



## Studies on efficiency of various soaps against *Staphylococcus aureus*

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### Abstract

*Staphylococcus aureus* is a common pathogen responsible for a range of infections, from minor skin conditions to severe systemic diseases. This study evaluates the antibacterial efficiency of various commercially available and medicated soaps against *S. aureus* using standard microbiological methods. The agar well diffusion method measured the zone of inhibition for each soap. Results indicated that medicated soaps demonstrated the highest antibacterial activity, producing significant zones of inhibition and reducing bacterial counts effectively. Beauty soaps exhibited the least antibacterial efficacy, with minimal zone of inhibition than the medicated soap against *S. aureus*. Herbal soaps, exhibited minimal or no inhibition against *S. aureus*. The study reveals the importance of selecting appropriate soap formulations for infection control in both healthcare and daily hygiene practices.

**Keywords:** *Staphylococcus aureus*, medicated soap, beauty soap, herbal soap, antibacterial efficacy

### Introduction

Microorganisms such as bacteria and fungi are generally believed to be ubiquitous, that is, they are found everywhere in places like soil, water, air, sewage and on human body and hence of great importance with reference to health (Amadi *et al.* 2018) [3]. *Staphylococcus aureus* is known to be both a commensal bacterium and a human pathogen. Approximately 30% of the human population is colonized with *Staphylococcus aureus* (Tong *et al.*, 2015) [16]. *Staphylococcus aureus* infections range in severity from mild skin infection to severe necrotising pneumonia. It is simultaneously the leading cause of bacteremia, infective endocarditis (IE), and can also cause osteoarticular, skin and soft tissue, pleuropulmonary, and device-related infections. These range from superficial skin lesions like folliculitis to deep-seated abscess and various pyogenic infections like endocarditis, osteomyelitis, etc. (Ikegbunam *et al.*, 2013).

In 1878, Irish chemist James Gamble began to manufacture a white, lightly perfumed soap that had a smooth, homogeneous consistency and could generate an enormous amount of foam. In the same period, the use of oils and seeds such as coconut, palm, and linseed began to replace olive oil as a raw material in the production of soaps. These are the first soap ever produced (Veloza, 2018). Soaps with antibacterial properties have been reported to remove 65% to 85% of bacteria from human skin (Amadi *et al.* 2018) [2]. Antibacterial activity refers to the Capacity to kill or impede the development of germs. This is referred to as cidal or static effects, depending on the situation. This is crucial in avoiding sepsis and skin infections in humans. Soap cleans by attracting molecules to the fatty component of the anions in the soap solution, which are then drawn off the filthy surface and into the water. Additional chemicals are commonly included in antiseptic soaps, which are used to treat skin diseases. Germicidal chemicals such as irgasan, trichlorocarbanilide (TCC), and others are added to antiseptic soaps to boost their antibacterial action.

Soaps contain active ingredients that have antibacterial activity and also the reducing power against the pyogenic skin infection caused by *Staphylococcus aureus* and other

gram-negative species of bacteria, antibacterial soap removes bacteria than a plain soap. (Nwankwo *et al.*, 2022) [10]. Some people consider that the antibacterial portion of soaps is effective against microorganisms and can prevent most communicable diseases, Too much use of medicated soaps might result in a resistant strain, and then the person is more prone to opportunistic skin infections (Abbas *et al.*, 2016) [1].

### Material and Methods

- **Collection of Soap:** The samples for the study were randomly purchased from medical stores and general shops located within Akola. A total 4 different brands of medicated and non-medicated soap were used. Medicated soap such as Tatmosol, Acnestar, Ketaconazole and Cetrimide Soap, Sulphur were used. Non-medicated soap such as beauty soap & herbal Soap were including, Lux, Dove, Santoor, Godrej No.1, Khadi, Himalaya, Haldi, Medimix were used. The soaps were dissolved in a sterile distilled water to make a Stock solution.
- **Collection of test bacteria:** The skin sample & wound sample inoculated on the mannitol salt agar, incubated at 37°C for 24 hours. After incubation period the bacterial growth was observed, bacterial colony selected, pure culture was maintained and gram staining and different biochemical test were carried out such as oxidase test, catalase test, urease test, Dnase test, acid production from glucose, mannitol, sucrose, lactose, maltose, coagulase test, Indole, methyl red, Vogus Proskauer, citrate test, after the biochemical test the bacteria was found *Staphylococcus aureus*. The pure culture of *Staphylococcus aureus* then was used for further study of antimicrobial activity of medicated & non- medicated soap.
- **Inoculum Preparation:** For inoculum, Nutrient broth was used, for its Preparation take a 0.6gm of nutrient broth and add 50 ml distilled water Then add 1 ml into

