International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

A study on the effect of commercial shower gels on normal human skin flora

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International Journal of Science and Research Archive, 2026, 18(01), 998-1012

Publication history: Received on 23 December 2025; revised on 28 January 2026; accepted on 31 January 2026

Article DOI: https://doi.org/10.30574/ijsra.2026.18.1.0189

Abstract

Human skin is naturally inhabited by a variety of microorganisms known as normal skin flora, which play an important role in protecting the skin from harmful pathogens. Commercial shower gels are widely used for personal hygiene, but their frequent use may influence the normal skin flora. The present study was carried out to assess the effect of commercial shower gels on normal human skin flora. Skin swab samples were collected before and after the use of shower gels and were cultured using nutrient agar, MacConkey agar, Rose Bengal Chloramphenicol agar, EMB agar, and standard microbiological techniques. The observed microbial growth was compared to assess changes in the skin flora. The results indicated that the use of shower gels reduced the number of microorganisms (CFU)on the skin after washing with shower gels, with variations depending on the type of shower gel used. This study highlights that while shower gels help maintain cleanliness, excessive or frequent use may affect the natural balance of skin microflora

Keywords: Normal Flora; Shower Gels; Microbial Flora; Macconkey Agar; Skin Swab; And CFU Count

1 Introduction

Human skin serves as a major physical and biological barrier between the body and the external environment and is colonized by a diverse community of microorganisms collectively referred to as normal skin flora. These microorganisms, including bacteria and fungi, exist in a stable relationship with the host and play a crucial role in maintaining skin homeostasis. Normal skin flora contributes to immune modulation, prevention of pathogen colonization, and maintenance of the skin's protective functions *Davis, C. P. (1996).*

Human skin acts as the first line of defense against the external environment and is naturally colonized by a diverse group of microorganisms known as normal skin flora. These microorganisms play an important role in maintaining skin health by preventing the colonization of harmful pathogens and supporting the skin's protective functions *Grice, E. A., and Segre, J. A.* (2011). The composition of normal skin flora is influenced by various factors such as hygiene practices, environmental exposure, and the use of personal care products.

Human skin is the largest organ of the body and is naturally inhabited by a wide variety of microorganisms known as normal or resident skin flora. These microorganisms include bacteria such as *Staphylococcus, Micrococcus, Corynebacterium*, and some Gram-negative rods. Normal skin flora plays an important role in protecting the skin by preventing colonization of pathogenic microorganisms. Normal flora of the human body means the microorganisms that normally live on and inside the human body without causing disease. Normal flora are good or harmless microbes (mainly bacteria, sometimes fungi) that naturally stay on our skin, mouth, gut, nose, and other body parts. Skin**:** *Staphylococcus epidermidis*, *Micrococcus,* Mouth**:** *Streptococcus* species, Intestine**:** *Escherichia coli*, *Lactobacillus*

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Resident flora are microorganisms that live permanently on the skin and are normal, harmless, and protective. They are different from transient flora, which stay only for a short time. Examples of resident (normal) skin flora: *Staphylococcus epidermidis, Micrococcus species, Corynebacterium species, Cutibacterium (Propionibacterium)* ***acnes.*** They play an important role in preventing the growth of pathogenic microbes, maintain normal skin pH, and support skin immunity *Byrd, A. L., Belkaid, Y., and Segre, J. A. (2018*).

1.1 Uses of Normal Flora of the Human Body

- **Prevention of pathogen growth-**Normal flora compete with harmful microorganisms for nutrients and space, preventing infections.
- **Maintenance of skin and mucosal health-**They help maintain normal skin pH and protect body surfaces.
- **Support of the immune system-** Normal flora stimulates and strengthens the immune response.
- **Vitamin production-**Intestinal flora produces vitamins such as **Vitamin K** and **B-complex vitamins**.
- **Aid in digestion-**Gut bacteria help in the digestion and absorption of nutrients.
- **Maintenance of acidic environment-**Vaginal flora (*Lactobacillus*) maintains acidic pH and prevents infections.
- **Production of antimicrobial substances-**Some normal flora produces bacteriocins that inhibit pathogens.

1.2 Composition and Diversity of Skin Microorganisms

1.2.1 Bacterial Phyla and Diversity

Modern molecular techniques, particularly 16S ribosomal RNA (rRNA) gene sequencing and metagenomic analysis, have revolutionized our understanding of skin microbiota and revealed that human skin is colonized by far greater microorganism diversity than earlier culture-based studies ever suggested. These comprehensive molecular studies have identified four major bacterial phyla on human skin: Actinobacteria (most abundant on skin, 40- 80% of bacteria), *Firmicutes* (10-40%), *Proteobacteria (5-20%), and Bacteroidetes (2-10%).*

1.2.2 Major Bacterial Genera and Species

Staphylococcus epidermidis (coagulase-negative staphylococcus) is one of the most abundant and well-studied residents, comprising 35-40% of the resident aerobic flora in many body sites, with particularly high abundance in moist areas of the skin. This gram-positive coccus is a facultative anaerobe (capable of surviving with or without oxygen) and is particularly well-adapted to the aerobic surface of the skin where it utilizes urea from sweat as a nitrogen source. *S. epidermidis* plays crucial roles in pathogen exclusion, immune education, and

