptually vague. Consumers may become worried about environmental contamination without understanding which ordinary behaviors contribute to emissions or which responses are proportionate. Deng and colleagues found that greater knowledge and concern were associated with stronger willingness to reduce microplastic emissions, while broader public-perception research similarly links environmental-impact awareness with pro-environmental behavior.

Environmental education should therefore make microplastic sources concrete. Communication concerning laundering can explain the connection between synthetic textiles and fiber shedding; personal-care communication can explain intentionally added particles where relevant; and plastic-consumption communication can distinguish visible disposable waste from subsequent fragmentation pathways. Such specificity increases behavioral relevance without requiring alarmist messaging.

At the same time, awareness campaigns should avoid suggesting that household behavior is the only or primary solution. Product manufacturers, textile producers, packaging systems, wastewater infrastructure, retailers, and regulators influence the conditions under which households consume. Consumer adaptation is therefore best understood as one layer within a broader source-reduction strategy.

6.2 Practical Feasibility and the Limits of Consumer Responsibility

The second implication concerns behavioral feasibility. Households differ in income, product availability, housing arrangements, access to safe drinking water, washing technology, retail infrastructure, and time available for product evaluation. A consumption practice that is easy for one household may be impractical for another. Responsible intervention design must therefore distinguish environmentally desirable behavior from universally feasible behavior.

Drinking-water behavior provides a particularly important example. The WHO has identified microplastics in drinking water as an area requiring additional scientific evidence and careful interpretation. Communication should not pressure households to make water choices based on exaggerated assumptions about health risk. Instead, where reliable tap water is available, reduction in unnecessary single-use bottles can be discussed as part of broader resource and packaging reduction.

Similar proportionality applies to textile practices. Evidence establishes synthetic garment washing as a microfiber-release pathway, but households cannot independently redesign textile production. Meaningful reduction will therefore require interaction between informed consumer choice and upstream improvements in fiber design, garment durability, labeling, appliance technology, filtration, and wastewater management.

6.3 Household Adaptation as a Shared Governance Challenge

The third implication is that microplastic reduction should move beyond an individualized model of environmental responsibility. If households are repeatedly instructed to “make better choices” while product information remains unclear and lower-impact alternatives are unavailable, behavioral interventions risk becoming symbolic rather than effective. Sustainable consumption requires institutional environments that make environmentally preferable behavior realistic.

Public policy can support this process through transparent product standards, restrictions on avoidable intentionally added microplastics where justified, improved waste prevention, research support, environmental labeling, and incentives for product redesign. Industry can contribute through reduced plastic intensity, improved material transparency, more durable textiles, and technologies that reduce unintended emissions. Retailers can influence choice by making alternatives visible and economically accessible.

Household awareness nevertheless remains important because public understanding can influence purchasing demand, political support, acceptance of environmental regulation, and willingness to participate in collective reduction strategies. Garcia-Vazquez and Garcia-Ael's synthesis emphasizes the central role of public knowledge in willingness to adopt sustainable behavior. The broader policy objective should therefore be to connect informed households with structural opportunities for action rather than expecting awareness to compensate for poorly designed consumption systems.

7. Conclusion

Microplastic pollution presents an unusual household behavioral challenge because many relevant emission pathways are invisible during ordinary consumption. Consumers can easily recognize discarded packaging but may be less aware of fiber release during laundering, plastic particles associated with particular products, or the gradual fragmentation of larger plastic materials. General environmental concern is consequently insufficient unless households also understand where their own consumption intersects with the wider pollution system.

This paper developed a conceptual framework connecting awareness with actionable knowledge, behavioral feasibility, consumption substitution, and routine stabilization. Five household domains were examined: single-use plastics, reusable containers, textiles and laundering, bottled beverages, and personal-care products. The framework demonstrates that these behaviors vary considerably in visibility and practical difficulty, making a uniform approach to environmental communication inappropriate.

The scenario analysis further conceptualized household adaptation as a portfolio rather than a single behavior. The simulated values are not empirical results, and future studies should validate the proposed relationships through representative household surveys, experimental information interventions, longitudinal consumption diaries, product-choice experiments, and measured changes in relevant household practices. Particular attention should be directed toward the distinction between stated environmental intention and sustained routine behavior.

The central conclusion is that meaningful microplastic awareness should enable informed action without transferring disproportionate responsibility to individual households or overstating uncertain health evidence. Consumer knowledge is most useful when it is source-specific, scientifically careful,

and connected with affordable alternatives and supportive infrastructure. Household adaptation can contribute to microplastic reduction, but its effectiveness will depend on coordinated changes involving consumers, manufacturers, retailers, technology providers, waste and water systems, and public policy.

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