test tube and autoclave at 121°C, 15 lbs for 15 min for the sterilization. After cooling, *Staphylococcus aureus* was inoculated in test sterilized nutrient broth test tube and placed in an incubator at 37°C for 10 mins. Uniform turbidity was observed, after incubation the inoculum was used.

▪ **Determination of Antimicrobial Activity of Soap:-**

The determination Of antimicrobial activity of soap was done on Mueller Hinton Agar by using agar well diffusion method. The inoculums of *S. aureus* was inoculated on to the MHA plate by using sterilized cotton swab. After inoculation with borer five wells were prepared in the plate, 4 wells for soap & 1 for control i.e. distilled water and various concentration of soap sample were introduced into the bored wells and were labelled. The concentration of soap used were 25%, 50%, 100%, 200%. After the addition of soap dilution in to the MHA plates were incubated at 37°C for 24 hrs. After incubation, the resultant diameter of zone of inhibition were measured and recorded.

**Results and Discussion**

Soaps are generally used for the removal of germs and for cleaning purpose. Soaps usage is very common and now a day's especially antibacterial soaps are very popular. According to company's claim their antibacterial soaps are bacteria killers. So with the use of antibacterial soaps we can get dual functions, removal as well as killing of bacteria. The purpose of the study was to determine the bactericidal activity of both the antibacterial as well as of the beauty soaps being used in our daily life.

In the present study *Staphylococcus aureus* was isolated & identified from skin samples was used for study of the antibacterial activity of different soaps. For the study different medicated, beauty and herbal soaps were collected from various shops of Akola city. The antibacterial activity of various soaps were checked at 25%, 50%, 75%, 100% concentration by diluting the soap samples by agar well diffusion method.

In the medicated soap tetmosol was checked against *Staphylococcus aureus* (Figure 1). It was found that at 25% concentration tetmosol showed 30 mm of zone of inhibition it was followed by 50% which showed 32 mm zone of inhibition, 37 mm at 75% concentration & 40mm at 100% concentration. The tetmosol contains 5% of Monosulfiram which reported effective against infection causing agents. *Staphylococcus aureus* was showed sensitivity towards tetmosol.

Nwambete and Lyombe (2001) reported that tetmosol had inhibitory activities against *Staphylococcus aureus* at lower concentrations than tested in their work. Majority of the assayed medicated soaps have demonstrated satisfactory effect, particularly the antibacterial activity, hence buttressing the information written on the soap labels that they possess' antibacterial activity. This is due to differences in the active antibacterial ingredients and type of formulations used. However, repeated use of the agents might have caused some resistance as noted in their work.

In the present study it was found that the tetmosol had more inhibitory activities against *Staphylococcus aureus* at lower

concentrations. Tetmosol was more effective than the other medicated soaps.

The acnestar medicated soap was also checked against the *Staphylococcus aureus* (Fig 2). It was found that highest zone of inhibition was obtained at 100% concentration which was 30 mm followed by 75% (29 mm), 50% (27mm), & 25% (25mm). The Acnestar contain Benzoyl peroxide which are effective to kills bacteria and causes inhibitory activities against bacteria.

The sulphur medicated soap was checked against *Staphylococcus aureus* (Figure 3). It was found at 25% concentration sulphur showed 15 mm zone of inhibition it was followed by 50% which showed 25 mm zone of inhibition, 26 mm at 75% concentration and 27 mm at 100% concentration. The sulphur contains sulphur powder which consisting antibacterial properties, which are reduced the growth of bacteria.

In the medicated soap KTC was also checked against *Staphylococcus aureus* (Figure 4). It was found that the highest zone of inhibition was obtained at 100% concentration which was 30 mm followed by 75% (29 mm), 50% (25 mm), 25% (10 mm).

