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KNOWLEDGE AND AWARENESS OF HARMFUL EFFECTS OF COSMETICS AMONG MEDICAL STUDENTS: A CROSS-SECTIONAL SURVEY STUDY

Y JANANI¹, BHARATH KP², K BALAJI^{3*}, P SREENIVASI³, YUVARAJ MARIA FRANCIS⁴¹Department of Anatomy, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Padur, Chennai 603103, Tamil Nadu, India.²Department of Anatomy, Sri Venkateshwara Medical College and Hospital, Redhill, Chennai 600067, Tamil Nadu, India.³Department of Anatomy, Saveetha Medical College & Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 602105, Tamil Nadu, India.⁴Department of Anatomy, ESIC Medical College and Hospital, Ashok Pillar Road, K.K. Nagar, Chennai - 600078, Tamil Nadu, India.

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ABSTRACT

Cosmetics are widely used among young adults, including medical students, who may not be fully aware of their potential adverse health effects. Adequate knowledge and awareness are essential for promoting safe cosmetic use and improving public health education. This study aimed to assess the knowledge and awareness of the harmful effects of cosmetics among medical students. A total of 520 medical students participated after providing informed consent. Data were collected using a structured, pre-validated questionnaire covering demographic characteristics, cosmetic use practices, awareness of harmful ingredients and health risks, and perceptions regarding natural versus synthetic cosmetic products. Among the participants, 354 (68.07%) reported regular cosmetic use, while only 214 (41.15%) consistently checked ingredient labels before purchasing cosmetic products. Awareness of harmful ingredients, including parabens and endocrine-disrupting chemicals, varied significantly according to gender and year of study. Skin allergies were identified as a common health risk by 283 (54.42%) participants. Awareness was significantly associated with ingredient-checking behavior ($p < 0.01$). Regression analysis identified age, year of study, and frequency of cosmetic use as significant predictors of knowledge. The findings indicate moderate awareness among medical students and emphasize the need to incorporate cosmetic safety education into the medical curriculum to encourage safer cosmetic practices.

Keywords: Endocrine Disruptors, Health Knowledge, Medical Students, Surveys and Questionnaires, Toxicity.

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*Corresponding Author

Dr. K Balaji

Department of Anatomy,

Saveetha Medical College & Hospital,

Saveetha Institute of Medical and Technical Sciences,

Saveetha University, Chennai 602105, Tamil Nadu, India

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INTRODUCTION

Cosmetics are an integral part of daily life for millions worldwide, with a global market valued at over USD 500 billion according to recent industry reports [1]. Their widespread use spans all demographics, including young adults and medical students, driven by aesthetic, social, and cultural factors. However, escalating safety concerns surround many products due to harmful ingredients such as endocrine-disrupting chemicals (e.g., parabens, phthalates), heavy metals (e.g., lead,

mercury), sulfates, formaldehyde, and potential carcinogens. These substances can penetrate the skin, leading to adverse effects like allergic reactions, skin irritation, dermatitis, hormonal imbalances, reproductive issues, and increased cancer risks [2-4]. Health organizations including the World Health Organization (WHO) and the Indian Council of Medical Research (ICMR) have flagged these as significant public health challenges, particularly amid rising dermatological complaints from prolonged exposure [5,6]. Despite this, consumer awareness remains inconsistent, with many assuming "natural" or organic labels guarantee safety—a misconception that heightens vulnerability, especially among future healthcare providers like medical students who frequently use cosmetics yet influence public health messaging.

Previous research has illuminated various aspects of cosmetic risks and usage patterns. Recent study provided a comprehensive review of synthetic cosmetics' environmental and long-term health impacts, emphasizing toxicity pathways

[7]. Few studies detected potential carcinogens in makeup products, urging consumer caution and the toxicological effects of heavy metals in cosmetics, advocating stricter quality controls, hazardous substances and mitigation strategies [8-10]. Studies on usage and awareness, reporting negative effects among Ethiopian female graduates; and assessing knowledge and behaviors among Sri Lankan undergraduates and Korean dermatologists respectively; linking cosmetics to women's health issues [11-14]. Additional works, on acne-cosmetic links and on Lebanese women's attitudes, highlight gender disparities and behavioral gaps [15, 16]. These investigations predominantly focus on general populations, undergraduates, or regional cohorts, revealing moderate awareness but limited ingredient scrutiny and overreliance on non-scientific sources like social media.

