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Original Research Article

Influence of repeated cleansing on skin biophysical parameters: a randomized and double-blinded comparative study of a grade 1 toilet soap and a face cleanser

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ABSTRACT

Background: The most commonly adopted face-cleansing habit is twice a day, which is part of the skin care routine. In India, face cleansing is commonly performed using soap bars, with different total fatty matter (TFM) percentages, while facial cleansers typically formulated with milder cleansing systems, such as synthetic surfactants or combinations of soap with synthetic surfactants, are also widely used. While face cleansing products may not cause skin damage, repeated washing may compromise skin health depending on cleansing characteristics of the formulation/product.
Methods: The present clinical study was a randomized, double-blinded, monocentric, split-face design, conducted in 36 healthy female volunteers aged 20–45 years. The study aimed to assess the impact of test face cleanser and Grade 1 soap upon multiple wash frequencies on various biophysical characteristics of skin.
Results: Present test face cleanser developed with fatty acid-based cleansing technology along with niacinamide, 12-HSA and glycerol demonstrated significantly superior glow, hydration and barrier integrity compared to the marketed grade 1 soap (high TFM soap) when used multiple times on the skin.
Conclusions: The present clinical study demonstrates the sustained efficacy of the test face cleanser in improving hydration, brightness and glow without compromising the skin barrier upon multiple uses, whereas the marketed high TFM soap weakened the barrier and worsened skin dullness upon multiple uses. Hence, the incorporation of skin care technologies in face cleansers to support skin hydration and barrier health can be beneficial in improving overall skin biophysical parameters, even when used multiple times.

Keywords: Niacinamide, 12-hydroxy stearic acid, High TFM

INTRODUCTION

Cleansing habits across cultures have evolved as practices of hygiene, purification and grooming. While skin care experts recommend face cleansing twice a day, consumers with excessively oily skin or regular exposure to urban pollution and those living in humid weather, tend to cleanse their face more frequently to keep skin clean and non-greasy.[1] Cleansers in general are designed to deliver clean skin and are often made with soap, soap-based technologies or synthetic surfactants.[2] Excessive cleansing can strip off skin's natural moisture, imparted by the natural moisturizing factors (NMF) and damage barrier integrity, making skin rough, dry, scaly and sometimes even sensitive.[3] To address these day-to-day consumer concerns, personal care industries are continuously innovating new technologies that can improve hydration, protect the skin barrier and enhance glow and smoothness through cutting-edge deposition technologies along with skin-benefiting ingredients. Skin care routines are becoming more sophisticated, with evolving consumer needs and expectations, such as gentle

cleansing, brightening benefits and luxurious sensory experiences, driving the face-cleansing category towards personalized, ingredient- and skin benefit-led cleansing solutions.

The present clinical study was designed to assess the effect of test face cleaner crafted with skin care actives like niacinamide, 12-HSA and glycerol, compared to marketed high TFM soap in improving the skin biophysical parameters like hydration, TEWL, brightness and glow upon multiple wash frequencies.

METHODS

Ethics and informed consent

Present clinical study was carried out as per GLP and ICH guidelines in compliance with the local government regulations. The study was reviewed and approved by independent ethics committee in India and an informed consent was obtained from all study subjects. The study was registered prospectively on Clinical Trial Registry of India, under cosmetic study with study number CTRI/2025/10/096537 and conducted at clinical study facility of Mascot Spincontrol India Pvt Ltd, Mumbai, India with dermatologist as the principal investigator between October 2025 to November 2025.