The KTC contains ketaconazole and cetrimide which are effective to disruption of bacteria. They contain antimicrobial agents which are effective to inhibit the growth of bacteria. Ikpoh *et al.*, (2012) <sup>[9]</sup> reported that medicated soap contain trichlocarban and triclosan as the active antimicrobial agents. These chemical compounds function by denaturing all disrupting cell activity and interfering with microbial metabolism. These depend on a number of factors such as the inherent properties of the organisms, contact time, the composition of the soaps (e.g. triclosan), concentration of individual formulation and skin sensitivity.

In the beauty soap Dove was checked against *Staphylococcus aureus* (Figure5). It was found that at 25% concentration dove showed 25 mm of zone of inhibition it was followed by 50% which showed 28 mm zone of inhibition, 29 mm at 75% concentration & 30 mm at 100% concentration. The Dove soap contains sodium isethionate which is act as a cleansing agent, and helpful to remove bacteria. Beauty soaps are found to lees effective than medicated soap.

The Lux soap was also checked against the *Staphylococcus aureus*. It was found that highest zone of inhibition was obtained at 100% concentration. which was 30 mm followed by 75% (25 mm), 50% (20mm), & 25% (19mm). The Lux soap contains Disodium distyrylbiphenyl disulfonate is a cleansing agent and surfactant which helps to remove bacteria.

This is in accordance with the other study as Riaz *et al.*, (2009) <sup>[11]</sup> who reported that the Lux contains Aloe vera which might have antibacterial activity. At 500 mg/ml, the Lux killed the bacterium but concentration was high as compared to the antibacterial soap. The MBC was observed at 500 mg/ml and MIC of the soap was 250 mg/ml. This revealed that Lux soap also showed antibacterial activity but not as much, then the other specific antibacterial soaps.

In the beauty soap Godrej no.1 was checked against *Staphylococcus aureus* (table 1). It was found that at 25% concentration Godrej no.1 showed 17 mm of zone of inhibition it was followed by 50% which showed 28 mm

zone of inhibition, 29 mm at 75% concentration & 30 mm at 100% concentration. The Godrej no.1 soap contains propylene glycol have antimicrobial properties which are helped to prevent microorganisms.

The Santoor soap was also checked against the *Staphylococcus aureus* (table 2). It was found that highest zone of inhibition was obtained at 100% concentration which was 30 mm followed by 75% (28 mm), 50% (24mm), & 25% (16mm). The Santoor soap contains calcianed kaolin gentle exfoliant which are effective to remove the microorganisms. Beauty soap contains chemical ingredients which are effective to inhibit the growth of bacteria. This justifies why beauty soaps are not used as medication in control of pathogens. However, it possesses saponin effects for which reason they are used as regular soap to primarily wash out dirt from body surfaces and leave perfume on the skin (Ike, 2016).

In the herbal soap Khadi was checked against *Staphylococcus aureus* (table 3). It was found that at 25% concentration Khadi showed 20 mm of zone of inhibition it was followed by 50% which showed 21mm zone of inhibition, 23 mm at 75% concentration and 25mm at 100% concentration. The Khadi soap contains mild antiseptic properties to inhibit the growth of bacteria.

The Himalaya soap was also checked against the *Staphylococcus aureus* (table 4). It was found that highest zone of inhibition was obtained at 100% concentration which was 22 mm followed by 75% (20mm), 50% (19mm), & 25% (17mm). The Himalayas was efficient in combating bacterial infections.

The Haldi soap was checked against *Staphylococcus aureus* (table 5). It was found that at 25% concentration haldi showed 15 mm of zone of inhibition it was followed by 50% which showed 17mm zone of inhibition, 19 mm at 75% concentration & 20 mm at 100% concentration. The Haldi soap contains neem, tulsi and turmeric which has antiseptic and antibacterial properties to inhibit the growth of bacteria. Chaudhary V (2016) was showed that the haldi chandan exhibited the least antibacterial activity with zone of inhibition of 10.2 mm for *Staphylococcus aureus*.