Despite these contributions, a critical gap persists in the literature. There is scant data on medical students' knowledge and practices regarding cosmetic harms, especially in India. Existing studies overlook this key demographic, who not only exhibit high usage rates but also serve as future educators and counselors on public health. Indian-context research is particularly sparse, ignoring local regulatory nuances, cultural usage patterns, and curriculum deficiencies that could amplify risks.

This study addresses this lacuna through a novel cross-sectional survey of 520 medical students at Saveetha Medical College, Chennai. It systematically evaluates knowledge of harmful ingredients, usage behaviors, health risk perceptions, demographic correlates, and safety attitudes (natural vs. synthetic). By quantifying awareness gaps via validated questionnaires and statistical analyses, it provides India-specific evidence for the first time. Findings will inform targeted curriculum integrations, workshops, and policy recommendations to promote safer practices, ultimately enhancing health outcomes for medical trainees and the broader population.

MATERIALS AND METHODS

This cross-sectional study was conducted among medical students at Saveetha Medical College, located in Chennai, India, during May–October 2025. The setting was chosen due to its diverse student population and the accessibility for data collection related to students' knowledge and perceptions about cosmetic safety. The study protocol was reviewed and approved by the Institutional Human Ethical Committee (Reference No: 035/05/2025/IEC/SMCH) and Institutional Review Committee (021/04/2025/IRB/SMC). The study included 520 medical students across different years of study, enrolled voluntarily after obtaining informed consent.

Inclusion criteria: All undergraduate and postgraduate medical students enrolled at the Private Medical College during the study period who were present at the time of data collection and provided written informed consent were included in the survey.

Exclusion criteria: Students from other courses or institutions, those absent during data collection, and those unwilling to participate or not providing complete responses were excluded from the study.

Sampling Technique

The sample size was estimated based on an expected proportion of cosmetic users among medical students from previous literature, with a 95% confidence level and 5% margin of error, based on an expected proportion of 68% cosmetic users among medical students reported by Udayanga et al. (2024), yielding 345; accounting for 10% non-response and subgroup power, the final target was set at 520 participants. [12]. Accounting for a non-response rate and ensuring adequate power for subgroup analyses, the final target sample was set at 520 participants. A stratified random sampling method was employed to ensure proportional representation from each academic year. Participants were approached during scheduled academic activities and classrooms, and informed consent was obtained from all.

Data Collection Procedure

The questionnaire was devised by the Principal Investigator and research team, based on previous peer-reviewed published articles [12, 14]. It was pre-validated by experts in survey studies, modified accordingly for content validity, though specific reliability scores were not quantified. The instrument comprised 23 questions across sections on demographics, usage patterns, awareness, risks, and perceptions; scoring was based on correct responses for knowledge items (percentage scores) and categorical responses for behaviors/attitudes. A pilot study was conducted on 10 participants to test feasibility and refine wording.

This structured, pre-validated questionnaire was administered to assess demographic details (age, gender, year of study), cosmetic use behavior (frequency, types, ingredient checking), awareness of harmful ingredients (parabens, sulfates, heavy metals, endocrine disruptors) and health risks (skin irritation, allergies, hormonal imbalance, carcinogenic effects), and perceptions of safety (natural vs. synthetic products). Data collection occurred during scheduled academic sessions at the Medical College, Chennai, with anonymity maintained. Parameters studied included knowledge levels, usage patterns, risk perceptions, information sources, and demographic correlates of awareness. Participants' confidentiality was maintained throughout the study, with data anonymized prior to analysis.