Clinical design

The present clinical study had a randomized, split-face, double-blind and monocentric design. Female volunteers aged 20–45 years were recruited as per the inclusion criteria (having dull skin) and exclusion criteria (pregnant and lactating women, volunteers with any skin-related problems or allergies that could potentially interfere in the study results, as per the dermatologist's discretion). There were two test products in the present study: the test face cleanser and the marketed high TFM soap. Study volunteers were divided into three groups. Each group had 12 subjects, with normal, oily, dry and sensitive skin types represented in equal proportion (with dull skin) and used the two products on a split face as per randomization. Each test group used the products at different wash frequencies (1X/day, 2X/day and 3X/day) for three consecutive days. Subjects underwent a wash-out period of three days with a neutral cleanser, followed by the treatment phase of product usage. After the wash-out period, a total of 36 participants qualified for the treatment phase and all of them completed the study. Volunteers were restricted from using any leave-on or cleansing product, other than the test products provided, during the study period. On the baseline visit, all the participants were acclimatized at 22°C±5°C and 50%±10 RH, for 15 minutes and following instrumental assessments were done-brightness (by L-Spectrophotometer (CM-26d, Konica Minolta), hydration (using Corneometer, CM 825) and trans-epidermal water loss (TEWL) by Tewameter® TM 300 (Courage+Khazaka Electronic GmbH), skin dullness was assessed by a dermatologist using a 10-point visual assessment scale (0–9, with 0 glowing skin and 9 very dull skin). To assess skin hydration and TEWL, measurements were taken on cheekbones, whereas skin brightness was assessed on forehead at all assessment time points. Study duration was for 3 days and assessments were measured instantly after using the product, at different wash frequencies. Consumer assessment on efficacy and sensory of products were taken on attributes like overall satisfaction, post usage sensory on skin like hydration, roughness, smoothness etc.

Statistical analysis

All statistical tests for clinical data were performed at two-sided 5% level of significance and 95% confidence interval and Statistical software PAST 4.03 and SigmaStat 3.5 were used for the analysis of the data. Paired t-test was used to evaluate the efficacy vs baseline and 2 sample t-test was used to compare between the test products.

RESULTS

Demographics of the study volunteers

Skin hydration

Skin hydration was assessed using a Corneometer immediately after wash at all evaluation time points. Test face cleanser (with niacinamide, 12-HSA and glycerol) demonstrated a significant improvement in hydration at all wash frequencies and maintained significantly higher to baseline levels even after 3X/day, whereas high TMF soap also showed improved hydration, which gradually dropped to near baseline line levels by 3X/day (Figure 1). Test face cleanser demonstrated significantly higher hydration at all wash frequencies compared high TFM soap. The present findings indicate that cleanser loaded with hydration technology not only enhances hydration, but also maintain the same above baseline levels, up to three washes per day.

Transepidermal water loss

TEWL was assessed using a Tewameter, immediately after wash at all evaluation time points. Test face cleanser (with niacinamide, 12-HSA and glycerol) demonstrated a significant improvement in skin barrier integrity till 3x/day wash frequencies, whereas high TFM soap damaged the barrier by 3X/day (Figure 2). Test face cleanser demonstrated significantly higher barrier enhancement at all wash frequencies compared to high TFM soap. The present findings indicate that cleanser loaded with barrier protection technologies like 12-HSA, not only enhance barrier integrity of skin but also maintains the same above baseline levels, up on multiple washes (like three washes) per day.

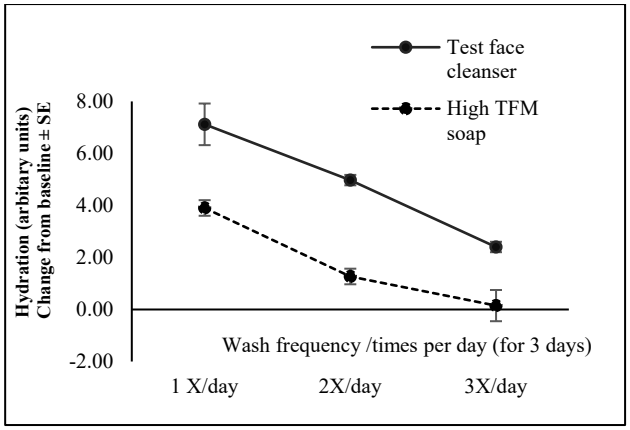


Figure 1: Skin hydration, data expressed as change from baseline ±SE (p value <0.05, test face cleanser vs high TFM soap).**

*Statistically significant.

