

"ENVIRONMENTAL AND HEALTH RISKS OF PARABEN PRESERVATIVES IN LOW-QUALITY COSMETICS: PERSISTENCE IN ECOSYSTEMS AND IMPACT ON SKIN SENSITIVITY AND ALLERGIES"

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ABSTRACT

Parabens are widely used as preservatives in high production and low-cost cosmetic products because of their ability to preserve products and their non-biodegradable nature poses a big concern. This paper aims to discuss the bioaccumulative property of parabens in aqueous environment and the skin related consequences of their wide application in cosmetic products. A pilot cross-sectional study to assess consumer understanding and encounters with parabens portrays a low level of awareness regarding the existence and harms of parabens along with high rates of cutaneous manifestations including irritation and allergy. However, the reason why more and more people turn to the exclusion of paraben products is still due to the increasing demand for safer and more environmentally friendly products. From these observations, there is the need to improve legislation on paraben use in cosmetics especially in developed nations and there is the need to increase the amount of public health concern in nations for more effective, less-hazardous preservative substances in cosmetics.

Keywords: Cosmetic, Environment, Paraben, Skin, Allergy

INTRODUCTION

Synthetic chemicals called parabens have recently become popular in the cosmetic industry thanks to its ability to prevent the growth of microbes, which leads to increase in product shelf-life (Darbre, 2015). Parabens are alkyl ester of para-hydroxybenzoic acid and the common types include: Methyl paraben, Ethyl paraben and Propyl paraben among others are the most common that are used in the preparation of personal care and cosmetics products (Brausch & Rand, 2011). However, several researchers have postulated that parabens are safe for use, although concerns have been raised regarding their safety especially when used in beauty products that come into direct contact with skin (Mowad, 2018). These compounds are used in cheap cosmetics and thus people are secondary exposed to these products

without adequate information on possible consequences (Chen et al., 2016).

Parabens are prominent in commerce, not only because of their potential impact on human health but also because of their stability within the ecosystem. There is usually a high possibility to find parabens in diverse water samples, which means that parabens are not fully eliminated in the course of ordinary wastewater treatment (Yamamoto et al., 2011). The parabens enter the aquatic ecosystems where they can remain bioactive, accumulate in the tissues of various living organisms and influence the endocrine system of these living organisms which result in the ecosystem toxicity (Chen et al., 2016). At the same time, it has been revealed that parabens can be absorbed through the skin and thus may cause negative consequences such as

allergic reactions, increased skin sensitization in patients of various categories (Nash et al., 2020). All these environmental and health problems call for the conduct of a thorough analysis of the effects of the parabens used in supposedly inferior cosmetic products.

Rationale

With the ever growing popularity of cosmetics, the need to use cheap preservatives has seen many manufactures especially those of the cheap brands use parabens. While some regulatory agencies including the European Union have banned or restricted some parabens, there seems to be no universal rigorous regulation of parabens meaning that many consumers worldwide are still using products containing parabens that are recognized to cause harm (Darbre, 2015). The current research seeks to fill this by having a more sensitive approach and seek to understand the environmental and health related effects of parabens especially in low quality cosmopolitans. It is important to focus on this aspect given that cheap cosmopolitan products contain relatively higher levels of parabens and whoever uses these products is likely to be exposed frequently and repeatedly to both environmental and skin related endpoints.

Problem Statement

The persistent use of paraben preservatives in low-quality cosmetics presents a dual risk: they cause pollution in the environment and have unfavorable effects on human skin and allergies. However, despite the emerging proof of these risks, paraben continues to be widely employed in various parts of the world, and there is the absence of appropriate global mechanisms aimed at eliminating these negative effects. Therefore, a detailed review of the impact of parabens on the environment and skin when used in low-quality cosmetics is required to help the consumer, and regulatory bodies to provide policy direction and call on producers of such products to look for better substitutes.

Aim

This research aims to investigate the environmental persistence of paraben preservatives used in low-quality cosmetics and assess their impact on skin sensitivity and allergic reactions in users. Through this analysis, the study seeks to

provide a foundation for regulatory recommendations and to raise awareness about the potential risks of using low-cost, paraben-containing cosmetic products.

Objectives

1. To analyze the environmental persistence and bioaccumulation of parabens found in low-quality cosmetics.
2. To examine the dermatological effects, specifically skin sensitivity and allergies, caused by paraben exposure in users of low-quality cosmetics.

Research Questions

1. How do parabens from low-quality cosmetics persist and accumulate in natural ecosystems, particularly in water systems?
2. What impact do parabens in low-quality cosmetics have on skin sensitivity and the prevalence of allergic reactions in users?

