

EXCESSIVE WHITENING CREAM CONSUMPTION: SOURCE OF SKIN MICROBIOTA ALTERATION AND SOCIAL BURDEN

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خلاصہ

گوری رنگت حاصل کرنے اور ہجمنٹیشن کے علاج کے لیے جلد کو سفید کرنا بہترین سمجھا جاتا ہے۔ بد قسمتی سے، IndoPak میں گوری رنگت کو حقیقی خوبصورتی کی علامت سمجھا جاتا ہے، اور یہ رجحان ایک اہم صنعت کی شکل اختیار کر چکا ہے۔ مزید برآں، تیار کے عمل کے دوران مائکروبیئل آلودگی کا کافی امکان ہے۔ جلد ایک امیونولوجیکل رکاوٹ کے طور پر کام کرتی ہے اور جسم کے قدرتی مائکروبیوٹا کے لیے سطح کے طور پر کام کرتی ہے۔ صحت مند جلد کو مدافعتی نظام، میزبان جلد کے خلیات، اور مائکروبیوٹا کی مدد کی ضرورت ہوتی ہے، اور کوئی بھی خلل، جیسے کہ کمزور توازن کے ساتھ پینتھوجینک مائیکریول، جلد کے کام کرنے کا طریقہ بدل سکتا ہے۔ دستیاب اعداد و شمار پر غور کرتے ہوئے، موجودہ مطالعہ ایگریڈائٹیشن کا استعمال کرتے ہوئے پریمیم وانٹنگ کریم برانڈز کی مائکروبیوٹا کی مائیکریول ٹیسٹنگ کے ذریعے کسی بھی ممکنہ آلودگی کا جائزہ لینے کے لیے بنایا گیا تھا۔ مزید برآں، کریموں کے زیادہ استعمال کا اندازہ لگانے کے لیے عام آبادی کی ایک کراس سیکشنل تحقیق کا استعمال کیا گیا۔ مائکروبیوٹا کی مائیکریول معائنہ کے ذریعہ تمام برانڈز بیکٹیریل تناؤ سے آلودہ پائے گئے۔ اعداد و شمار کے مطابق، کھپت نسبتاً زیادہ ہے، خاص طور پر خواتین سنگلز کے درمیان۔ فیئر نیس کریم کے بڑے پیمانے پر استعمال سے کمیونٹی مالی طور پر متاثر ہوئی ہے، لیکن سماجی رویوں، اخلاقی معیارات کو بدل کر، اور اندازہ فارمولیشنوں کے بارے میں بیداری بڑھا کر منفی اثرات کو کم کیا جاسکتا ہے۔

Abstract

To acquire lighter skin and cure pigmentations, skin whitening is considered best. Unfortunately, fairness is regarded as a sign of real beauty in IndoPak, and the phenomenon has grown into a significant industry. Additionally, there is a considerable potential for microbial contamination due to contamination occurring during the pathogenic formulation process. Considering the available data, the current study was created to examine any potential contamination by microbiological testing of premium whitening cream brands using agar dilution. Furthermore, cross-sectional research of the general population was used to assess the high usage of creams. All of the brands studied were contaminated with bacterial strains by microbiological examination. The skin serves as an immunological barrier and as a surface for the body's natural microbiota. Healthy skin requires support from the immune system, host skin cells, and pathogenic species with a tenuous balance, changing the way the skin functions. According to statistics, consumption was shown to be relatively high, particularly among female singles. The community has been financially impacted by the widespread use of fairness cream, but negative effects can be mitigated by changing societal attitudes, moral standards, and raising awareness of tainted formulations.

Key words: Whitening, microbiota, fairness, pathogen, microbial contamination.

Introduction

Skin acts as a barrier to shield against dangerous organisms including bacteria, fungi, and viruses as well as other antigenic particles hence, serves as an immunological barrier in addition to a physical one (Jensen *et al.*, 2009; Proksch *et al.*, 2009). The establishment of protective and well-controlled immune responses as well as the maintenance of tissue or external tolerance depend on these tissue-specific immunological networks that characterize strong skin microbiota (Proksch *et al.*, 2006; Chen *et al.*, 2019).