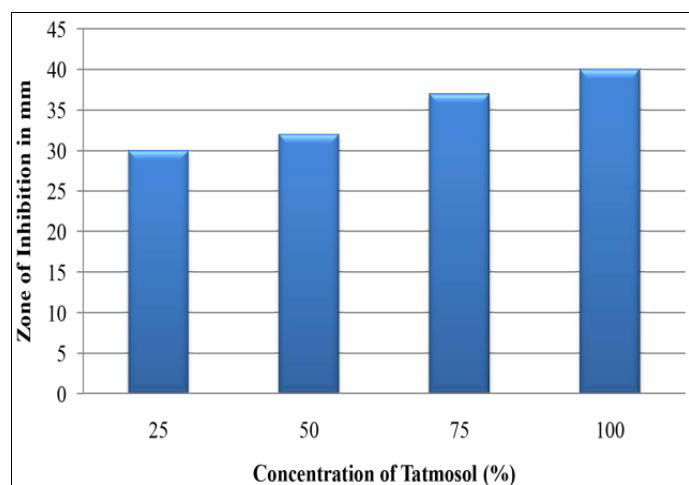
The Medimix soap was also checked against the *Staphylococcus aureus*. It was found that highest zone of inhibition was obtained at 100% concentration which was 19mm followed by 75% (18mm), 50% (17mm), & 25%

(16mm). The Medimix soap contains neem, Chopchini & Chitraka, Vanadraka & Nimbatwak, which Are effective to inhibit the bacteria.

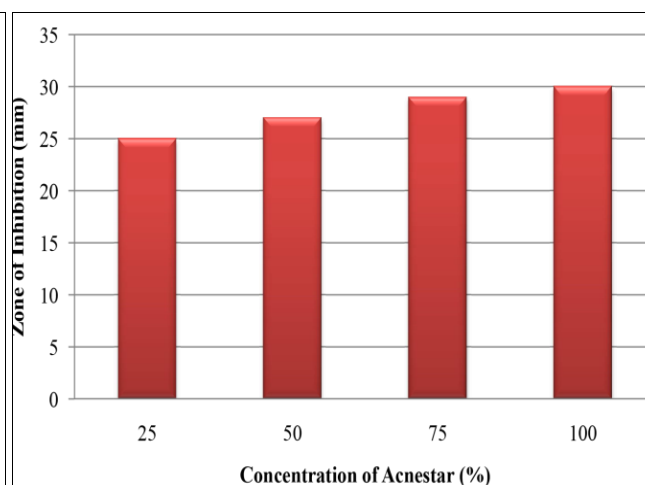
The herbal soaps contains natural ingredients such as neem, Aloe vera, turmeric, Ocimum sanctum which are inhibit the growth of bacteria, but sometime bacteria can shows resistance, Lacks a key ingredient used in killing microorganisms such as triclosan, instead when the soap is scrubbed into the skin; it helps release oils on the surface of the skin that can kill bacteria and rinsing microorganisms away on the skin and preventing the emergence of mutating bacteria (Ikpoh *et al.*, 2012) [8].

This study suggests that antiseptic soaps were more effective against Gram- negative and Gram-positive bacteria than were plain soaps. Present work showed that plain soaps also possessed antibacterial activity although lesser than that of antibacterial soaps. Garner and Favero (1985) [6] studied the hand washing with plain soaps removes millions of microorganisms (Garner and Favero, 1985) [7]. Most of the research has been focused on hand washing and hand disinfectants for personnel in health care settings where patients are immune compromised and are at high risk. Bannan and Judge (1965) [5] indicated that hand washing with bar soap reduced bacterial population (Bannan and Judge, 1965). Tierno (1999) [14] response to the Association for Professionals in Infection Control and Epidemiology (APIC) emphasized the use of antimicrobial household products (Tierno, 1999) [15].