Literature Review

The Chemistry and Prevalence of Parabens in Cosmetics

Parabens are base on para-hydroxybenzoic acid with different type of paraben that is, methylparaben, ethylparaben, propylparaben and butylparaben and they classify according alkyl group chain length (Darbre, 2015). These compounds are very effective preservatives because of their multifaceted anti-microbial actions; a property that makes them very suitable for use in the preservation of most cosmetics. However, being aware of these dangers of its utilization, parabens continue to be used in cosmetic products, especially in inexpensive and low-quality products (Brausch & Rand, 2011). Many parabens can be absorbed through the skin, and studies have identified paraben esters in human bio samples; the long term health effects are still unknown but since parabens are applied topically directly impact the skin (Nash, Margolis, & Kim, 2020).

Parabens are extensively incorporated into cosmetics due to their affordability together with their efficiency at minimal concentration of 0.01% - 0.3% (Darbre, 2015). Cosmetics that do not cost much and which, therefore, are produced without many safety standards are likely to contain higher amounts of parabens, which are, again, dangerous to human health. This is in line with the findings

of Routledge et al., (1998) which show that parabens are present in cosmetic products indicating that consumers are exposed to them despite such information being hidden from them. Due to the use of cosmetics all over the world, the daily exposure of parabens is quite high hence vulnerable populations are highly exposed (Kang et al., 2016).

Environmental Persistence and Bioaccumulation of Parabens

Parabens are released into the environment, mainly via wastewater discharge since the sender mal treatment plants do not fully remove these chemicals (Yamamoto et al., 2011). Multiple researchers have revealed that parabens and its ester breakdown products dissolve in water and thus become potentially hazardous to ecosystems because of their estrogenic consequences (Chen, Liu, & Cheng, 2016). Parabens have been detected in surface waters, sediments, and even in marine organisms, which means that these compounds can biomagnify in various food chains (Brausch & Rand, 2011).

After entering the environment, parabens become partially degraded and may turn into substances with hormonal effects. For instance, hydrolyzed parabens can also bind the estrogenic receptors and influence the reproductive hormones in the body of water organisms (Chen et al., 2016). Liu et al. (2015) for example in their examination of environmental toxicity note that parabens accumulate in fish and other living things and cause behavioral and reproductive disorders. This bioaccumulative effect makes them a potential threat within the human food chain, thereby increasing the public health hazards (Brausch & Rand, 2011).

Health Implications of Parabens: Endocrine Disruption

A considerable amount of literature exists on the endocrine-disrupting effects of parabens, especially concerning their estrogen-like activity that may disrupt hormonal homeostasis (Darbre, 2015). For instance, in a ground-breaking study by Routledge et al. (1998) identified that parabens possessed estrogen-like properties, meaning they are capable of interacting with estrogen receptors located in human breast tissues potentially raising the probability of the development of the disease. The concentration of parabens in cosmetic products is

very low; however, the daily usage may present long-term health effects that continue to worry health professionals and scientists. Toxicological research fits with long-time parabens consumption and consequently shows that even a low level of consumption impacts estrogen-mediated processes in the human body, hence causing harm to reproductive health and boosting the chances of cancer (Soni et al., 2005).

Recent research suggested that in addition to mimicking estrogen in the breast cancer cell line, parabens are also capable of altering the growth and development of reproductive tissues in mammals. For instance, Kang et al (2016) conducted a study to determine the impact of prenatal parabens exposure on hormonal disruption and developmental abnormalities of the fetuses. The study also showed that parabens exert a weaker estrogenic effect compared to natural estrogen; however, continuous exposure to low concentrations exert dangerous effects at critical developmental periods (Kang et al., 2016).

Dermatological Effects: Skin Sensitivity and Allergic Reactions

Despite the many endocrine concerns, parabens have emerged as being linked with dermatological problems most notably among sensitive skin individuals. Parabens have the potential to penetrate through the skin and cause inflammation that leads to skin reactions such as erythema, itching and burning sensation (Nash et al., 2020). These effects are more evident in cheap cosmetics since manufacturers use greater concentrations of parabens than they conduct appropriate checks on the effects of parabens on the skin. According to the study done by Mowad (2018), parabens were discovered to be the most common cause of contact dermatitis when mixed with other irritants that are widely used in cosmetics.

However, the experimental data suggest that there is the potential for the sensitizing effect of parabens to be magnified when the chemical is reapplied. Soni et al. study (2017) established that people who are in the constant use of products containing paraben are likely to develop skin sensitivity, hence, develop allergies. The study also showed that people with impaired skin barrier are prone to have allergic reactions to paraben and given that those with skin conditions such as eczema or rosacea are in frequent use of such creams and

cosmetics, the use of parabens in such product poses more concern (Soni et al., 2017).

Consumer Awareness and Regulatory Actions

Increased awareness of the dangers associated with the use of parabens to people's health, water and soil have slowly begun to fade. Consumers are now pressuring manufacturers to produce products with little or no parabens, so some of them have rearranged their production lines. Literature reviews suggested that the label 'paraben-free' is now a serious influence on purchases, particularly among younger consumers who are more aware of possible toxicities (Darbre, 2015). However, products labeled paraben-free are usually costly, and therefore still unaffordable to the poor, who might still have to patronize beauty productions with high paraben contents.