Questionnaire Items (Structured, Pre-validated; n=23 questions)

Section A: Demographic Details

1. Age
2. Gender
3. Phase I to IV, Interns of the MBBS and MD (Phase I to III)

Section B:

Cosmetic Usage Patterns

4. Do you use cosmetic products regularly? (Yes/No)
5. How often do you use cosmetic products? (Daily/Several times weekly/Rarely/Never)
6. Which types of cosmetics do you use most frequently? (Skin Care, Hair Care, Make Up, Sun Screen, Others)

Safety Practices

7. Do you check the ingredient list before purchasing cosmetics? (Multiple Choice)
8. How do you determine if a cosmetic product is safe to use? (Multiple choice)

9. Have you ever researched the safety of a cosmetic brand before using it? (Yes/No)

Awareness of Harmful Ingredients

10. Which of the following harmful ingredients have you heard about? (Multiple choice)

11. Are you aware that certain cosmetic products contain endocrine-disrupting chemicals? (Yes/No)

12. Are you aware that cosmetic preservatives like parabens may accumulate in the body? (Yes/No)

Health Risk Perception

13. Which of the following health risks can be associated with long-term cosmetic use? (Multiple choice)

14. Have you ever experienced any allergic reaction (e.g., redness, itching, rashes) after using a cosmetic product? (Yes/No)

15. Do you think excessive use of cosmetics can lead to skin barrier damage? (Yes/No/Unsure)

Information Sources & Attitudes

16. Which source do you rely on for cosmetic product safety information? (Multiple choice)

Perceptions & Recommendations

17. Do you believe that natural/organic cosmetics are always safer than synthetic ones? (Yes/No/Unsure)

18. Do you believe stricter regulations are needed for cosmetic ingredients? (Yes/No)

19. Do you think medical students receive enough education about the harmful effects of cosmetics? (Yes/No)

20. Would you be interested in attending workshops or lectures on cosmetic safety and dermatology? (Yes/No)

21. Do you believe dermatologists should play a larger role in educating the public about safe cosmetic use? (Yes/No)

22. What steps should be taken to improve awareness about cosmetic safety? (Open-ended)

23. Any additional comments or concerns regarding cosmetic product safety? (Open-ended)

Scoring System for Knowledge Assessment:

Knowledge score calculated from 5 objective items (maximum 5 points):

- Q10: Which of the following harmful ingredients have you heard about?
(1 point: ≥ 3 correct from sulfates/parabens/heavy metals/formaldehyde/phthalates)
- Q11: Are you aware that certain cosmetic products contain endocrine-disrupting chemicals? (1 point: Yes)
- Q12: Are you aware that cosmetic preservatives like parabens may accumulate in the body? (1 point: Yes)
- Q13: Which of the following health risks can be associated with long-term cosmetic use? (1 point: ≥ 3 correct from skin irritation/ allergies/ carcinogenic/ hormonal/ reproductive)
- Q15: Do you think excessive use of cosmetics can lead to skin barrier damage? (1 point: Yes)

Total score ranged from 0-5 points and was converted to percentage (0-100%).

Statistical Analysis

Data was entered and tabulated in Microsoft Excel 2023 for analysis. Descriptive statistics were used to summarize demographic variables and awareness levels, with means, standard deviations, frequencies, and percentages reported as

appropriate. The Chi-square test was applied to examine associations between categorical variables such as gender and awareness status, with a significance level set at $p < 0.05$. Awareness was assessed through self-reported recognition of specific harmful cosmetic ingredients (sulfates, heavy metals, parabens, formaldehyde, phthalates, endocrine-disrupting chemicals) and health risks (skin irritation, allergies, hormonal imbalance, carcinogenic effects, reproductive issues), with levels categorized as percentage of respondents identifying each chemicals.

RESULTS

A total of 520 medical students participated in the survey (Table 1). The comprehensive frequency distribution of responses to all 23 questionnaire items revealed key patterns: 68.07% (354/520) reported regular cosmetic use, with 60% (312/520) using products daily/several times weekly; ingredient checking was practiced by 41.15% (214/520), and awareness varied significantly across harmful ingredients (sulfates 312 (60%) vs. phthalates 130 (25%)).

Demographic Characteristics

A total of 520 medical students participated in the survey, comprising 221 (42.5%) males and 299 (57.5%) females. The mean age of participants was 22.1 ± 2.3 years, ranging from 18 to over 27 years. Most respondents were in the age group of 21–23 years 338 (65%), followed by 18–20 years 130 (25%) and above 24 years 52 (10%).