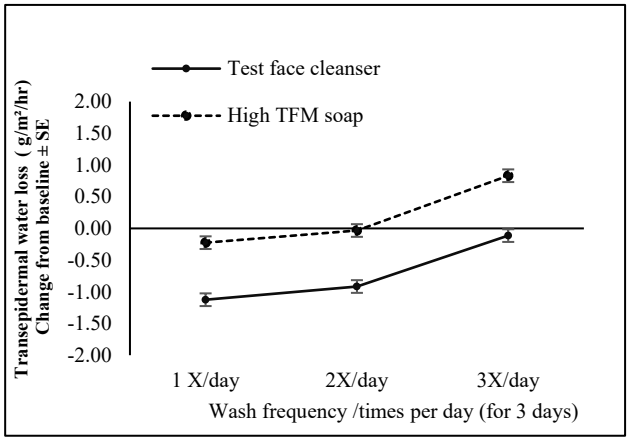


Figure 2: Transepidermal water loss, data expressed as change from baseline±SE (p value <0.05, test face cleanser vs high TFM soap).**

*Statistically significant.

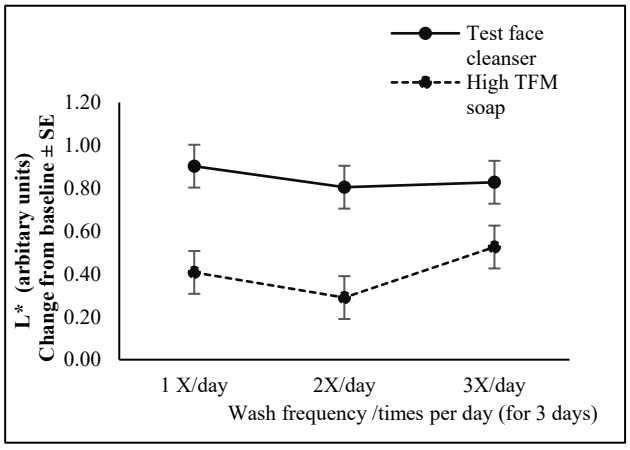


Figure 3: Skin Brightness (by L*), data expressed as change from baseline ±SE (p value <0.05, test face cleanser vs high TFM soap).**

*Statistically significant.

Skin brightness (L*)

Skin brightness was assessed using a Spectrophotometer by L*, immediately after wash at all evaluation time points. Both the products demonstrated a significant improvement in brightness all wash frequencies vs baseline. Test face cleanser demonstrated significantly higher brightness compared to high TFM soap at all assessment time points (Figure 3).

Skin dullness

Skin dullness was assessed by dermatological visual assessment, immediately after wash at all evaluation time points. Test face cleanser (with niacinamide, 12-HSA and glycerol) demonstrated a significant reduction in dullness all wash frequencies vs baseline, whereas high TFM soap worsened dullness from 2X/day below baseline levels (Figure 4). Test face cleanser demonstrated significantly lower dullness at all wash frequencies compared to high TFM soap. The present findings indicate that cleanser loaded with brightening and hydrating technologies like niacinamide, 12-HSA and glycerol, improves multiple skin biophysical parameters, that that can translate into reduced dullness or improved skin glow.

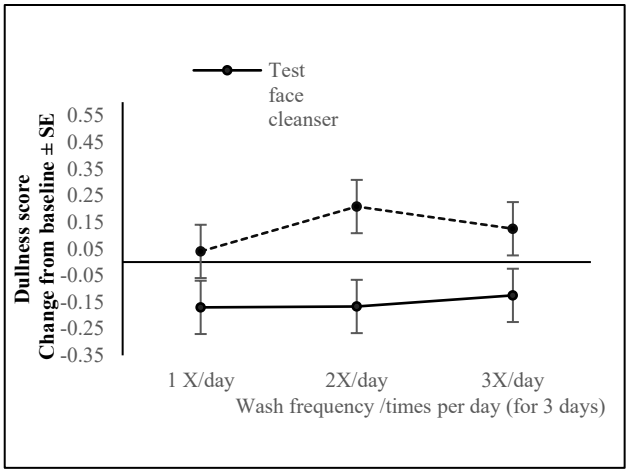


Figure 4: Skin dullness, data expressed as change from baseline ±SE (p value <0.05, test face cleanser vs high TFM soap).**

*Statistically significant.