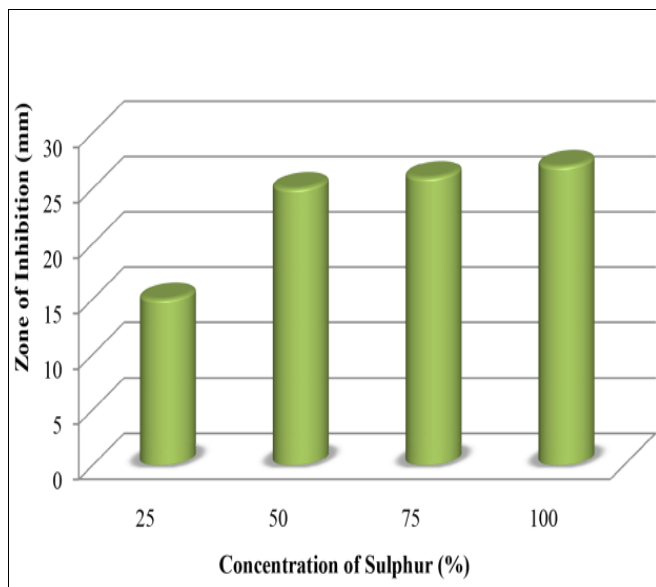
As described by Ike (2016), the inhibition of the growth pattern of the isolates indicates the varying abilities of the organism to resist the antimicrobial effect of the soaps. However, these variations could be due to differences in the nature and structures of the bacterial cell wall since it is ultimate target of any antimicrobial agent or disinfectant. The active ingredient in the soap is what distinguishes in the antimicrobial agents (Ike, 2016). The results agree with studies that also presented that *S. aureus* and *P. aeruginosa* strains were sensitive to a variety of commercially available antiseptic and antimicrobial products (Silva *et al.* 2016; [12] ABDI, 2015; Araújo, 2013; [4]. Silva *et al.* 2018) [13].



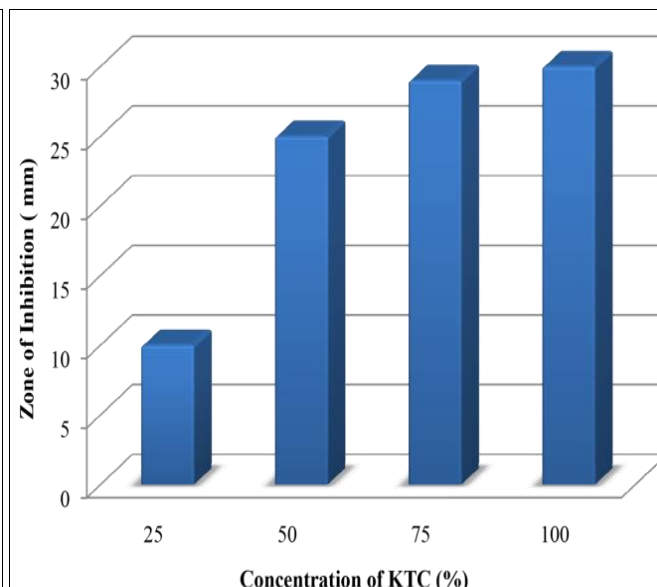
**Fig 1:** Antibacterial activity of Tatmosol against *Staphylococcus aureus*



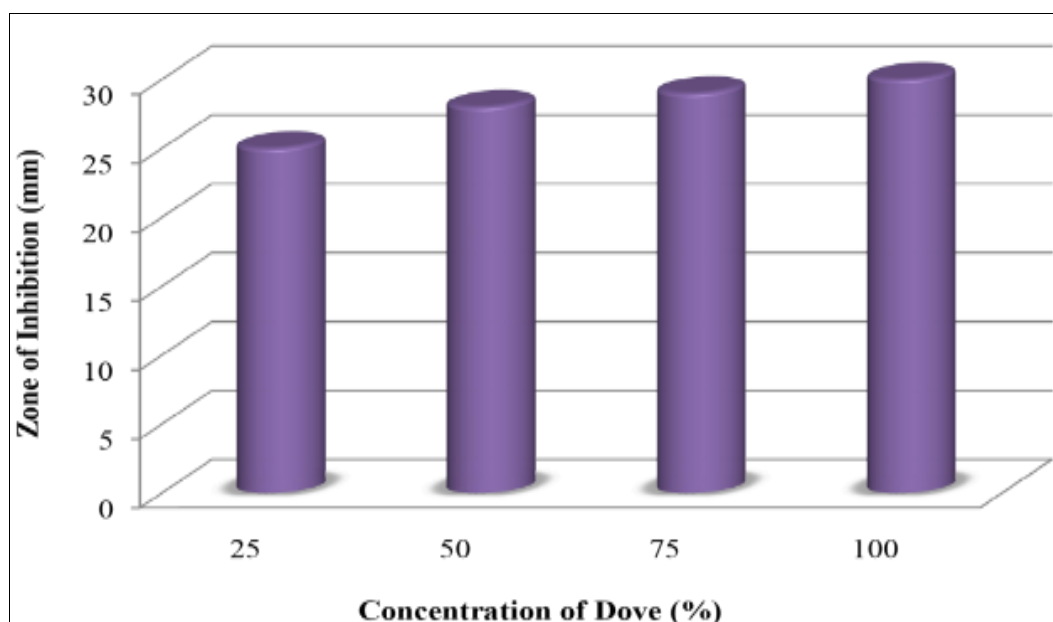
**Fig 2:** Antibacterial activity of Acnestar against *Staphylococcus aureus*