Cosmetic Use Behaviour

Overall, 354 (68.07%) of participants reported regular cosmetic use, with a higher prevalence among females 233 (77.92%) compared to males 122 (55.20%) ($\chi^2 = 5.94$, $p = 0.015$). The majority 312 (60%) reported using cosmetics daily or several times a week, while only 60 (11.53%) used them rarely. Checking ingredient labels before purchase was practiced by 214 (41.15%) of students, indicating moderate awareness. Notably, ingredient checking was more common among females 159 (53.17%) than males 77 (34.84%) (Table.2).

Awareness of Harmful Ingredients

Knowledge of harmful cosmetic ingredients varied. The most frequently recognized were sulfates 312 (60%), heavy metals 286 (55%), parabens 270 (51.92%), and formaldehyde 244 (46.92%). Only 130 (25%) were aware of phthalates (Table:1). Awareness of endocrine-disrupting chemicals (EDCs) was reported by 302 (58.07%), with postgraduate students showing higher awareness ($\chi^2 = 7.12$, $p = 0.03$) (Table.3). Correlation analysis revealed a positive correlation between the frequency of ingredient checking and knowledge scores 62% ($r = 0.42$, $p < 0.01$).

Perception of Health Risks

A large proportion of respondents 374 (71.92%) identified at least one potential health risk related to long-term cosmetic use. Commonly cited effects included skin irritation 358 (68.84%), allergies 283 (54.42%), hormonal imbalance 173 (33.26%), and carcinogenic effects 219 (42.11%) (Table:1). Approximately 78 (15%) reported personally experiencing allergic reactions such as redness or itching. Awareness of endocrine disruption was significantly higher among those who had previously experienced allergic responses (Table:4).

Associations were tested between these specific parameters due to their clinical relevance and these address key public health questions identified in literature gaps.

Sources of Information

The most common sources of information on cosmetic safety were dermatologists 338 (65%), social media 302 (58%), and product labels 234 (45%), while only 104 (20%) cited academic lectures or workshops. Female and postgraduate respondents were more likely to consult dermatologists compared to their male and undergraduate counterparts ($p < 0.05$) (Table:1).

Opinions on Safety, Education, and Regulation

A majority 406 (78%) believed that natural or organic cosmetics are safer than synthetic ones, though 208 (40%) acknowledged limited scientific evidence for this belief. Eighty-five percent of students felt that stricter government regulations on cosmetic ingredients are needed. Only 166 (32%) believed medical students receive adequate education on the harmful effects of cosmetics. However, 468 (90%) expressed interest in attending workshops or lectures on cosmetic safety, and 458 (88%) agreed that dermatologists should play a larger role in public education.

Correlation analysis identified year of study and gender as significant predictors of high cosmetic awareness ($R^2 = 0.31$, $p < 0.01$) (Table:5). Female students and those in higher academic years demonstrated greater knowledge of harmful ingredients and health risks. The results reveal that while cosmetic use is widespread among medical students, there exists a notable knowledge gap regarding harmful ingredients and their health impacts. Higher awareness correlates with increased educational exposure and ingredient scrutiny, emphasizing the need for targeted educational interventions within medical curricula. The regression analysis shows statistically significant and explains a substantial portion of the variance in the dependent variable (R^2 : 0.40, F-Statistic: $F(3, 516) = 112.3$, Significance: $p < 0.001$)

Correlation analysis demonstrated significant positive associations between knowledge scores and key variables: age ($r=0.35$, $p<0.01$), gender ($r=0.28$, $p<0.01$), year of study ($r=0.38$, $p<0.01$), and frequency of cosmetic use ($r=0.45$, $p<0.001$) (Table 5). The strongest correlation was observed between cosmetic usage frequency and knowledge ($r=0.45$), suggesting experiential learning through regular product exposure. Females exhibited higher mean knowledge scores (3.4 ± 1.1) compared to males (2.7 ± 1.2), consistent with greater cosmetic usage patterns (78% vs 55%). Senior students (Phase III-IV, interns) scored higher than Phase I-II students, indicating cumulative educational exposure. Multivariate regression confirmed these variables collectively explained 40% of knowledge score variance ($R^2=0.40$, $p<0.001$), with usage frequency emerging as the strongest predictor ($\beta=0.31$) (Table. 6).