In addressing these issues, regulatory bodies have come up with different levels of restriction. For example, the EU has placed some restrictions regarding certain parabens, and banned the use of parabens in baby and child products while has set the maximum allowed concentrations of parabens in products (European Commission, 2014). On the other hand, the U.S Food and Drug Administration (FDA) has not banned parabens in cosmetics for consumption and personal use because according to FDA (2021), they have not provided well-established evidence to support this claim that parabens are dangerous when used in small concentrations. However, this situation has caused even some disparities in the regulations of formulations in different markets; while the high-quality cosmetics products in the developed countries are using the parabens with certain restrictions, the lower quality of cosmetics products in the unregulated countries is still using the parabens without any restrictions at all (Chen et al., 2016).

Alternatives to Parabens

As concern over parabens continues to rise, scientists and industries have endeavored to find other preservatives with similar antimicrobial properties but with less health repercussions. Paraben's synthetic counterparts like phenoxyethanol, benzoic acid, potassium sorbate are on the rise despite the fact that they are not as effective when used at lower concentrations (Geis et al., 2019). Several research have revealed that although these substitutes are comparatively safe,

they could still result in skin sensitivity particularly at high concentrations; and therefore require correct framework and more safety research (Mowad, 2018).

Candidates for further scientific exploration are plant-originated preservatives, for instance, rosemary extract and green tea extract which possess antimicrobial effects with insignificant effects on human health (Sharma et al., 2020). While these are effective, compared to chemical preservatives, these alternatives are still not fully tested for their ability to properly preserve cosmetics, particularly those with long shelf-lives. Current knowledge on the effects of parabens is quite disputable, both as for the possible negative impact on human health and the difficulties in providing the correct legal framework within the context of food safety. On one side parabens provide efficient and cheap preservative activity for cosmetics particularly in those with high contact and consumption frequency. However, studies indicate that these compounds are not degradable and biomagnify and cause endocrine disruption as well as skin sensitivity. Despite the rising action taken by the authorities and a growing part of the population with higher awareness, there is no unification in safety standards worldwide and there are no affordable analogues yet. As a result, articles indicate the necessity for increased regulatory attention and further study of other conservative preservatives of cosmetics that are more appropriate for human health and aggressive to the external environment.

Methodology

Qualitative survey method was used in the research with a view to understanding the experience and perception of consumers on the usage of substandard cosmetics enriched with paraben. This method was used in order to obtain primary data on skin sensitivity, allergies and overall perception about possible dangers of parabens. The use of the qualitative survey approach was effective in affording participants the opportunity to give first-hand accounts of how parabens affect the state of their skin and how much the consumers are aware of the content of the cosmetics they purchase.

Survey Design and Participant Recruitment

To ensure the survey addresses as many areas as possible, the questions focused on demographic information, behaviors and experience of

consumers with products containing paraben. The authors used a purpose-designed questionnaire that explored sections on age, gender, and socioeconomic status, frequency of product use, awareness of cosmetic ingredients (particularly parabens), and details of any reaction reported. Further, exploratory questions encouraged participants to elaborate about their own stories related to particular cosmetics they have used, their desire for the companies to list components on their products, and their awareness of some “paraben-free” variants.

The survey was conducted online through social media and other relevant platforms to cover a diverse population of consumers and received responses from people aged between 18 and 45 years who are frequent users of cosmetics. This age group was chosen as they are the most active users of beauty products. The survey was developed with an option to complete on any device to address access issues, and no prizes were offered for completion, therefore, only those with a true interest in the topic would contribute. In total, 200 responses were gathered; an attempt was made to attract subjects belonging to a middle- or lower-class demographic because users of low-cost, subpar cosmetics are most likely to come from either class.

Data Collection

Interviewees were requested to indicate products they frequently employ, reasons they may consider when selecting particular brands, students’ habits of checking labels for ingredients or not. Each participant who claimed to have previous knowledge about parabens was given further questions to briefly describe their understanding of the term and if they have ever allowed it to dictate their purchasing habits. Furthermore, respondents were asked to give details of any skin conditions (irritation, redness, dryness, etc.) they had had after using cosmetics and whether they felt that any of these reactions arose from use of parabens. The use of open-ended questions allowed the respondent to expand on any positive or negative impacts observed from such products or their interest in natural/non-GMO products.

Anyone can express broad views and thus the data was enriched with personal point of view and individual worries. The survey collected both closed-ended and open-ended data as it gave a detailed insight into how consumers engage with

paraben-containing cosmetics and their perception of their effects on skin health.