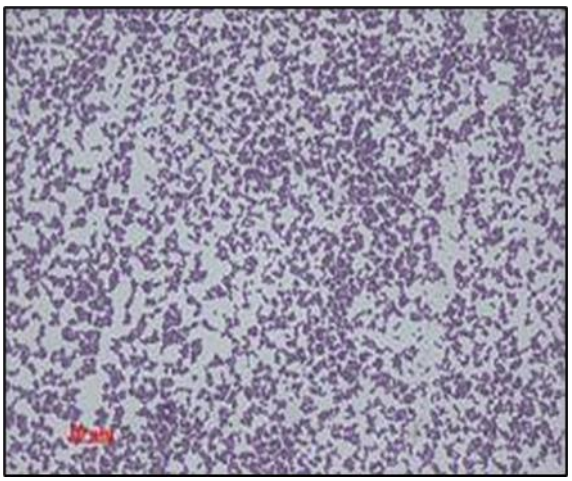

Figure 1 *Staphylococcus epidermidis*

Cutibacterium acnes (formerly *Propionibacterium acnes*) is a gram-positive, anaerobic or facultatively anaerobic rod-shaped bacterium that is absolutely dominant in sebaceous (oil-rich) areas of the body, comprising up to 50-90% of the flora in facial and trunk skin. This organism produces multiple lipases, proteases, and hyaluronidases that enable degradation of sebaceous gland lipids and manipulation of the skin environment. *C. acnes* secretes antimicrobial compounds contributing significantly to the maintenance of acidic pH on the skin surface. This organism is more prevalent in post-pubertal individuals due to hormonal stimulation of sebum secretion

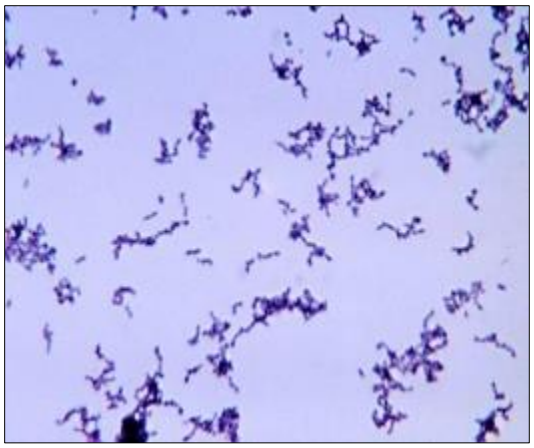

Figure 2 *Cutibacterium acnes*

Corynebacterium species (coryneforms) are fastidious, slow-growing gram-positive bacteria historically underestimated as skin colonizers due to their difficulty in cultivation. These organisms are found predominantly in moist and occluded skin areas, including armpits, skin folds, toe webs, and other areas with increased humidity. Corynebacteria are capable of producing biofilms that physically block pathogenic organism access to the skin surface; they function in concert with staphylococci to metabolize apocrine sweat secretions, producing the characteristic human body odor.

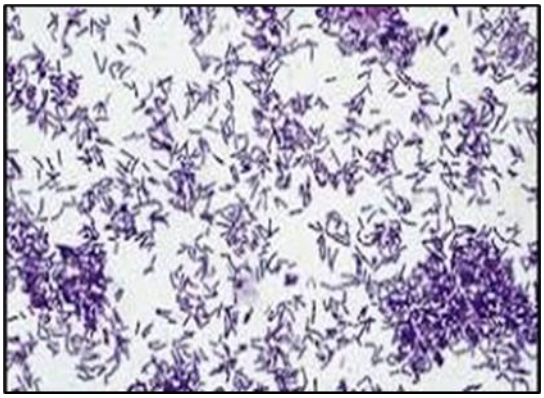

Figure 3 *Corynebacterium species*

Staphylococcus aureus is present in 10- 40% of normal adults, with the highest prevalence in the nasal and perineal regions. This gram-positive coccus can become overgrown in conditions of increased pH (such as in occluded areas) and becomes pathogenic when the skin barrier is compromised or immune function is impaired.

Figure 4 *Staphylococcus aureus*

Gram-negative bacteria, considered rare or merely contaminant organisms on skin, are now recognized via modern molecular methods to be more prevalent than previously appreciated, particularly in dry skin areas. These include *Acinetobacter*, *Brevundimonas*, and *Betaproteobacteria* species.

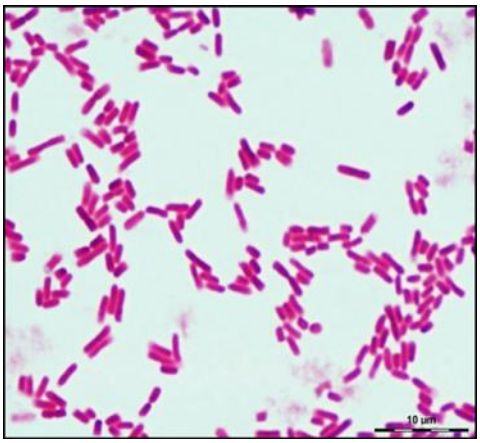

Figure 5 Gram-negative bacteria

1.3 Fungal and Other Components

1.3.1 Fungi

Malassezia species are the predominant fungi on healthy human skin, comprising 53-80% of the total fungal population, depending on body site, with the highest prevalence in sebaceous areas and the retroauricular crease. *Candida* species rarely colonize healthy intact skin but can cause clinical infection following antibiotic therapy or in immunocompromised individuals.