**Fig 3:** Antibacterial activity of Sulphur against *Staphylococcus aureus*



**Fig 4:** Antibacterial activity of KTC against *Staphylococcus aureus*



**Fig 5:** Antibacterial activity of Dove against *Staphylococcus Aureus*

**Table No.1:** Antibacterial activity of Godrej No.1 against *Staphylococcus aureus*

Concentration of Godrej No.1 (%)	Zone of Inhibition (mm)
25	17
50	28
75	29
100	30

**Table No.2:** Antibacterial activity of Santoor against *Staphylococcus aureus*

Concentration of Santoor (%)	Zone of Inhibition (mm)
25	16
50	24
75	28
100	30

**Table No.3:** Antibacterial activity of Khadi against *Staphylococcus aureus*.

Concentration of Khadi (%)	Zone of Inhibition (mm)
25	20
50	21
75	23
100	25

**Table No.4:** Antibacterial activity of Himalaya against *Staphylococcus aureus*

Concentration of Himalaya (%)	Zone of Inhibition (mm)
25	17
50	19
75	20
100	22

**Table No.5: Antibacterial activity of Haldi against *Staphylococcus aureus***

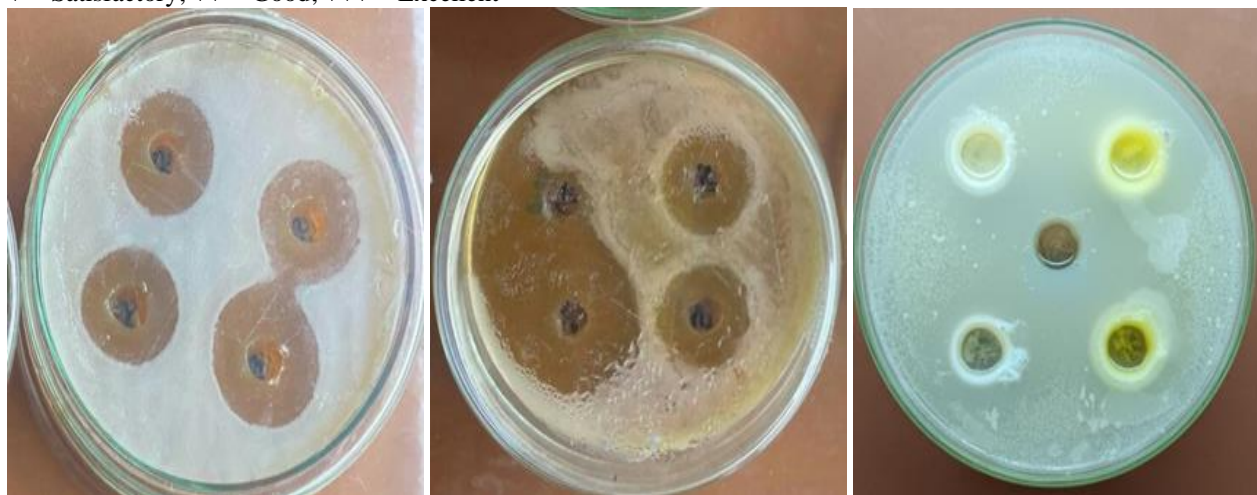
Concentration of Haldi (%)	Zone of Inhibition (mm)
25	15
50	17
75	19
100	20

**Table No. 6:- Efficacy of medicated, herbal & beauty soaps against**

Sr. No.	Type of Soap	Name of Soap	Efficacy
1	Medicated	Tatmosol	+++
		Acnestar	++
		Sulphur	++
		KTC	++
2	Beauty	Dove	++
		Lux	++
		Godrej No. 1	++
		Santoor	++
3	Herbal	Khadi	++
		Himalaya	+
		Haldi	+
		Medimix	+