Since the 16th century, the use of skin-lightening chemicals in anti-aging and skin-fairness cosmetics has increased both clinically and aesthetically. Skin lighteners include a substance that actively lightens the skin's

melanin content, either alone or in combination with other substances (Saeedi, 2019). Although the quality has improved due to the addition of preservatives following GMP and quality control procedures (Zaidi *et al.*, 2019; Boo *et al.*, 2020). However, it is a common observation that most of the lightning creams are formulated without following the mentioned guidelines. According to studies, the most common bacteria, fungi, and yeasts observed frequently in cosmetics and creams include *P. aeruginosa*, *K. oxytoca*, *B. cepacia*, *S. aureus*, *E. coli*, *C. albicans*, *E. gergoviae*, and *S. marcescens* (Murphy *et al.*, 2021; Halla *et al.*, 2018).

The use of skin-whitening creams is very common in Pakistan. Unfortunately, most are formulated under non-sterile conditions. The purpose of this study was to ascertain how frequently some skin-fairing lotion sold in Pakistan included microbiological contamination (Maguire *et al.*, 2017; Sanford *et al.*, 2013). To maintain the security of cosmetic items, the FDA and USP have set rules for the permissible levels of bacteria for microbiological contamination. However, most are prepared without following the approved limits and have ten times more microbes. Microbiota, host skin cells, and the immune system work closely together to sustain healthy skin; any disruption of this delicate equilibrium, such as pathogen invasion or a break in the skin barrier, may disrupt skin function (Pillaiyar, 2017; Borowska *et al.*, 2015).

The skin microbiome is an ecosystem where many different microbial species coexist with host immune and epithelial cells as well as other microbes (Pramanik *et al.*, 2021). Hence, the presence of microbes in fairness creams is highly accountable for disturbing the skin microbiota and for enhancing the pathogen to cause infection and there are high chances of worsening pathogenic conditions due to the presence of ingredients like mercury, hydroquinone, and steroids used as essential component and out of the FDA allowed amount. Prolonged exposure to mercury leads to the corrosion of skin and the development of Pink disease, however, renal damage is one of the most observed toxic effects of mercury as the kidney deposits the inorganic mercury (Wang *et al.*, 2015). Nausea and metallic taste are other symptoms related to GTI and highly extreme exposure to mercury may lead to neurotoxicity (Soo *et al.*, 2003; Arshad *et al.*, 2020). In Pakistan, and particularly in Karachi, fairness creams are aggressively marketed despite their damaging effects on the skin. The second most popular component in these creams is steroids, which momentarily alter skin color and reduce hyperpigmentation, but long-term usage causes skin atrophy or thinning (Matejuk *et al.*, 2017; Pramanik *et al.*, 2021). Almost all the branded and unbranded whitening creams contain mercury, hydroquinone, and steroids up to or more than a range, consequently being accountable for toxic and hazardous effects on dermal layers (Iqbal *et al.*, 2019; Ashraf *et al.*, 2021).

Additionally, the excessive depigmentation and thinning of the top layer of skin caused by the constituents in these creams contribute greatly to the skin's susceptibility to several bacterial and fungal illnesses (Kalsoom *et al.*, 2016; Al-Saleh *et al.*, 2009).

Though the combination has a long indicated shelf life, no formulation standards are observed. The main ingredients, mercury, hydroquinone, and steroids, when combined with prolonged exposure, can cause serious derma damage. Acne, infections, dermatitis, pigmentation, photosensitivity, and skin atrophy are some of these problem (Grice *et al.*, 2011). At dermatology clinics in Karachi, there have been several reported incidents when patients, especially women, have fallen prey to skin-whitening chemicals. According to a famous dermatologist at the Civil Hospital in Karachi, topical steroid-based cream usage has an intriguing history with many severe acne instances (Park *et al.*, 2020) (<https://www.dawn.com>). According to these recommendations, cosmetic items should not include more harmful bacteria than allowed by the FDA and United States Pharmacopoeia (USP) (102 cfu/g for eye region and fewer than 1000 cfu/g for non-eye area). Skin conditions including eczema, acne, dyschromia, and scabies have been connected to topical cosmetic usage that exceeds microbial bio-burden limitations. In the last several decades, topical application of skin-whitening treatments has grown. The majority of cosmetics are derived from non-sterile basic materials and are not sterile. Therefore, whitening treatments include microorganisms that pose major health concerns to users and might contaminate items (Arshad *et al.*, 2021).