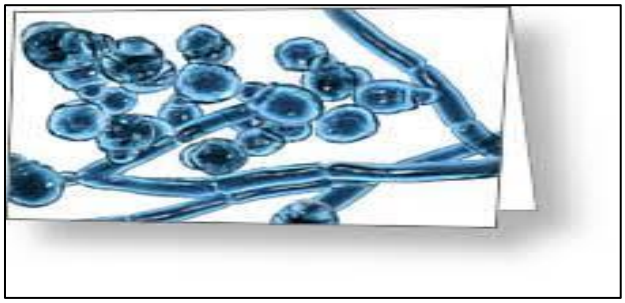

Figure 6 Fungi

1.3.2 Mites

Demodex species (arthropods), particularly *Demodex folliculorum* and *Demodex brevis*, reside in pilosebaceous units, showing preference for facial skin and sebaceous areas. They feed on sebum and lipid secretions and are considered part of normal skin flora.

1.4 Effects of Shower Gels on Normal Skin Flora

Thy mainly causes Reduction in microbial load. Shower gels contain surfactants and sometimes antimicrobial agents that remove dirt and microorganisms, leading to a temporary decrease in normal skin flora. They mainly causes Disturbance of microbial balance.Frequent use can disturb the natural balance between beneficial and harmful microbes on the skin.

They Alteration of skin pH. Some shower gels change the skin's natural acidic pH, which may affect the survival of normal flora. The Removal of beneficial microorganisms will occur. Along with harmful microbes, protective bacteria like *Staphylococcus epidermidis* may also be reduced.They Increased susceptibility to infections (if overused). Loss of normal flora may allowpathogenic microorganisms to colonize the skin more easily. The Dryness and irritation (indirect effect). Harsh surfactants can damage the skin barrier, indirectly affecting the growth of normal flora.

Commercial shower gels are widely used for daily cleansing due to their pleasant fragrance, foaming properties, and ease of use. These products contain surfactants and antimicrobial agents that help remove dirt, sweat, and microorganisms from the skin surface. Frequent or prolonged use of such products may also affect beneficial skin microorganisms, leading to an imbalance in the natural skin microflora.

Understanding the effect of commercial shower gels on normal human skin flora is important for evaluating their safety and long-term impact on skin health. The present study aims to assess changes in normal skin flora before and after the use of commercial shower gels using standard microbiological techniques. This study contributes to better awareness of the relationship between personal hygiene products and the maintenance of healthy skin microflora.

1.5 The main antibacterial ingredients used in typical bath/shower gels:

- Triclocarban (TCC): Earlier very common in antibacterial soaps. Active antibacterial agent. Now less used due to safety concerns.
- Triclosan: Broad-spectrum antimicrobial. Kills bacteria like *E. coli*, *Staphylococcus*. Banned in some countries in wash-off products.
- Benzalkonium Chloride (BAC): A quaternary ammonium compound: Effective against bacteria, fungi, and some viruses.Mild, widely used in cosmetics, hand washes, shower gels.
- Chlorhexidine Gluconate (CHG): Strong hospital-grade antiseptic. Rare in normal shower gels, but present in medicated body washes for skin infections.
- Essential Oils (natural antimicrobials): Some shower gels use natural antimicrobial agents:
- Tea tree oil, Eucalyptus oil, Neem extract, Lavender oil These give mild antibacterial action.
- Alcohol (very rare in shower gels): Some cleansing gels include low % alcohol as antimicrobial and solvent. Not common in routine products.

1.6 Other components NOT antibacterial but important in shower gels

1.6.1 Shower gels mainly contain

- Surfactants/Detergents – Sodium Lauryl Sulfate (SLS), Sodium Laureth Sulfate (SLES), Cocamidopropyl betaine → remove dirt and some bacteria physically.
- Preservatives – parabens, phenoxyethanol → prevent bacterial growth *inside the product*.
- Fragrance,Moisturizers – glycerin, aloe vera, Thickeners – carbomers

Most common antibacterial agents in regular shower gels Benzalkonium chloride, Essential oils (tea tree, neem), Triclocarban/Triclosan (less common now)

2 Materials and methods

2.1 Materials Required

Sterile cotton swabs, sterile test tubes, micropipettes with sterile tips, Petri plates, an inoculating loop, a measuring cylinder, marker pens, and labels were used for sample collection and processing.

2.2 Culture Media

The following culture media were employed for the isolation and enumeration of microorganisms:

- Nutrient Agar (NA), MacConkey Agar (MA)
- Rose Bengal Agar (RBA),
- Nutrient Broth,
- MacConkey Broth Reagents
- Normal saline (0.85%)
- Gram staining reagents
- IMViC test reagents, including Indole reagent, Methyl Red reagent, and Simmons' Citrate medium, catalase medium

2.2.1 Test Products

Some of the commercially available cleansing products were evaluated:

2.2.1.1 Instruments

Incubator maintained at 37°C, laminar air flow (where available), colony counter, and spectrophotometer (660 nm) were used during the study.