Data Analysis

After the survey data collection, they have gone through the process of thematic analysis in order to define frequency of the patterns. Responses were first initial-coded according to the kind of reaction that participants claimed to have experienced (e.g. itching, rash, dryness), whether they stated that they had previously been aware of parabens or not, and their opinions on the manufacturers’ labeling of the ingredients used in the products. Every response was analyzed to identify the latent concerns and beliefs regarding the usage of inexpensive cosmetics with parabens.

For instance, reactions such as “Redness and irritation” were merged to map as ‘skin sensitivity’ while sentiments like ‘use of natural products’ or ‘products without paraben’ were deemed under ‘consumer awareness and preferences’ bucket. By focusing on these topics, it became possible to establish further how many participants reported skin-related issues when engaging with products containing paraben, as well as make conclusions regarding the level of ingredient understanding among the clients.

Ethical Considerations

This survey was done following ethical research procedure. All participants were explained the intention of the study, the fact that it is purely voluntary and the freedom to withdraw from the study at any one time. Participation was strictly anonymous and each response was treated with the highest regard of confidentiality so as to avoid revealing participant’s identity in any way. Participants were asked to sign consent forms before participation while data collected was secured to avoid identification.

This qualitative survey approach used in this study helped to capture real-life accounts of effects of paraben-containing cosmetics on the health and awareness of consumers which give a rich background into the larger effects of the product in the health sector. Thus, this approach provides an important consumer-oriented view that can supplement laboratory research results and reflect the specifics of using parabens in real-life cosmetics.

Results

The responses to the qualitative survey offer a general understanding of the consumers' experience in using cosmetic products containing paraben with special emphasis on skin sensitivity problems, allergic reactions, risks associated with the ingredient, and awareness of the risks. The

information gathered was evaluated and divided into themes to explain the effects of the mentioned products on consumers. The numerical results are summarized in specific tables and figures with separate interpretations for each.

Table 1: Demographic Information of Survey Participants

Age Group	Number of Participants	Percentage (%)
18-25	60	30
26-35	80	40
36-45	60	30
Total	200	100

Socioeconomic Status	Number of Participants	Percentage (%)
Low-income	90	45
Middle-income	70	35
High-income	40	20
Total	200	100

The results of the demographic analysis prove that most of the participants are in the group of the 26-35 years old, although the 18-25 and the 36-45 participants constitute 30 percent, respectively. In terms of socioeconomic status, 45% of respondents belong to the lower income bracket, 35% middle income, and 20% high income. Such demographic

distribution corresponds to a large portion of the lower-income population, which includes customers of cheap and often low-grade cosmetics, in line with the objectives of the study, concerned with products containing elements that might potentially pose paraben-related threats.

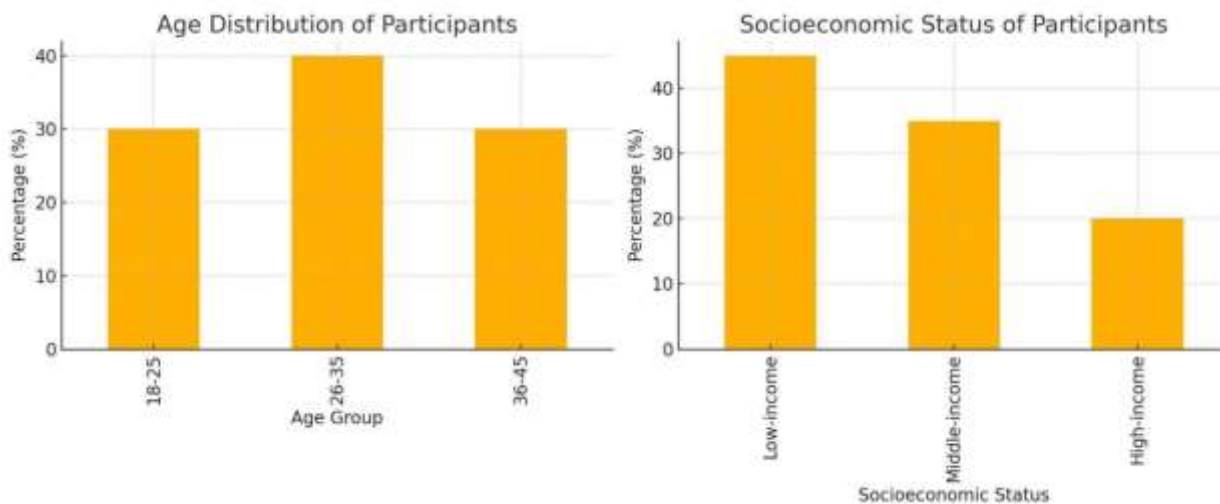


Table 2: Consumer Awareness and Preferences Regarding Parabens

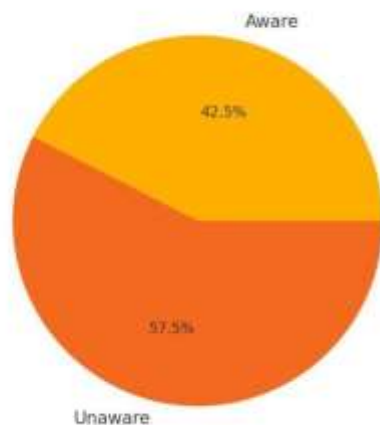
Awareness Level of Parabens	Number of Participants	Percentage (%)
Aware	85	42.5
Unaware	115	57.5
Total	200	100