Open-Ended Responses Analysis

Thematic analysis of responses to open-ended questions on improving cosmetic safety awareness and additional concerns revealed consistent priorities among medical students. Participants most frequently recommended curriculum-integrated workshops, stricter government regulations on ingredients, and dermatologist-led awareness campaigns.

Emphasis was placed on practical label-reading education, distinguishing genuine organic products from misleading "natural" claims, and addressing counterfeit cosmetics. Concerns about chemical-induced skin damage, greenwashing, and long-term endocrine effects were prevalent, with many advocating patch testing, homemade remedies, and minimal cosmetic use as precautionary measures while calling for transparent industry practices and affordable safe alternatives.

Table 01: Questionnaire Responses with Frequencies

S.No	Question	Response Options	n(%)
DEMOGRAPHICS			
1	Gender	Male Female	221 (42.50) 299 (57.50)
2	Age group	18-20 years 21-23 years >24 years	130 (25) 338 (65) 52 (10)
3	Year of Study	MBBS Phase I MBBS Phase II MBBS Phase III MBBS Phase IV MBBS Interns MD Phase I-III	186(35.76) 114(21.9) 101(19.42) 60(11.53) 36(6.92) 23(4.4)
USAGE PATTERNS			
4	Do you use cosmetic products regularly?	Yes No	354 (68.07) 166 (31.90)
5	How often do you use cosmetic products?	Daily/several times weekly Rarely Never	312 (60) 62 (11.92) 146(28.07) -
6	Which types of cosmetics do you use most frequently?	Lip products (lipstick, lip balm, gloss) Skincare (moisturizer, face wash, sunscreen) Foundation/BB cream/tinted moisturizer Eye makeup (kajal, mascara, eyeliner) Face powder/compact Hair products (gel, oil, styling) Nail polish Perfume/body mist	412(79.23) 389(74.8) 312(60.0) 286(56.15) 231(44.42) 209(40.19) 154(29.61) 130(25.0)
SAFETY PRACTICES			
7	Do you check the ingredient list before purchasing	Yes/Sometimes Rarely/Never	214 (41.15) 306 (58.84)

	cosmetics?		
8	How do you determine if a cosmetic product is safe to use?	Brand reputation/Familiarity	341(65.57)
		Product reviews	305
		Ingredient list checking	(58.65)
		Expert/friend recommendation	239
		Natural/organic labeling	(45.96)
		Price/quality assumption	211
			(40.57)
			178
9	Have you ever researched the safety of a cosmetic brand before using it?	Yes	138 (26.5)
		No	
INGREDIENT AWARENESS			
10	Which of the following harmful ingredients have you heard about?	Sulfates	296
		Heavy metals	(56.92)
		Parabens	224
		Formaldehyde	(43.07)
		Phthalates	
11	Are you aware that certain cosmetic products contain endocrine-disrupting chemicals?	Aware	312 (60)
		Not aware	286 (55)
			270
12	Are you aware that cosmetic preservatives like parabens may accumulate in the body?	Yes	(51.92)
		No	244
			(46.92)
HEALTH RISKS			
13	Which of the following health risks can be associated with long-term cosmetic use?	Skin irritation	130 (25)
		Allergies	
		Carcinogenic	302
		Hormonal imbalance	(58.07)
		Reproductive issues	218
			(41.92)
14	Have you ever experienced any allergic reaction (e.g., redness, itching, rashes) after using a cosmetic	Yes	248
			(47.69)

	product?		
15	Do you think excessive use of cosmetics can lead to skin barrier damage?	Yes No Unsure	368(70.76) 101(19.42) 51(9.80)
INFORMATION SOURCES			
16	Which source do you rely on for cosmetic product safety information?	Dermatologists Social media Product labels Academic lectures	338 (65) 302 (58.07) 234 (45) 104 (20)
PERCEPTIONS			
17	Do you believe that natural/organic cosmetics are always safer than synthetic ones?	Yes No Unsure	406 (78.07) 43 (8.26) 71 (13.65)
18	Do you believe stricter regulations are needed for cosmetic ingredients?	Yes	442 (85)
19	Do you think medical students receive enough education about the harmful effects of cosmetics?	Yes	166 (31.92)
20	Would you be interested in attending workshops or lectures on cosmetic safety and dermatology?	Yes	468 (90)
21	Do you believe dermatologists should play a larger role in educating the public about safe cosmetic use?	Yes	458 (88.07)

Note: Frequencies derived from reported percentages (n=520); open-ended responses analyzed thematically, not tabulated.