***Staphylococcus aureus.***

+ = Satisfactory; ++ = Good; +++ = Excellent



Antibacterial activity of medicated soap

Antibacterial activity of beauty soap

Antibacterial activity of beauty soap

**Conclusion**

It is found that different soaps used in the present study showed varying degree of activity against *Staphylococcus aureus*. Amongst all soap medicated soaps were found more efficient in preventing *Staphylococcus aureus*, specially Tetmosol of found to exert good activity in combating *Staphylococcus aureus*, while herbal & beauty Soaps were less efficient in preventing the test organism

**References**

1. Abbas, S.Z. Hussain, K. Hussain, Z. Ali, R. Abbas, T. J. P. A. A. Anti-bacterial activity of different soaps available in local market of Rawalpindi (Pakistan) against daily encountered Bacteria. Pharm Anal Acta, 2016;7(11):522.
2. Amadi W.S, Patience A.N, Olayiwola O J. Comparison of antimicrobial activity of locally produced soaps and conventional medicated soaps on bacterial isolates from skin and wound. Wjpmr, 2018;4(10):16-20.
3. Araújo, A.C.F. Avaliação da qualidade microbiana de sabonetes comercializados em feiras de artesanato de Brasília. Brasília: Universidade de Brasília, 2013:72. Dissertação de Mestrado em Ciências da Saúde.
4. Bannan EA, Judge LF Bacteriological studies relating to hand washing. The inability of soap bars to transmit bacteria, Am. J. Public Health, 1965;55(6):915 – 922.
5. Chaudhari V.M. Studies on Antimicrobial activity of antiseptic soap and herbal soaps against selected human pathogens. Journal of scientific and Innovative Research, 2016;5(6):201-204.
6. Garner JS, Favero MS Guidelines for Hand Washing and Hospital Environmental Control NTIS United

- States, Department of Commerce, Springfield, 1985:110-115.
7. Ike and C.C. Antibacterial activities of different antiseptic soap sold in abia on *staphylococcus aureus* from clinical samples. IJRDO- Journal of Biological science, 2016:2(7):36- 46.
  8. Ikegbunam, MN, Metuth, RC. Anagu, Lo. Awan, NS. Antimicrobial Activity of some cleaning product against selected bacteria International Research Journal of Pharma-ceutical Applied Science, 2013:133-135.
  9. Ikpoh, I.S, Lennox, J.A, Agbo, B.E, Udoekong, N.S, Ekpo and Iyam, S.O. Comparative studies on the effect of locally made black soap and conventional medicated soap on isolated human skin microflora. Journal of Microbiology and Biotechnology Research, 2012:2(4): 535- 537.
  10. Mwambete, Lyombe Antimicrobial activity of medicated soaps commonly used by Dar es Salaam Residents in Tanzania. Indian Journal of pharmaceutical sciences, 2011:73(1): 92-97.
  11. Nwankwo, Edwards, Itaman, Udensi, Unah Antibacterial activities of medicated and antiseptic soaps on *staphylococcus aureus* and *Pseudomonas aeruginosa* isolated from wound infection. Academic Journal of Life Sciences, 2022:8(3):39-45.
  12. Riaz, Ahmad, and Hasnain. Antibacterial activity of soaps against daily encountered bacteria. African Journal of Biotechnology, 2009:8(8):1431-1436.
  13. Silva, A.C.N. Vasconcelos Júnior, A.A. Cunha, F.A., Cunha, M.C.S.O. and Menezes, E.A. Susceptibility testing of *Candida albicans* by disk diffusion method: a comparison of the culture media used. Revista Brasileira de Análises Clínicas, 2016:48(4):363-369.
  14. Silva, E.S.S. Vieira, F.C. Neves, G.A.A. Batista, P.C. Lima, W.A.S.B. and Paula, C.C. Controls microbiological de antiseptics' e antimicrobianos commercialized na farmácia UNIVAG from às bacteria gram-positives' e Negatives. Seminário Transdisciplinar da Saúde, 2018:3:25-29.
  15. Tierno PM Efficacy of triclosan, Am. J. Infect. Contr, 1999:27:71-72.
  16. Tong S. Y. Davis T. S. Eichenberger, E., Holland, T. L. Flower, V. G. *Staphylococcus aureus* infections: epidemiology, pathophysiology, clinical manifestations, and management. Clinical Microbiology Review, 2015:28(3):603-661.
  17. Velozo, V.O. Comparative analysis between two laundry detergent commercial.