2.2.2 Collection of Sample Source

Skin swab samples were collected from the palmar surface of the hand or forearm of a healthy volunteer.

2.2.2.1 Inclusion Criteria

Healthy individual with no visible skin infection

- No history of antibiotic or antifungal usage for at least 7 days prior to sampling Exclusion Criteria
- Presence of skin wounds, cuts, eczema, or dermatitis
- Recent use of medicated soaps or antiseptic products Sampling Procedure

A sterile cotton swab moistened with sterile normal saline (0.85%) was used for sample collection.

2.3 Before wash sample

- The selected skin area (approximately 4–5 cm^2) was swabbed by gently rotating the swab
- over the surface. The swab was immediately transferred into a sterile test tube containing 5 ml of sterile saline and properly labeled.
- The skin area was then washed using the selected commercial shower gel or soap for 30–60 seconds, rinsed thoroughly with water, and allowed to air-dry.

2.4 After wash sample

- The same skin area was swabbed again using a new sterile cotton swab and processed in the same manner as the pre-wash sample.
- Separate samples were collected for each test product on different days to avoid cross-interference and ensure accuracy of results.

2.5 Microbiological Analysis

Collected samples were serially diluted and inoculated onto Nutrient Agar, MacConkey Agar, and Rose Bengal Agar plates using the standard spread plate technique. Nutrient broth and MacConkey broth. The plates and tubes were incubated at 37°C for 24–48 hours. After incubation, colonies were counted using a colony counter, and OD values were taken using a calorimeter at 660nm. expressed as colony-forming units (CFU). Representative colonies were subjected to Gram staining and biochemical tests, including IMViC tests, for microbial identification.

2.5.1 Procedure

- Preparation of culture plates
- Take sterile nutrient agar plates, Nutrient broth, and label them as: Control, Shower Gel A, Shower Gel B
- Collection of skin flora (before washing)
    - Using a sterile cotton swab moistened with sterile saline, gently swab a small area of skin (e.g., forearm or palm) before washing.
    - Streak the swab evenly over the control agar plate.

2.6 Application of shower gel

- Wash the same skin area with the selected shower gel for 30–60 seconds.
- Rinse with clean water and allow the skin to dry naturally.

2.6.1 Collection of skin flora (after washing)

- Take a new sterile swab moistened with saline.
- Swab the same area after washing.
- Streak the swab on the agar plate labeled Shower Gel A.
- Repeat for other shower gels if required.

3 Result

3.1 Qualitative Results

Table 1 Colonies on Nutrient agar before and after wash with shower gel

SAMPLE	Before Washing	After Washing	Observation
S12	Heavy growth	Very few colonies	Strong microbicidal effect
S13	Heavy growth	Reduced growth	High antibacterial activity
S17	Moderate growth	Slight reduction	Mild effect
S14	Moderate growth	Moderate reduction	Mild effect
S15	Heavy growth	Reduced growth	Moderate effect
S16	Moderate growth	Slight reduction	Low effect
S10	Heavy growth	Moderate reduction	Moderate effect
S9	Moderate growth	Mild reduction	Least effect

3.2 Quantitative analysis

Result Analysis (Qualitative)

The qualitative results show that all samples had visible bacterial growth before washing, confirming the presence of normal skin flora. After washing with commercial shower gels, a reduction in bacterial growth was observed in all samples, though the level of reduction varied among samples.

Samples S1 and S2 showed a significant decrease in bacterial growth after washing. S1 showed very few colonies, indicating a strong microbicidal effect, while S2 showed reduced growth, indicating high antibacterial activity.

Samples S5 and S7 showed a moderate reduction in bacterial growth, suggesting a moderate antibacterial effect. Samples S3 and S4 showed only slight to moderate reduction, indicating a mild effect on normal skin flora.

Samples S6 and S8 showed the least reduction in bacterial growth after washing, indicating a low or least antibacterial effect. The analysis suggests that different commercial shower gels have varying levels of antibacterial activity, and some shower gels reduce normal skin flora more effectively than others.

Table 2 Turbidity (O.D values) of MacConkey broth and number of colonies (CFU) on agar before and after wash with shower gel

MacConkey broth						
SL.NO	**sample**	**Incubation time**	**OD value before**	**OD value after**	**No.of colonies Before**	**No.of colonies after**
1	S1	24-48 Hrs	0.1	0.02	35	15
2	S2	24-48 Hrs	0.2	0.03	25	10
3	S3	24-48 Hrs	0.11	0.01	50	30
4	S4	24-48 Hrs	0.2	0.04	40	20
5	S5	24-48 Hrs	0.28	0.18	35	15
6	S6	24-48 Hrs	0.35	0.12	60	30
7	S7	24-48 Hrs	0.26	0.13	7	3
8	S8	24-48 Hrs	0.35	0.12	20	5

Table 3 Turbidity (O.D values) of Nutrient broth and number of colonies (CFU) on agar before and after wash with shower gel