To ensure the quality of skincare and the protection of consumers' public health, there should be reliable and consistent microbiological surveillance throughout the production, packaging, and storage. Topical use of skin-whitening therapies has increased during the past several decades. The majority of cosmetics are derived from non-sterile basic materials and are not sterile. Therefore, whitening treatments include microorganisms that pose major health concerns to users and might contaminate items (Gopinath *et al.*, 2021).

Most senior dermatologists recommend against using any such products since these harm the skin. These treatments make the skin resistant to standard care and prolong the time it takes to heal. A variety of readily available whitening creams were investigated by the Pakistan Council of Scientific and Industrial Research (PCSIR), Karachi, and it was discovered that they included corticosteroids, a high quantity of mercury, and microbiological contaminants (Burki *et al.*, 2021). The current study was conducted to examine the high community usage of skin fairness products among women and men in Karachi, Pakistan, to identify the beliefs and reality background about the benefits of skin fairness that the population mostly have and to make the community aware of the microbes that are being utilized with the formulation. Most probably the assumption

that white skin is a source of attraction, especially for getting married, is not only adopted by society but interestingly has been explored by vendors of such products to exploit the psychology of men and especially women (Pillaiyar *et al.*, 2017).

Cosmetic Good Manufacturing Practice (GMP) guidelines, designed to uphold consistent quality in the production of cosmetics. Covering various aspects of manufacturing, storage, and shipment, the guidelines underscore the crucial requirement for proper registration under relevant legislation in Nigeria. The focus is on product quality, with a notable exclusion of considerations related to personnel safety and environmental protection, emphasizing the company's inherent responsibility in these areas. Furthermore, the guidelines do not extend to research and development activities or the distribution of finished cosmetics.

This research aims to investigate the cultural and societal perceptions of skin color, with a specific focus on the preference for fair or white skin and its impact on beauty standards. The study will involve a cross-cultural analysis to examine how these perceptions vary across different regions and ethnic groups. Additionally, the research will explore the impact of the beauty creams to cause the microbial infections on skin. The research will assess the impact of fair skin preferences on broader beauty standards within different societies, considering the influence of media, social norms, and historical context.

Methodology:

I. Study of Whitening Creams Consumption

Aimed population

This cross-sectional investigation was conducted in several saloons in the Pakistani metropolis of Karachi. The participants were urged to immediately complete the provided questionnaire. The surveys were then gathered for additional study. The purpose of the study was explained to the participants, and they received assurances about the privacy of their answers and personal data.

Study tool

The data was collected through the questionnaire designed by considering various studies conducted in different areas of the Pakistan. The questionnaire consisted of initial demographic information of the participants covering the following areas: gender, age, education, marital status and current employment status and second part consist of nine items that include reasons for use of fairness cream, duration of use and effect of fairness cream on their skin etc.

Sample size

To determine the actual use of whitening creams as well as experience, views, and side effects, a questionnaire was created in both Urdu and English. Among total of three hundred participants were agree to fill the questionnaire but only 224 completed the forms. An appropriate time for the filling of questionnaire was given to the participants.

Exclusion & Inclusion Criteria

The present target population for the study were women and men both adult and teenaged. However, the old aged and children below 14 years were excluded from the study.

Study period

In present study, total 300 questionnaire surveys were distributed, among them 224 forms were completely filled from February, 2021 to July, 2021.

Statistical analysis

Statistical Package for Social Science version 21.0 (SPSS 20.0, Chicago, IL) was used to evaluate the data from completed questionnaires, and the threshold of significance was set at 0.05 for all analyses. The correlation between various factors (gender and age) and the replies was calculated using Pearson's Chi-squared (χ^2) test.

Ethical Approval

Participants were instructed about the study's justification. The Department of Pharmacology at Jinnah Sindh Medical University in Karachi authorised the study, which was conducted in compliance with all ethical standards (Ref. No. JSMU/Pharma/147/2021). The participants' verbal agreement was obtained before any information was gathered, and all provided participant information was considered confidential.