Table 1: Demographics and volunteers characteristics at baseline.

Age range	20-45 years
Gender category and No. participants	Female and 36
Ethnicity	Asian (Indians)
Skin condition or types	All skin types (oily, normal, dry and sensitive)

DISCUSSION

Cleansing habits, whether it is face-cleansing or body-cleansing or hand-cleaning are the most common socially acceptable grooming routines across the globe and are linked to cultural, physical and personal hygiene practices. Fast moving consumer goods (FMCG) companies across the world develop different cleansing formats and design specifically for face, hand, whole body and scalp (shampoos), marketing them under different categories. Of these, the face cleaning market in India is poised to grow very fast and reach to 44.34 Billion US$ by 2030.[4] Even though the primary function of these facial cleansers is cleaning, to keep skin free from dirt and grease, evolving consumers, due to their unique skin needs expect high order benefit like skin health, from these formats. Human skin is inherently different by genetics and is susceptible to change in terms of biophysical parameters like hydration, TEWL, oiliness etc in due course of time from infant, puberty to middle age and old age.[5-7] Apart from these various external factors like pollution, geographical location like humidity, dry or cold weathers are known to impact skin conditions. Considering these skincare needs, personal care market leaders tailored the face cleansing products suitable to skin types, needs with different technologies to improve skin sensory and benefits post using the products.

Currently Indian market has a wide range of cleanser formats suitably formulated for different skin needs and routines and it is continuously evolving. The market has transformed from a basic hygiene category, essential daily care to advanced skin care benefits like brightness, hydration, barrier protection driven by rising consumer awareness, purchasing power and enhancing impact of global beauty trends. The market earlier had dominance of simple soap-based high TFM bars, which has now evolved into a diversified face wash care category, with strong growth across mass and premium segments. While traditional FMCG players continue to lead through distribution, the digital-first brands alongside dermatologist-led brands have made it more skin care focused and aspirational.

Glowing skin is the highly expected benefit, next to clean skin from face cleansers. Glow is a very subjective skin benefit, however measurable with a composite skin attributes hydration, smoothness, brightness etc.[8] Skin brightness is the first visual benefit experienced upon face cleansing due removal of dirt and grease, whereas hydration might not follow the same line as cleansers might strip off the natural skin moisture when made with harsher surfactants or similar technologies due to repetitive cleansing habits. Consumers with excessive oily skin or exposed to regular pollution due to lifestyle tends to clean face more than twice may experience skin dryness. Healthy human skin is well hydrated at its top layers (approximately up to 15-25%) of water with a gradient up to 70% in the viable region of epidermis.[9] This is essential for optimal skin biochemical and physiological functions like balanced exfoliation,10 maintenance of NMF and pH. However excessive cleansing with harsh cleansers strips of the NMF, alter the lipid architecture of stratum corneum making skin dehydrated/rough and scaly eventually impacting skin glow, brightness and overall health.

In the present clinical study, cleanser designed with high levels of Niacinamide,12-HSA and, showed the highest improvement in skin hydration and brightness when used at multiple frequencies per day, whereas marketed high TFM soap gradually reduced hydration and showed lower brightness. During cleansing, water penetrates the skin and swells the corneocytes, adding to this harsher cleansing technologies like high TFM soaps can enhance the swelling process leading denaturation of proteins.[2,11]

During this process net negative charge on the protein is increased due to binding of anionic surfactant to cationic sites and hydrophobic pockets of protein, causing osmatic swelling.[2] Once the skin is dry and equilibrated with the relative humidity either skin hydration levels reach prewash condition or lowers (during multiple wash cycles) as loss of NMF not being replenished during the recovery phase. Cleansers designed with hydration technologies help prevent this osmotic shock by depositing the hydrating actives and protect the corneocytes from the stress of osmotic swelling. In the present clinical study, test face cleanser showed sustained hydration and maintained the same till 3x/day wash frequency, could be attributed to deposition of hydrating actives that helped to replenish lost natural skin moisturizers.