NUTRIENT AGAR MEDIUM

Sample	Incubation Time	OD Before	OD After	No. of colonies before	No. of colonies After
S1	24-48 hrs	0.07	0.01	7	3
S2	24-48 hrs	0.11	0.06	150	120
S3	24-48hrs	0.03	0.01	61	41
S4	24-48hrs	0.23	0.18	34	24
S5	24-48hrs	0.23	0.11	68	22
S6	24-48 hrs	0.22	0.12	75	65
S7	24-48hrs	0.11	0.06	62	20
S8	24-48hrs	0.05	0.02	100	60

Table 4 Turbidity (O.D values) of Rose Bengal broth and number of colonies (CFU) on agar before and after wash with shower gel

ROSE BENGAL MEDIUM

Sample	Incubation time	Od before	Od after	Cfu before	Cfu after
S1	24-48 hrs	0.15	0.02	25	12
S2	24-48 hrs	0.20	0.12	35	06
S3	24-48hrs	0.13	0.03	25	12
S4	24-48hrs	0.14	0.06	30	20
S5	24-48hrs	0.05	0.02	10	05

3.3 GRAM-STAINING RESULTS

Table 5 Gram-stained colonies on Nutrient agar and Macconkey agar before and after wash with shower gel

Organism Type	Observation
Gram-positive cocci -	Purple, spherical cells in clusters
Gram-negative rods	Pink, rod-shaped bacteria

3.4 Biochemical Test (IMVIC)

Table 6 Biochemical test for colonies on Nutrient agar and MacConkey agar before and after wash with shower gel

Indole	Negative
Methyl Red	Positive
Citrate	Negative
Catalase	positive

3.5 MacConky agar medium

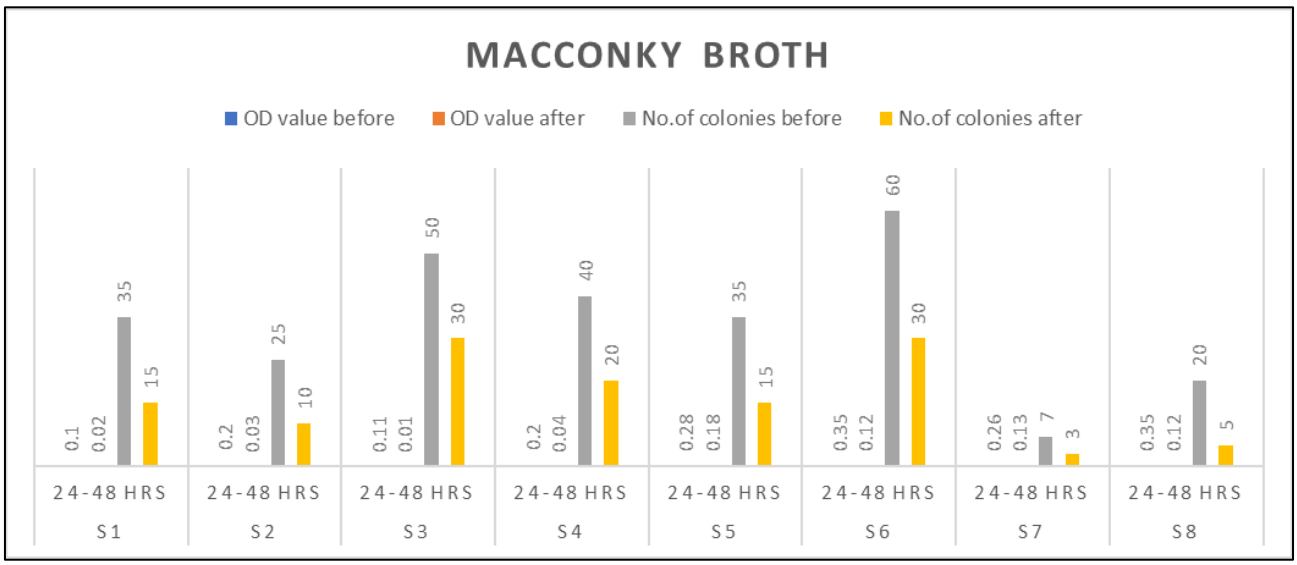

Figure 7 Graphical representation of turbidity (O.D values) of MacConkey broth and number of colonies (CFU) on agar before and after wash with shower gel