II. Bacterial Contamination Analysis:

A crucial component of the safety and quality of cosmetic products is microbiological testing. Since microorganisms in cosmetics have the potential to degrade the product or chemically alter it, they also run the risk of negatively affecting the users of health, beauty, and personal care products. The microbiological quality of non-pharmaceutical or cosmetic products can be controlled by using estimation of total viable count. For the microbial analysis of whitening creams, four leading brands were selected and are designated as brand A, brand B, brand C, and onward. These are most commonly used by the consumers and were taken from the well-known selling outlets in Karachi. The microbial testing was done using freshly prepared cultures of four microorganisms including *S. aureus*, *B. subtilis*, *E. coli* and *Klebsiella* in broth. The culture medium used for microbial growth is nutrient agar plate. It was inoculated with an inoculum of each microorganism by the means of sterile loop. Phosphate buffer saline (BPS) was used for dilution. At a temperature of no greater than 40 degrees Celsius, one gram of the sample was mixed with a small quantity of sterile Tween 80. Water bath was used to maintain the temperature. In order to create the 1:10, 1:100, and 1:1000 dilutions of the product, enough pre-warmed phosphate buffer saline was added using disposable cotton swabs made of USP grade pure cotton that were tightly attached to one end of wood shafts, each sample was put onto the agar plate. The whole performance was carried out near the burning flame to prevent the inclusion of microorganisms from the surrounding environment. The plates were incubated in inverted position in an incubator for 24 hours at 30-35 ±2 °C and were noted for growth after 24 & 48 hours.

Results and Discussion

All the brands locally manufactured showed positive response with respect to the growth of microorganisms. *E. coli* and *Klebsiella* were found absent in few brands while *S. aureus* and *Bacillus* species were present in all brands. The test showed higher concentration of total viable bacteria against various whitening cream’s brands mentioned in table-1 (TNTC and crossed the USP or FDA limit of <10³).

During the cross sectional study, out of 300 participants, 224 completed the forms and included in the final result. In current study, response rate was 74.66%. Among 224 participants, 68 were male and 156 female, majority of the participants (63.4%) were belong to the age bracket of 18-25 years and 32.1% were between 26 and 35 years old. More than half of the respondents (64.28%) were unmarried and 49.1% had secondary school qualification (table-2). Of the total sample, 57 (25.4%) participants were using fairness cream to look attractive and fair and 15 (6.7%) to get marriage proposals and 11 (4.9%) used fairness cream for the purpose to have better career prospects. 78 (34.8%) participants do not know how fairness cream works on the skin. 65.2% participants were using fairness cream from last six months (table-3 & 4).

Among current users, 42% (n = 94) reported the adverse effects of fairness products including acne, allergic reaction, darkening of skin, hair growth, skin dryness and production of more melanin after skipping the usage of fairness cream. When current users were asked “who or what prompted you to start using fairness products,” almost 54% (n=121) responded family or friends prompted their use, while 37.5% (n=84) reported that Media/TV/Advertisements”, and 8.5% (n=19) office colleagues prompted their first use of fairness products. Among current users 72.8% were not willing to spend more money on fairness creams. A significant association was analyzed regarding the use of fairness cream with gender and age. A substantial number of current users 42% (n = 94) reported adverse side effects after the use of fairness products with the 0.000 value of significance and regarding the after effects no significant association for the use of fairness cream between gender and age.

Table 1. Microbial concentration against various whitening cream’s brands

Cream Brands	<i>Escherichia coli</i>	<i>Klebsiella pneumonia</i>	<i>Staphylococcus aureus</i>	<i>Bacillus subtilis</i>
Brand A	0.00	0.00	5.6×10 ¹	4.6×10 ¹
Brand B	2.7×10 ¹	0.00	5.3×10 ¹	4.3×10 ¹
Brand C	0.00	2.2×10 ¹	5.2×10 ¹	6.2×10 ¹
Brand D	6.5×10 ¹	6.5×10 ¹	3.8×10 ¹	+
Brand E	0.00	2.8×10 ¹	2.5×10 ¹	4.5×10 ¹
Brand F	0.00	0.00	1.2×10 ¹	2.5×10 ¹
Brand G	5.1×10 ¹	4.8×10 ¹	4.2×10 ¹	1.4×10 ¹
Brand H	1.5×10 ¹	0.00	1.2×10 ¹	0.00
Brand I	0.00	0.00	2.2×10 ¹	0.00
Brand J	0.00	0.00	0.00	0.00
Brand I	0.00	0.00	0.00	0.00