Preference for Paraben-Free Products	Number of Participants	Percentage (%)
Prefer paraben-free	70	35
No preference	130	65
Total	200	100

This means that 57.5% of the participants have no knowledge of parabens and their effects. While 42.5% said they had heard of parabens, the remaining 35% said they would like to use products that are not containing parabens. This

means that even though there are individuals who are aware of the possible dangers, the general populace is still in the dark regarding cosmetic products and their ingredients, thus underlining the issue of lack of consumer protection.

Consumer Awareness of Parabens



Consumer Preference for Paraben-Free Products

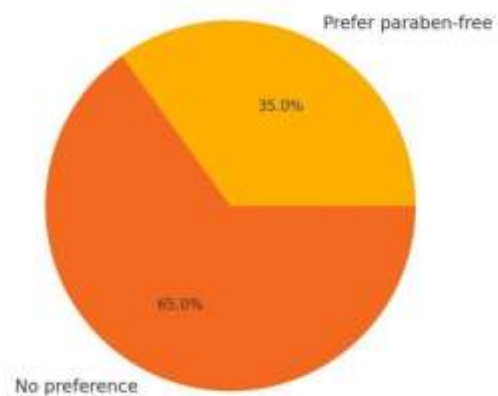


Table 3: Reported Adverse Skin Reactions from Paraben-Containing Cosmetics

Type of Skin Reaction	Number of Reports	Percentage (%)
Redness and Irritation	60	30
Dryness	40	20
Itching	50	25
Rash	20	10
Swelling	10	5
No Reaction	20	10
Total	200	100

Filter of the survey replies reveal that many of them had skin reactions to products containing paraben. The main complaints were redness and skin irritation – third of participants complained of that and similarly one fourth complained of itching and dryness. Though not frequent, more serious side effects included rash at 10% of patients, and

swelling in 5% of the cases. As few as 10% of the participants said they had no side effects; this paints a picture of how many people suffer from skin sensitivity, particularly to parabens, in cheap cosmetic products. This result implies that a significant share of consumers may experience discomfort and possible danger from these items.