Skin's natural barrier integrity is facilitated by lipid bilayer in the stratum corneum (SC), made up of fatty acids, ceramides, cholesterol and others.[12] While cleansers in general are designed to wash off the surface sebum constituents, they can potentially extract the endogenous SC lipids and can intercalate into the bilayer making it weak.[13] Multiple wash cycles can disrupt the structural integrity leaving SC damaged causing increase in higher transdermal water loss. In the present clinical study test face cleanser designed with active levels barrier protecting technology, 12-HSA demonstrated decreased TEWL till 3X/day wash frequencies, which is line with demonstrated deposition of 12-HSA from skin cleansers with proven improvement of barrier integrity and immunity.[14] Adding to this, there is strong scientific evidence, that treatment of 12-HSA to keratinocytes have been proven increase ceramide production and lipid elongation that supports healthy skin barrier formation.[15]

Glow is a high order benefit of skin, determined by multiple skin biophysical parameters like brightness, hydration, texture, even tone etc.[8,16] In the present clinical study cleanser designed with optimal levels of niacinamide and 12-HSA have shown highest improvement in the skin brightness (with reduced

dullness) and sustained till 3X/day wash frequency, whereas other high TFM soap reduced skin brightness and worsened skin dullness. Skin micro texture/surface topography is proven to impact light reflection properties due to diffuse scattering and impact the effective brightness/translucency.[17-19] During multiple face wash cycles skin loses the NMF and lipids, with no scope to maintain optimal hydration skin becomes dry and rough. In line with this highest improvement in brightness (as measured by L* and reduced dullness) was demonstrated by test face cleanser and maintained at significantly higher levels compared to high TFM soap, which showed steady increase in dullness, could be a consequence of loss of hydration and barrier integrity, further worsening the texture and impacting the surface topography.

Based on the consumer's self-assessment, 100% of the subjects agreed that the present test face cleanser, delivers instant brightness, improves smoothness, does not dry the skin and moisturizes the skin effectively and have not experienced any side effects like itching, burning or redness during the 3 days treatment period when used for multiple times.

Based on instrumental, dermatological visual assessment and subject's feedback, present study demonstrates that face cleansers developed with functional levels of hydration, barrier and glow enhancing technologies (like glycerol, niacinamide and 12-HSA) help maintain moisture and barrier balance upon multiple wash cycles, with sustained brightness and glow benefits. While cleansing the face twice a day is generally recommended as a part of the skin care routine, face cleansing 3X/day may be adopted depending up on the skin type or need or environmental exposure by prudently choosing cleansers with hydrating and barrier enhancing technologies to keep the biophysical parameters of skin at optimum levels.

Repeated cleansing with high TFM soaps may adversely affect skin barrier function by disrupting the structural organization of the stratum corneum and removing NMF and intercellular lipids. Traditional soap bars are typically alkaline and repeated exposure can increase skin surface pH, impair lipid-processing enzymes and weaken barrier homeostasis.[20,21] In concurrence with previously reported studies demonstrating the skin-damaging effects of soaps, attributed to higher disruption barrier lipids and protein denaturation, the present study confirms repeated use of high TFM soap strips off the skin's natural hydration and disrupts the barrier health.[2,22-24]

Limitations

The present study is a randomized double blinded study with limited number of only female participants. Higher number of participants with equal proportion of men in the study helps add more value to the study results.

CONCLUSION

As repeated cleansing can impact the skin barrier health, personal care cleansing category needs to focus on developing new technologies that can effectively deliver skin benefits from cleansers to consumers living in diverse geographic regions, with varying weather patterns, skin types, pollution exposure levels and cleansing habits. These innovations help consumers to adapt their cleansing routines based on their individual skin needs, environmental conditions, daily exposure to pollution and climate variations.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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