Table 2. Demographic details of study population (n=224)

Variables	N (%)
Age (years)	
18-25	142 (63.4)
26-35	72 (32.1)
36-45	9 (4.01))
46 and above	1 (0.44)
Gender	
Male	68 (30.4)
Female	156 (69.6)
Education	
Matric	110 (49.10)
Inter pass	70 (31.25)
Graduation	44 (19.64)
Marital Status	
Married	80 (35.71)
Unmarried	144 (64.28)
Current employment status	
Employed	13 (5.80)
Unemployed (currently looking for work)	13 (5.80)
Students	198 (88.39)

Table 3. Gender related analysis

Fairness cream questions	Pearson χ^2	Significance
Do you use fairness cream?	2.061	0.151
Why do you think fairness creams are used?	0.165	0.921
Do you know how fairness cream works on the skin?	8.005	0.018
For how long you have been using fairness creams	2.049	0.359
After using for a long duration,		
Have you ever experienced any side effects?	0.527	0.468
After using for a long duration, you felt	4.595	0.101
Betterment in the skin?	0.657	0.418
Are you willing to spend more on fairness creams?	08.005	0.018
Are you inspired from the advertisement campaign?		

Table 4. Age related analysis

Responses about using Fairness cream	Pearson χ^2	Significance
Do you use fairness cream?	6.670	0.036
Why do you think fairness creams are used?	7.435	0.115
Do you know how fairness cream works on the skin?	15.586	0.004
For how long you have been using fairness creams	12.523	0.014
After using for a long duration,		
Have you ever experienced any side effects?	17.568	0.006
After using for a long duration, you felt		
betterment in the skin.	11.947	0.018
Are you willing to spend more on fairness creams?	7.647	0.022
Are you inspired from the advertisement campaign?	8.005	0.018

Cosmetics are not meant to be sterile since they include suitable ingredients that stimulate the growth of microorganisms. It's crucial to keep cosmetics products of high quality. Microbiological examination of the finished product is important to provide a high-quality product and reduce the risk of skin illness. In the current investigation, various types of whitening cream that Pakistanis frequently use were examined for microbial contamination in order to gauge the issue (Hsieh *et al.*, 2016).

The top ten local and international whitening cream brands that are most often used for face whitening have been chosen. *E. coli* was found in four out of ten samples and was one of the harmful bacteria. In every sample, *Staphylococcus* specie was found. Additionally, *Klebsiella* and *Pseudomonas* species was found in four brands.

S. aureus and *Bacillus subtilis* were observed in seven brands and interestingly, the probability of all the species being present altogether was high. Local brands had greater levels of total and pathogenic bacteria than international brands. Environmental factors, unsanitary handling practices, and unclean raw materials may be accountable for the microbial proliferation. Sometimes microbial development is also caused by storage temperature, low preservative action, product pH, oxygen availability, and preservative quality.

In present study, during the population survey, it was analyzed that the corrosive social issue of being fair at any cost of money and health is the actual factor towards the consumption of fairness cream. Due to having intense demand the issue attracts vendors and has become a moneymaking trade with only aim of marketing and trading of creams having quality of making fair only without any fair formulation (Li *et al.*, 2008). Additionally, television advertisements and media marketing in Pakistan made the population agreed to adopt the creams. Most of the advertisements are plotted to change the mindset of general population and accordingly this is the only way to get better matrimonial proposal or good career pursuance. However, in the current study, 224 participants, 156 of whom were female and 68 of whom were male, and the majority of whom fell within the age range of 13 to 19 years, were discovered to think that the advantages of fairness creams as advertised on television were exaggerated (table 1-3). Participants in the survey also stated that using the fairness cream consistently left their facial skin looking youthful but not white. Fairness creams are over-the-counter products that are marketed on television. Additionally, they are sold for a low price that conveys the inferior quality and ineffectiveness of the cream. The proprietors of the product continue to tout its excellent results and finest quality. The topic of debate is how manufacturers may create excellent-quality creams by including pricey components into goods that are sold for a very low price. The bulk of the population was found to be from the lower to middle sectors, where they are less able to purchase things and have lower literacy rates, which means that the advertisement for fairness cream may be able to take advantage of existing psychological tendencies. It was shown that a sizable portion of the participants believed that using fairness creams would beautify them, however, within, a few days or weeks, people will start to suffer skin issues including itching, rashes, dryness, pimples, hardness, and darkening of the facial skin. Amazingly, the risks of using these fairness creams, since they are non-prescription medications and may potentially cause facial skin problems, are completely excluded in the TV advertisements, despite being information that consumers have a legal right to know. This uncertainty is a serious shortcoming and unethical advertising practice since such information, such as skin compatibility, proper quantity, duration, and other precautions, is not supplied. Like other countries, in Pakistani, as well, the concept of beauty focus more on skin tone and physical appearance (Zota *et al.*, 2017).