3.6 ROSE BENGAL MEDIUM

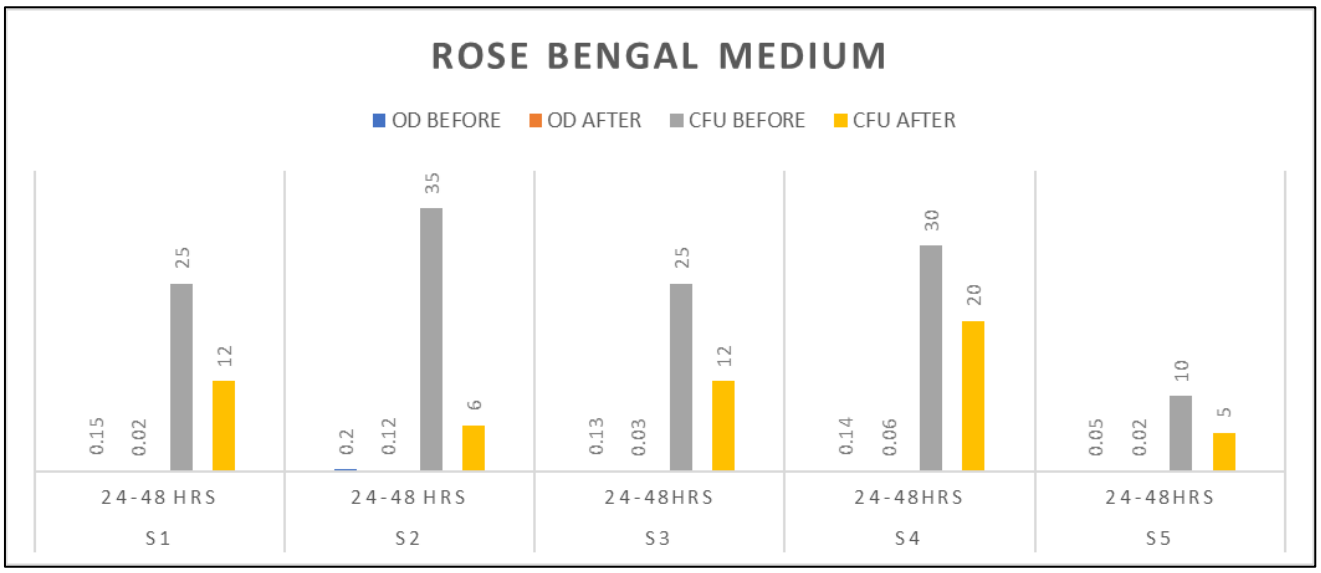

Figure 8 Graphical representation of turbidity (O.D values) of Rose Bengal broth and number of colonies (CFU) on agar before and after wash with shower gel

3.7 Nutrient agar medium

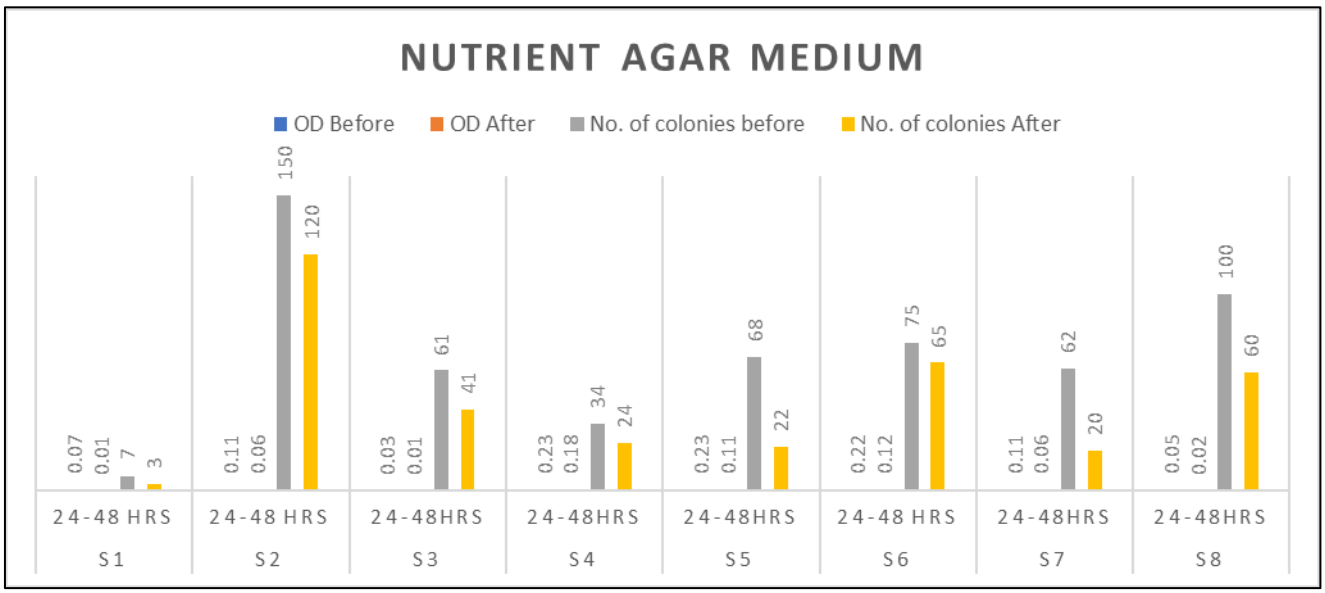

Figure 9 Graphical representation of turbidity (O.D values) of Nutrient broth and number of colonies (CFU) on agar before and after wash with shower gel

Fig: 1.6 Different (Macconkey agar, Nutrient agar. Rosebengal agar) media

Figure 10 Images of work done 1,2,3,4,5,6

Figure 11 Laminar work

Sample S1

Before washing, S1 showed noticeable OD values and CFU counts in all three media, indicating the presence of normal bacterial and fungal skin flora. After washing, there was a marked reduction in OD values and CFU in MacConkey agar (35 to 15 colonies), Nutrient agar (7 to 3 colonies), and Rose Bengal medium (25 to 12 colonies). This shows that the shower gel used for S1 had a strong microbicidal effect against both bacteria and fungi.