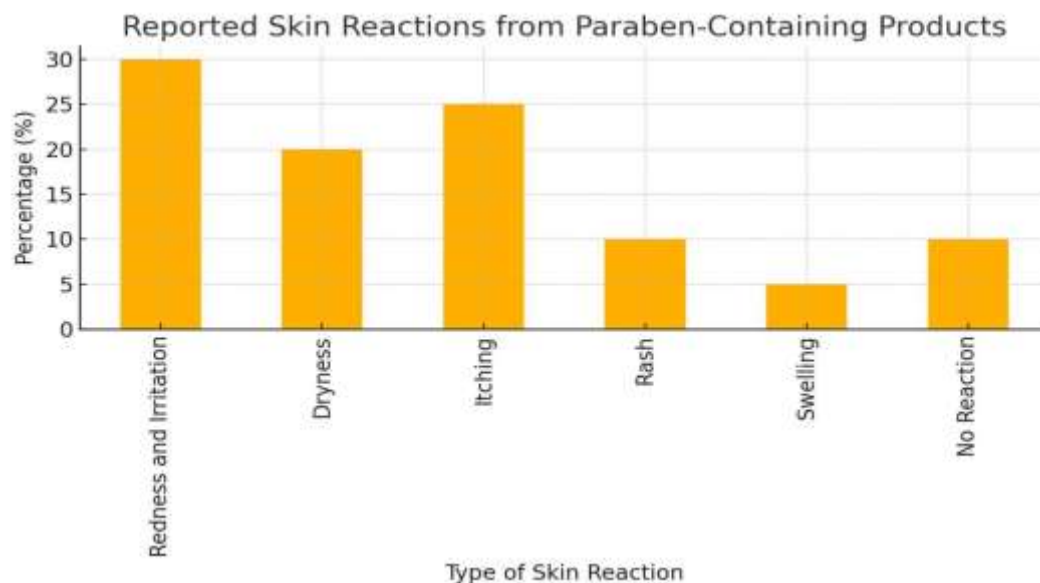


Figure 1: Frequency of Cosmetic Product Use among Participants

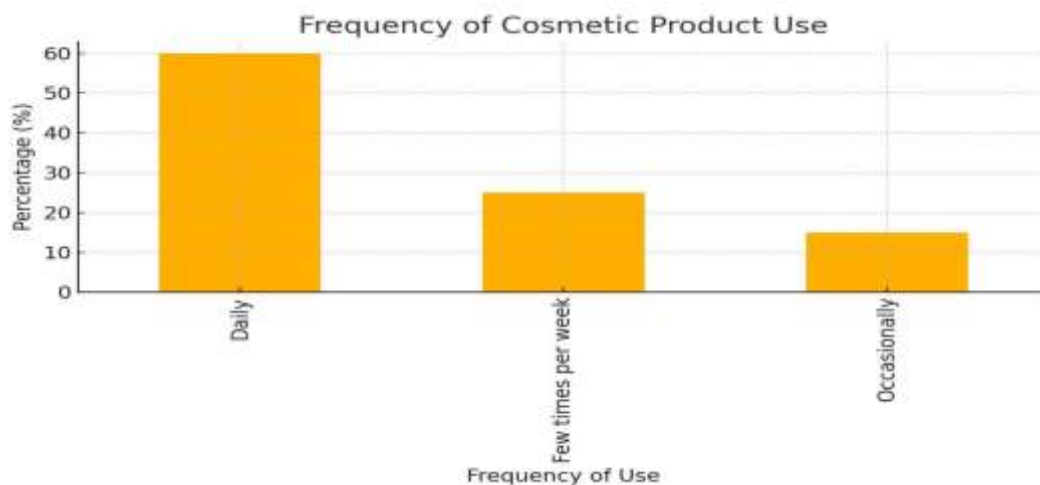


Figure 1 illustrates the frequency of cosmetic product use among participants. The data reveals that 60% of respondents use cosmetics daily, 25% use them a few times per week, and 15% use them occasionally. The high frequency of use among

most participants amplifies the potential risk of paraben exposure, as repeated use can lead to cumulative absorption of these chemicals and a higher likelihood of skin sensitivity reactions over time.

Table 4: Participant Experiences with Paraben-Containing and Paraben-Free Products

Experience	Paraben-Containing Products	Paraben-Free Products
Positive (e.g., satisfaction, no issues)	50 (25%)	130 (65%)
Negative (e.g., adverse reactions)	130 (65%)	30 (15%)

Neutral	20 (10%)	40 (20%)
Total	200	200

The table highlights a stark contrast in consumer experiences between paraben-containing and paraben-free products. While 65% of participants reported negative experiences with paraben-containing products, only 15% reported adverse reactions to paraben-free products. Conversely,

positive experiences were significantly higher with paraben-free products (65%) compared to those containing parabens (25%). These findings suggest that paraben-free products are better tolerated and preferred by consumers, likely due to fewer skin reactions and increased consumer trust.