To identify the possible contamination in fairness creams, brands were bought from different markets of Karachi and were examined for the bacterial growth via agar dilution method for selected bacteria including *Escherichia coli*, *Klebsiella pneumoniae*, *S. aureus* and *Bacillus subtilis*. The four strains were chosen because they have skin pathogenic characteristics. Skin conditions brought on by *E. coli* include cellulitis and type-1 necrotizing soft tissue infections (NSTIs), which develop when layers of the dermis, subcutaneous tissue, superficial fascia, or muscle become infected.

If *pneumoniae* enters a skin fissure, it can lead to a soft tissue or skin infection. This frequently happens with wounds that have healed from an operation or an accident. Blisters, tiredness, fever, and discomfort at the surgery site or wound site can all be symptoms.

Since *Staphylococcus aureus* may infect every tissue in the human host, it is one of the most common bacteria that causes infection. Staph infections, however, have the potential to be lethal if the bacteria move farther into your body and enter your joints, bones, lungs, or heart.

According to the study, because these creams are not sterile formulations, they encourage microbial development and are readily contaminated. According to the FDA, sterility is not required for cosmetic goods, but they must be free of pathogenic germs and have a low density of non-pathogenic microorganisms. The process and distribution of cosmetic items among medical supply stores should be watched over by the regulatory authorities throughout production, packing, and storage of cosmetics. When whitening creams are contaminated with harmful microorganisms, the product may degrade and pose a risk to consumers' health.

Furthermore, the arrival of modernization, media fascination and materialism have impacted and destroyed the natural beauty and community is moving more towards the artificial beauty, however, the characteristics like morality, ethics and education are considered with lesser attributes. Age and gender, both were analyzed in significant ratio regarding the buying and using of fairness creams, as the attraction of whitening creams was found at high frequency among both the gender because in the decades of twenty the male gender was addressed equally in the marketing of such products and that worked for changing the mindset of the male gender. Beauty standards vary from person to person and nation to country and racism can occasionally be the source of embarrassment and contempt as the majority of women in the IndoPak area have Asian skin tones.

A recent study found that some widely used whitening treatments included greater loads of bacteria. The larger population of total live bacteria provided a clear indication of the harmful impact of using such non-sterile cosmetics on consumer health as well as compelling justification for more study on other cosmetics items to

lessen the burden of skin illnesses. Many people use whitening treatments without understanding the risks associated with product contamination. Microbial contamination and face skin infections are possible. Therefore, there should be enhanced Good Manufacturing Practice and the frequent training that manufacturing organization's need. The process and distribution of cosmetic items among health-care outlets should be monitored by the regulatory authorities. Present research clearly shows evidence that these non-sterile cosmetic goods are widely consumed not just in Pakistan but also in emerging nations. The upkeep of sterile manufacturing conditions, the management of all raw materials, and finally, their storage and transportation to medical supply outlets, should all receive more attention.

Conclusion

This research aims to contribute valuable insights into the complex interplay between societal perceptions of skin color, beauty standards, and the practices of the beauty industry. The findings may inform discussions on diversity, inclusion, and the need for positive change in societal attitudes towards beauty. Consumers should also avoid using these contaminated skincare products because they may cause skin diseases and encourage microbial growth on the skin. Our investigation suggests that care should be taken during formulation, procurement, quality compliance, packing, and storage of such whitening creams and other cosmetic products.

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