Sample S2

In S2, high bacterial growth was observed before washing, especially in Nutrient agar (150 CFU), showing heavy total bacterial load. After washing, CFU counts reduced in all media: MacConkey (25 to 10), Nutrient agar (150 to 120), and Rose Bengal (35 to 6). Although reduction was seen, higher CFU remained in Nutrient agar, indicating high antibacterial activity but incomplete removal of skin flora.

Sample S3

S3 showed moderate growth before washing in all media. After washing, there was a slight reduction in OD and CFU values, especially in MacConkey (50 to 30) and Nutrient agar (61 to 41). Rose Bengal medium also showed reduced fungal colonies (25 to 12). This indicates that the shower gel had a mild antimicrobial effect on both bacterial and fungal flora.

Sample S4

In S4, moderate microbial growth was present before washing. After washing, a moderate reduction was observed across all media: MacConkey (40 to 20), Nutrient agar (34 to 24), and Rose Bengal (30 to 20). The results suggest that the shower gel caused partial reduction of skin flora, showing a mild to moderate effect.

Sample S5

S5 showed relatively higher OD values before washing, particularly in MacConkey and Nutrient media, indicating a good amount of bacterial growth. After washing, CFU counts decreased significantly in all media: MacConkey (35 to 15), Nutrient agar (68 to 22), and Rose Bengal (10 to 5). This shows that the shower gel used in S5 had a moderate antibacterial and antifungal effect.

Sample S6

In S6, high OD values and CFU counts before washing indicated heavy microbial presence. After washing, reduction was observed, but the decrease was less pronounced, especially in Nutrient agar (75 to 65). MacConkey (60 to 30) and Rose Bengal also showed a reduction. Overall, this sample indicates a low antibacterial effect, with many microorganisms surviving after washing.

Sample S7

S7 showed comparatively lower CFU counts in MacConkey agar even before washing (7 colonies), suggesting fewer gram-negative bacteria. After washing, the CFU was further reduced to 3. In Nutrient agar, a sharp reduction was observed (62 to 20), and Rose Bengal also showed a good reduction. This indicates a moderate to strong antimicrobial effect, particularly against general bacterial flora.

Sample S8

In S8, moderate microbial growth was observed before washing. After washing, CFU counts reduced in MacConkey (20 to 5), Nutrient agar (100 to 60), and Rose Bengal medium. Although reduction was evident, a considerable number of colonies remained, especially in Nutrient agar. This suggests that the shower gel had the least effect compared to other samples.

4 Discussion

Human skin is naturally colonized by a wide variety of microorganisms, including bacteria and fungi, which together form the normal skin flora. These microorganisms play an important role in protecting the skin by preventing the growth of harmful pathogens. The present study was conducted to evaluate the effect of commercial shower gels on normal human skin flora using MacConkey agar, Nutrient agar, and Rose Bengal medium, with microbial growth assessed through optical density (OD) values and colony-forming units (CFU).

Before washing, all samples showed significant microbial growth, as indicated by higher OD values and CFU counts in all three media. This confirms that the skin surface supports a diverse microbial population. Nutrient agar showed the highest CFU counts, as it is a general-purpose medium that supports the growth of a wide range of bacteria present on the skin. MacConkey agar showed growth of gram-negative bacteria, while Rose Bengal medium showed the presence of fungal flora.

After washing with commercial shower gels, a noticeable reduction in microbial growth was observed in all samples. The decrease in OD values and CFU counts indicates that shower gels contain antimicrobial agents and surfactants that disrupt microbial cells and remove them from the skin surface. However, the degree of reduction varied among samples, suggesting differences in the antimicrobial effectiveness of different shower gels.

In some samples, such as S1 and S7, a marked reduction in CFU was observed across all three media, indicating a strong microbicidal effect. These shower gels were effective in reducing both bacterial and fungal populations. Samples such as S2 and S5 showed a moderate reduction in microbial load, indicating moderate antibacterial and antifungal activity. In contrast, samples S6 and S8 showed the least reduction in CFU, especially in Nutrient agar, suggesting a low antimicrobial effect and possible resistance of certain skin microorganisms to these shower gels.

The results from MacConkey agar indicate that gram-negative bacteria are generally susceptible to shower gels, as seen by reduced colony counts after washing. Nutrient agar results showed variable reduction, highlighting that some skin bacteria are more resistant and can survive washing. Rose Bengal medium showed a reduction in fungal growth after washing, but the decrease was comparatively less than that observed for bacteria, suggesting that fungi may be more resistant to the ingredients present in shower gels.

This study demonstrates that commercial shower gels significantly influence the normal microbial population of human skin. While the reduction of harmful microorganisms is beneficial for hygiene, excessive removal of normal skin flora may disturb the natural protective balance of the skin. Therefore, regular use of mild shower gels is preferable to maintain skin health.

4.1 Effect of Soaps on Microbial Load

The antimicrobial activity of different commercial soaps was assessed by comparing optical density (OD) and colony-forming units (CFU) before and after treatment.