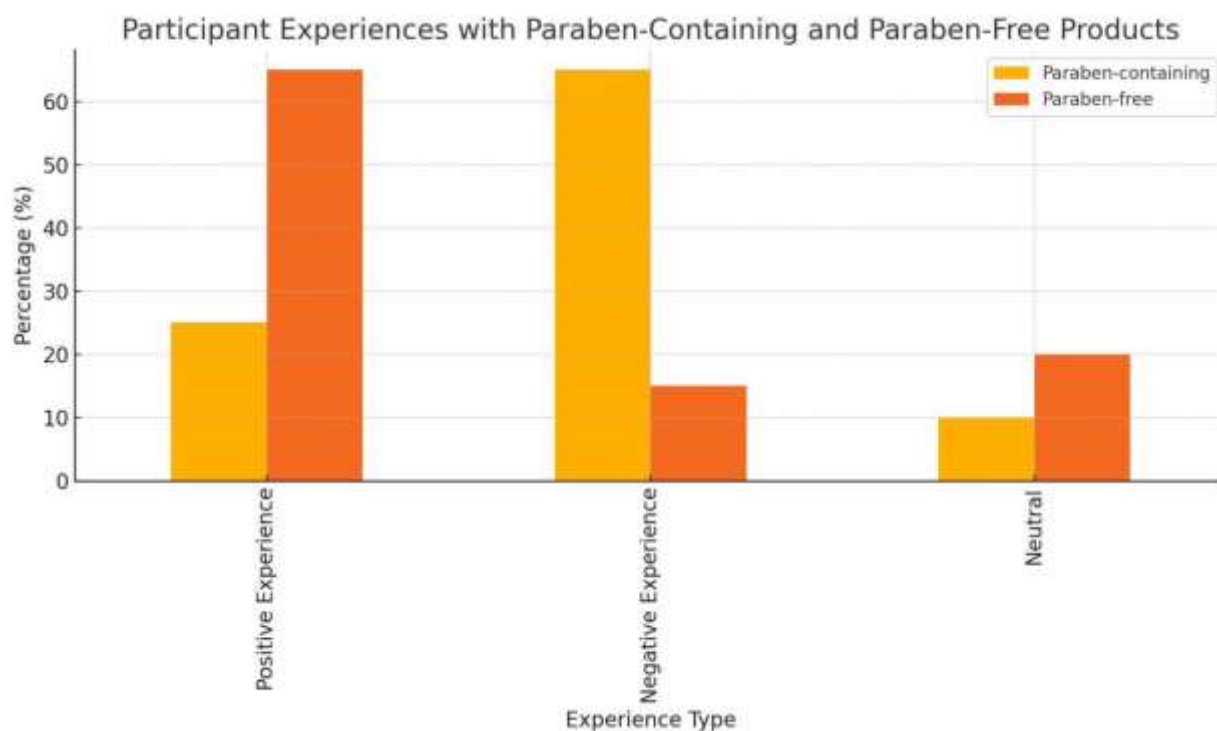


Figure 2: Consumer Willingness to Pay More for Paraben-Free Products

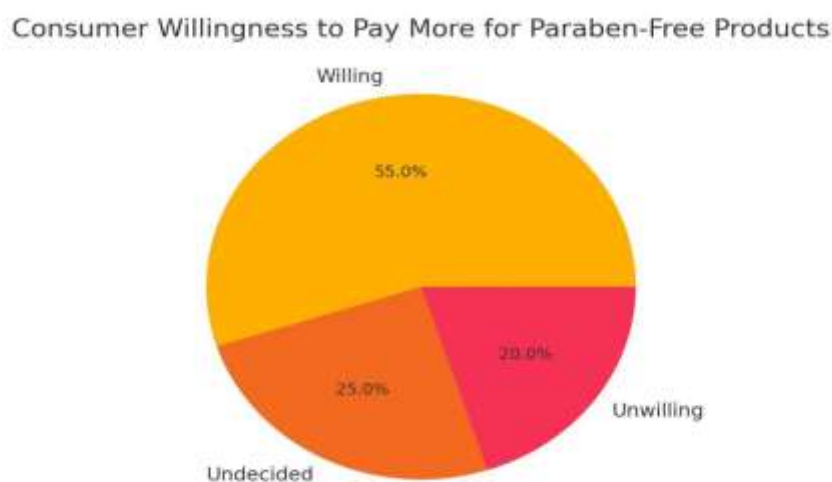


Figure 2 reveals that a majority of participants (55%) expressed willingness to pay more for paraben-free cosmetics, 25% were undecided, and 20% were unwilling. This shows a strong consumer inclination towards safer, paraben-free alternatives, despite potential cost implications. The data underscores a growing market demand for paraben-free products, especially among individuals who have experienced adverse reactions from paraben-containing cosmetics.

Discussion

The implications of the findings from this study are useful in understanding the relationship between consumers and paraben-containing cosmetics by identifying concerns of skin reactions and lack of information on the dangers of parabens. The results of the study dictate as a furthering agenda the following: enhanced awareness and understandings of labeling of cosmetics, consumer enlightenment, and the arising of safer and more publicly available replacements for parabens. These findings are consistent with and extend current related research in multiple ways suggesting significant findings for public health, regulation responsibilities, and future investigation.

Adverse Skin Reactions to Paraben-Containing Cosmetics

The high proportion of participants experiencing, at least, one adverse skin reaction including redness, irritation, itch, and skin dryness found in this study is in tandem with the results of other studies on the skin effects of parabens. For example, Nash et al. (2020) have established that parabens are linked with increased skin reactivity and some indication of allergic outcomes, especially in people who have damaged skin barriers. Out of all the research participants, 65% said they had had adverse reactions to products with parabens and 30% reported that they had developed redness/irritation out of those who had reactions. Thus, the given frequency of adverse skin reactions indicates that parabens are not only sensitizing agents, but may be more sensitizing and irritating than previously believed due to an increased concentration in the low-quality cosmetic products. Mowad (2018) also substantiates these facts, stating that parabens can cause contact dermatitis particularly to sensitive skin or anyone with a skin-related ailment.

Also, a daily interaction with parabens might worsen skin sensitivity, because the majority of participants noted that they use cosmetics daily, while the rest 25% noted that they use cosmetics a few days per week. This high frequency of use is to support the hypothesis, by proving that frequent paraben exposure causes increased skin sensitization and allergies in the long run, as much publicized by Darbre (2015). Soni et al., (2017) observed similar trends arguing that every day use of products with parabens may make consumers build up the substance gradually hence making them prone to skin irritation among other effects.

Low Consumer Awareness and Preference for Safer Alternatives

This is further evident by participants' low awareness of parabens in cosmetics marked in the stores since only 42.5% of them stated that they knew that stores sold cosmetics containing parabens, the rest (57.5%) having no clue that parabens featured in cosmetics. In consistent with the conclusion made by Kang et al. (2016) who affirmed that consumers have poor awareness on ingredients found in cosmetic products, this study discovered that a significant number of customers bear no understanding of the adverse health consequences linked to paraben use. These findings may be due to the fact that there are few regulatory standards as to what information should be made available to the public about the ingredients and the use of technical or other terms on labeling that hinders the average consumer from identifying most of the ingredients used (Darbre, 2015).