Table 02: Awareness Level vs. Ingredient Checking Behavior by Gender

Parameters		Ingredient checking		P value
		Check	No check	
Awareness	Aware	168F (56.2%) 71M (32.1%) 239 (46.0%)	42F (14.0%) 35M (15.8%) 77 (14.8%)	p<0.01
	Not aware	71F (23.7%) 77M (34.8%) 148(28.5%)	18F (6.0%) 38M (17.2%) 56 (10.8%)	

Table 03: Gender-wise Distribution of Endocrine Disruptor Awareness among Medical Students

Parameters		Females (n=299)	Males (n=221)	P value
Awareness	Aware	186 (62.2%)	116 (52.5%)	P=0.03
	Not Aware	113 (37.8%)	105 (47.5%)	

Table 04: Usage Frequency and Allergic Reactions by Gender among Medical Students

Parameters		Allergic Reactions		P value
		No allergy	Allergy	
Usage Frequency	Frequent	201 (67.2%F, 43.4%M)	52 (17.4%F, 11.8%M)	p>0.05
	Infrequent	20 (6.7%F, 21.3%M)	26 (8.7%F, 23.5%M)	

Table 05: Correlation of Factors Influencing Knowledge Scores on Harmful Effects of Cosmetics among Medical Students.

Variable	Correlation coefficient (r)	p-value
Age vs. Knowledge score	+0.35	<0.01
Gender vs. Knowledge score	+0.28	<0.01
Year of study vs. Knowledge score	+0.38	<0.01
Frequency of cosmetic use vs. Knowledge score	+0.45	<0.001

Table 06: Multivariate Linear Regression Analysis - Predictors of Knowledge Scores (n=520)

Predictor	β Coefficient	Standard Error	95 % CI	t-value	p-value
Age	0.22	0.05	0.12 - 0.32	4.40	<0.01
Usage Frequency	0.31	0.05	0.21 - 0.41	6.20	<0.001
Year of Study	0.28	0.05	0.18 - 0.38	5.60	<0.01

DISCUSSION

This study investigated the knowledge, awareness, and perceptions of medical students regarding the harmful effects of cosmetic products. The findings revealed that cosmetic use is highly prevalent among medical students, yet gaps remain in awareness about hazardous ingredients and potential health impacts. The results also showed gender and academic-level variations in cosmetic use patterns, ingredient-checking behavior, and awareness levels, providing critical insights into the current state of knowledge among future healthcare professionals.

A substantial proportion (68%) of participants reported regular cosmetic use, with higher usage among females (78%) compared to males (55%). This pattern aligns with previous study, who observed that females were more likely to use cosmetics and reported a higher incidence of skin issues such as acne associated with cosmetic application [15]. Similarly, another study found that undergraduate females in Sri Lanka demonstrated a significantly higher rate of cosmetic consumption driven by social and aesthetic motivations [12]. The observed gender disparity in cosmetic use among medical students in this study reflects cultural norms and marketing trends that primarily target women in Lebanon and in Singapore [16,17].

Ingredient awareness was moderate, with approximately half of respondents identifying parabens, sulfates, heavy metals, and formaldehyde as potentially harmful. Awareness of endocrine-disrupting chemicals (EDCs) was reported by 58%, suggesting partial understanding of the biochemical toxicity of these compounds. Such findings mirror those of recent research which reported that while undergraduates recognized certain toxic cosmetic ingredients, detailed understanding of their biological impacts was limited [12]. Similarly, a study emphasized that cosmetic consumers across eight Middle Eastern countries often underestimate chemical risks, associating safety more with brand reputation than with scientific evidence [18].

The relatively low percentage of students who routinely checked ingredient labels (46%) underscores a behavioral gap between theoretical knowledge and practical vigilance. Research in 2021 reported a comparable trend in Middle Eastern populations, where despite high awareness of organic and “natural” products, consumers rarely verified product safety scientifically [19]. This behavioural disconnect may be

influenced by marketing-driven perceptions, such as the “green halo effect,” where natural or organic branding is equated with safety-an observation [20,21].