Among all soaps tested, S12 showed the highest antimicrobial effectiveness, as indicated by a sharp reduction in OD (0.30 to 0.08) and CFU count (60 to 10). S13 and S15 also demonstrated significant reductions in microbial load, indicating good antibacterial activity. Moderate reductions were observed with S10, S14, and S17.

In contrast, S9 showed an increase in OD after treatment, although the CFU count decreased, suggesting partial inhibition but lower effectiveness compared to medicated soaps. S16 showed the least reduction in CFU, indicating comparatively weaker antibacterial action.

Overall, the results indicate that medicated soaps are more effective than cosmetic soaps in reducing microbial load.

4.2 Gram Staining Results

Gram staining revealed the presence of two types of bacteria:

- Gram-positive cocci, observed as purple, spherical cells arranged in clusters, indicating organisms similar to *Staphylococcus* species.
- Gram-negative rods, observed as pink, rod-shaped bacteria, suggesting enteric bacteria.

The presence of both Gram-positive and Gram-negative organisms indicates a mixed microbial population, commonly found in environmental or surface samples.

4.2.1 Biochemical Characterization (IMViC Test)

- Indole: Negative
- Methyl Red: Positive
- Citrate: negative
- Catalase : positive

A negative indole test indicates that the organism is unable to degrade tryptophan to produce indole, suggesting the absence of the enzyme tryptophanase. The positive methyl red reaction confirms that the organism carries out mixed acid fermentation, producing stable acidic end products that significantly lower the pH of the medium.A negative citrate test suggests that the organism cannot utilize citrate as the sole carbon source.

This IMViC reaction pattern (– + – +) is characteristic of *Escherichia coli* and distinguishes it from other enteric bacteria such as *Salmonella* and *Enterobacter*. Therefore, based on the IMViC test results, the Gram-negative isolate can be presumptively identified as *Escherichia coli*.

Growth on MacConkey Agar Medium- MacConkey agar selectively supports the growth of Gram-negative bacteria while inhibiting Gram-positive organisms. In this study, all samples showed a reduction in OD values and colony counts after incubation.

The growth observed confirms the Gram-negative nature of the organism. The reduction in colony numbers may be due to the selective agents present in the medium. The results also suggest that the organism is a non-lactose fermenter, which is consistent with the biochemical findings.

Growth on Rose Bengal Medium-Rose Bengal medium is primarily selective for fungi and inhibits bacterial growth. In the present study, limited growth and reduced colony counts were observed.

This indicates that the isolates are bacterial rather than fungal, and there was minimal fungal contamination in the samples. The inhibitory nature of Rose Bengal further confirms the bacterial identity of the isolates.

Growth on Nutrient Agar Medium-Nutrient agar supported maximum growth of the isolates, as shown by higher OD values and CFU counts compared to selective media.

This confirms that the organism is non-fastidious and viable, capable of growing well under general laboratory conditions. Differences in colony counts among samples may be due to variation in inoculum size or bacterial concentration.

4.3 Antibiotic Susceptibility Test

The antibiotic sensitivity test revealed that the organism was:

- Sensitive to streptomycin, indicated by a clear zone of inhibition.
- Sensitive to penicillin, indicated by a clear zone of inhibition

5 Conclusion

The present study successfully demonstrated the antimicrobial effectiveness of commonly used soaps, the morphological and biochemical characteristics of isolated bacteria, and their growth and antibiotic response patterns.

Medicated soaps such as S3 and S4 were found to be more effective in reducing microbial load compared to cosmetic soaps. Gram staining revealed the presence of both Gram- positive cocci and Gram-negative rods. IMViC test results supported the presumptive identification of the Gram-negative isolate as *Salmonella* species.

Growth studies on selective and non-selective media further confirmed the bacterial nature of the isolates. Antibiotic susceptibility testing showed resistance to tetracycline and sensitivity to penicillin, emphasizing the need for proper antibiotic selection.

The present study demonstrates that cosmetic cleansers significantly influence the microbial population of human skin. Antibacterial soaps such as S3and S4 showed a marked reduction in both Gram-positive and Gram-negative bacteria, indicating strong microbicidal activity. This may be due to the presence of antimicrobial agents like chloroxylenol and triclosan- like compounds.

Mild cosmetic soaps and shower gels showed comparatively lower antibacterial activity, suggesting that they are less disruptive to resident skin flora. This supports the idea that excessive use of strong antibacterial products may disturb skin microbiome balance.

The persistence of Gram-positive cocci after washing suggests that resident flora are more resistant and firmly attached to the skin. Excessive use of strong antibacterial soaps may disrupt the natural skin microbiome, potentially leading to dryness, irritation, or increased susceptibility to pathogenic infections.

Compliance with ethical standards

Acknowledgement

We express my sincere gratitude to Dr. V. Anuradha, Principal of Vignan Degree College, for providing the necessary facilities and a supportive environment to carry out this project successfully.

We are extremely thankful to Ms. A. Amruthavalli, Head of the Department of Microbiology, Acharya Nagarjuna University, Guntur, Andhra Pradesh for her valuable guidance, constant encouragement, and support throughout the course of this study.

We also extend our thanks to all the faculty members of the Department of Microbiology for their cooperation and timely assistance during the completion of this project.

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