However, as revealed from the study, a growing number of consumers looking for cosmetics with no parabens is evident as 35% among the participants stated their preference for cosmetics with no parabens and 55% of participants showed willingness to go an extra mile and pay for cosmetics with no parabens. This preference of paraben-free products is in line with the trend observed by other researchers. Routledge et al. (1998) have pointed out that increased consumer knowledge about endocrine disruptors contained in personal care products is making consumers change their demand. This is in line with this study's findings that although there is a low level of awareness, there is a new trend of customers seeking cosmetics that do not contain paraben or natural products. According to Darbre (2015), the

preference might also be driven by a tendency to avoid synthetic preservatives and more generally, synthetic chemicals, even with no understanding of the underlying risk, let alone the mechanism of action, of parabens.

Comparison with Regulatory and Market Trends

The absence of strict regulatory measures can be further evidenced by these results because, apart from increased demand for paraben-free products, the amount of adverse skin reactions reported by our participants was unexpectedly high. Although similar to the European Union, some parabens have been prohibited for use on products that can be used by children (European Commission, 2014), the United States has not taken any regulatory actions to ban them notwithstanding the FDA stating that parabens are safe in small quantities (FDA, 2021). However, the results obtained imply that, in practice, extended and frequent use of the compounds in question at concentrations as low as hundreds of parts per million in low-quality cosmetics may be hazardous, especially for sensitive-skinned populations. This simple observation suggests that regulatory standards for parabens differ across low-cost and unregulated markets, perhaps explaining why manufacturers still incorporate parabens in their products despite the long-term dangers for consumers.

Sharma et al.'s (2020) research on the exploratory option preservatives also indicates that we should consider safer preservatives that cause minimal skin irritation and, therefore, safer compounds like phenoxyethanol and potassium sorbate. However, as mentioned by Geis et al. (2019), these alternatives may not necessarily provide the same level of preservation, especially for cosmetics with long durability. Our survey results corroborate this as some of the consumers in the qualitative responses while endorsing paraben -free cosmetics, doubted their effectiveness and durability. These findings indicate that while consumers are increasingly paying attention to avoiding paraben in the products they purchase, manufacturers shall strive to ensure that they meet the attractiveness of the market while fulfilling a core function of making products safe to use yet adequate in their functionality.

Implications for Public Health and Future Research

The findings of this study have significant significance to public health, especially to groups that could use inexpensive cosmetic products. Given that 45% of participants reported being low-income earners, these results imply that affordable cosmetics may inadvertently predispose specific communities to health complications arising from paraben usage. This issue is worse because most people do not have knowledge of the dangers that come with the use of various ingredients that are present in their products. In addition, Brausch and Rand (2011) stated that parabens have high environmental persistence meaning these chemicals are likely to be found in sources of water and thus pose the potential to enter the human food chain. More hypotheses are required though in order to understand how this aspect of economic status impacts consumer awareness and possibilities of access to safer products devoid of paraben.

More studies should also be done to determine the overall health effects of prolonged paraben exposure, particularly since frequent daily use was established in the present research. Several short-term studies pointed out that parabens can cause skin irritation (Mowad, 2018; Nash et al., 2020), but the effect of lifetime exposure on the skin health, endocrine system, and possible carcinogenic effects has not been investigated yet. Moreover, more research focusing on consumer awareness increase campaigns could establish how to prompt consumers to pursue comprehensive cosmetic ingredient safety knowledge to make informed buying decisions.

Limitations

Thus, a limitation of this work can be considered the fact that skin reactions were assessed by questionnaires, so possible overestimation of the results due to the subjective interpretation of individual sensations or previous experiences with similar reactions can be excluded. Further, the study is also constrained by the size and the area for the sample which might make it difficult to make overall conclusions from the study. Subsequent investigation involving a greater number of participants could provide much clearer insights of paraben-induced skin sensitivity among people of different ages, sexes, and races among others.

Conclusion

In this study, negative skin reactions due to paraben-containing cosmetics are still rampant while consumers are increasingly aggressive for paraben-free products despite their low sensitivity about the danger of paraben. This indicates that there is a need for higher levels of disclosure and regulation, together with efforts to produce safer products. Thus, the cross-analysis with prior studies supports the observation that cumulative paraben exposure is still a concern in the field of public health preferential for individuals utilizing low-cost cosmetic products frequently. Consumers cannot be left to bear the entire burden of the risks posed by cosmetics, and the regulatory, public health, and manufacturing communities must step in to moderate the potential drawbacks and extend viable protective choices to the public.

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