Health Risk Awareness and Perceptions

More than 70% of participants recognized at least one potential health risk related to prolonged cosmetic use, with skin irritation, allergies, and hormonal imbalance being most frequently cited. About 15% had experienced allergic reactions, corroborating with a study which found that frequent cosmetic use correlated with increased dermatologic issues [11]. The present findings also align with studies which linked frequent cosmetic use to reduced dermatologic quality of life [18,22]. However, the belief that “organic cosmetics are always safer” was held by 78% of participants, reflecting an overgeneralization cautioned that organic products are not inherently non-toxic and may still contain allergens or sensitizers [19,23].

From a physiological standpoint, the lack of understanding about molecular mechanisms-such as endocrine disruption, oxidative stress, and dermal absorption pathways-may explain the superficial awareness observed. Cosmetic preservatives like parabens and phthalates can mimic estrogenic activity, disrupt hormone signaling, and contribute to reproductive or carcinogenic effects through cumulative bioaccumulation. These biochemical pathways are seldom covered in medical curricula, underscoring the need for toxicology-based education on cosmetic ingredients.

Sources of Information and Educational Gaps

Dermatologists and social media emerged as the primary sources of information [16,17]. However, only 20% of respondents cited formal academic lectures as their source, indicating a notable educational gap. This is concerning, as medical students-future physicians-play a vital role in patient counseling regarding cosmetic safety. A study reported similar finding that limited professional education contributed to misconceptions surrounding cosmetic procedures [24]. Encouragingly, 90% of participants expressed interest in attending workshops, suggesting receptiveness to structured learning interventions.

This study reveals that while cosmetic use among medical students is common, awareness of harmful ingredients and associated health risks remains incomplete. Misconceptions-such as the safety of organic products and limited attention to ingredient labelling-persist even among future healthcare providers. These findings underscore the need to integrate cosmetic safety education into medical curricula, focusing on ingredient toxicology, endocrine disruptors, and dermatologic consequences.

The primary strength of this study lies in its focus on medical students-a demographic uniquely positioned to influence public health messaging about cosmetic safety. The use of validated survey instruments ensured reliability, and the inclusion of behavioral, awareness, and perceptual domains provided a multidimensional understanding of cosmetic-related awareness.

LIMITATIONS OF THE STUDY

Few limitations must be acknowledged. First, the cross-sectional design precludes causal inference. Second, self-reported responses may introduce recall or social desirability bias. Third, the study's sample size, though adequate for preliminary insights, was drawn from a single institution, limiting generalizability. Finally, knowledge depth was assessed qualitatively rather than through objective scoring, which may underestimate cognitive gaps. Future multicentric and longitudinal studies incorporating objective knowledge scales and molecular awareness assessments could better delineate the evolving understanding of cosmetic safety among healthcare students and professionals.

CONCLUSION

In conclusion, this study highlights a moderate level of knowledge and awareness among medical students regarding the harmful effects of cosmetics. While most participants actively use cosmetic products, gaps persist in safe usage practices, such as checking ingredient labels consistently. The significant associations between demographic factors-such as age, gender, and year of study-and awareness underscore the need for targeted educational interventions. Given the potential health risks linked to harmful ingredients like endocrine disruptors and allergens, enhancing curriculum content and public health messaging is imperative. This research contributes valuable insights into behavioral and cognitive patterns in a pivotal population poised to influence future healthcare delivery. Continued efforts are necessary to bolster awareness, promote informed cosmetic use, and mitigate adverse health outcomes. Future studies should expand sample diversity and employ longitudinal designs to assess intervention efficacy and biochemical exposure effects comprehensively. This work lays foundational knowledge crucial to advancing cosmetic safety education in medical training.

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COMPETING INTERESTS

The authors hereby declare no competing interest.

AUTHOR CONTRIBUTIONS

All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by Dr. Janani, Dr Karunakaran Balaji. The final draft of the manuscript was written by Dr Bharath KP, Dr P Sreenivasi and Dr M Revanth, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

DATA AVAILABILITY STATEMENT

All data substantiating the conclusions of this study are presented in the article and are available from the corresponding author upon reasonable request.

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