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# Pathogenic bacteria colonization of the skin of some students of Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt

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## Abstract

The study was carried out to isolate, enumerate and identify bacterial colonization of the human skin. The analysis was done among randomly selected students of Ignatius Ajuru University of Education. Sterile swab sticks were used to scrub the faces, legs and palms of each of the five students selected. The swab sticks were quickly dropped inside labeled sample bottles and immediately taken to the laboratory for microbial analysis. Nutrient agar and MacConkey agar medium was prepared and swab sticks were dissolved separately in 150 ml distilled water in a beaker and taken as stock. From the stock, tenfold serial dilution was carried out and 0.1 ml aliquot inoculated by the spread plate technique. The inoculated culture media plates were incubated at room temperature for 24-hours. The different bacteria colonies were counted and sub-cultured unto freshly prepared media plates. Identification of the bacteria isolates was done through gram staining and different biochemical tests. The results showed the presence of *Staphylococcus aureus, Escherichia coli,* and *Micrococcus* species in the frequencies of 54%, 20% and 20% respectively. This clearly indicated that *Staphylococcus aureus* with a prevalence rate of 54% occurred more in the skins of the students studied. Proper personal hygiene and clean living environment is imperative to prevent the occurrence of infectious diseases among students of Universities.

**Keywords**: Students Skin; Bacteria Colonization; *Staphylococcus; E. coli; Micrococcus*

## 1. Introduction

A diverse microbial flora is associated with the skin and mucous membrane of every human shortly after birth until death [1]. The human body contains about 1013 cells and therefore routinely harbors about 1014 bacteria. This bacterial population constitutes the normal microbial flora with specific genera populating various body regions during particular periods in an individual's life [2].

The skin is an ecosystem composed of 1.8 $m^2$ of diverse habitats with an abundance of folds, invaginations and specialized niches that support a wide range of bacteria [3].

The primary role of the skin is to serve as a physical barrier, protecting our bodies from potential assault by foreign organisms or toxic substances. The skin is also an interface with the outside environment and, as such, is colonized by a diverse collection of bacteria [4]. Many of these bacteria are harmless and in some cases provide vital functions that the human genome has not evolved. Symbiotic microorganisms occupy a wide range of skin niches and protect against invasion by more pathogenic or harmful organisms [5].

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The perception of the skin as an ecosystem composed of living biological and physical components occupying diverse habitats can advance our understanding of the delicate balance between host and bacteria. However, disruptions in the balance on either side of the equation can result in skin disorders or infections [6].

The normal flora in human usually develops in an orderly sequence, after birth leading to the stable populations of bacteria that made up the normal adult flora [1]. The main factor determining the composition of the normal flora in a body region is the nature of the local environment which is determined by pH, temperature, redox potential, oxygen, water and nutrient levels. Other factors such as peristalsis, saliva lysozyme secretion and immunoglobulin secretions also play important roles in flora control. The local environment is like a concern, in which one principal instrument usually dominates [7]

Human skin is constantly covered with microorganisms, both commensals and pathogens depending on topography, environmental factors and host factors Chiller [8]. Cultures from the skin have frequently demonstrated bacteria such as *Diphtheroids, Staphylococcus, Streptococcus viridans, Streptococcus faecalis, Micrococcus, Corynebacteria, Brevibacteria*, *Propionibacteria*, gram positive aerobic spore-bearing bacilli, gram negative bacilli such as *Escherichia coli, Proteus* and other intestinal organisms, non-pathogenic Mycobacteria and fungi like *Candida albicans* and [9].

Previous research on this study has shown that hair frequently harbours *Staphylococcus aureus* and forms a reservoir for cross-infection. Most of these organisms act as commensals but they become pathogenic in persons with compromised immune response as in hospitalized patients [7]. In recent years, *Staphylococcus epidermidis* is regarded as an agent of hospital and community acquired infections. They act as causative agent of bloodstream infections, urinary tract infections and surgical site infections. Another concern is increasing incidence of drug resistance in these organisms [1]. Penicillin resistant Staphylococci are seen in individuals working in hospitals [10].

Although, the normal microbial flora inhabiting the human skin, nails, eyes, genitalia and gastrointestinal tract are harmless in healthy individuals [4], these organisms can frequently become pathogenic in compromised individuals [8], hence this study on the skin of some University students.

## 2. Material and methods

### 2.1. Study area

The project was carried out among randomly selected students of Ignatius Ajuru University of Education Campus, Rivers State, Nigeria. The University lies in the tropic region with the average temperature of 35-39$^{o}$C.

### 2.2. Sample collection

Swab sticks were used to wipe the faces, right legs and right palms of each selected five (5) students picked randomly from the University and the swab sticks were dropped in a labelled sample bottle and immediately taken to the Laboratory for microbial analysis.

### 2.3. Sterilization of glass wares

The glassware were properly washed with detergent and rinsed with distilled water. The glass wares were then sterilized in hot air oven at 160$^{o}$C for 2 hours. The non-glass wares were washed properly with water and detergent before cleaning with ethanol and cotton wool.

### 2.4. Preparation of culture media for inoculation

8.4g of Nutrient Agar and 13.2g of MacConkey Agar were weighed and dissolved in 300ml of water and stirred to mix properly in a flask. The flask was stoppered with a non-absorbent cotton wool and autoclaved at 121$^{o}$C for 15 minutes and allowed to cool. All media were dispensed into already sterilized petri dishes and then allowed to set and surface dried.

The sampled swab sticks were dissolved separately in 150 ml of distilled water in each beaker and taken as stock solutions. From the stock, tenfold serial dilution was carried out in sterile normal saline up to the fourth dilution ($10^{-1}$; $10^{-2}$; $10^{-3}$ and $10^{-4}$). The spread technique was used for inoculation. 0.1ml aliquots of each diluents from the water sample was inoculated unto the freshly prepared sterile plates of nutrient agar and MacConkey agar. All the inoculated plates were incubated at 37$^{0}$C for 24 hours. After 24 hours of incubation, the petri dish plates were brought out of the incubator and examined for growth bacterial colonies. The distinct colonies observed on the agar plates were picked

with a sterile wire loop and streaked on a freshly prepared agar plates. Each distinct observable colony with different cultural characteristics was streaked on different agar plates. The streaked plates were incubated for another 48hours. The different colonies of bacteria found on the streaked culture plates were examined to identify them using gram reaction and relevant biochemical tests.

### 2.5. Identification of bacteria isolates

The probable identity of the pure cultures of the bacteria isolates were confirmed by carrying out gram staining and the following biochemical tests: sugar test, Oxidase test, Indole test, Catalase test, Citrate test, Methyl red and Vogues proskauer test.

## 3. Results

The results of the total number of bacteria isolates and the respective frequencies of the bacteria isolated from the face, hand and the leg regions of the students are presented in figures 1, 2 and 3 respectively.

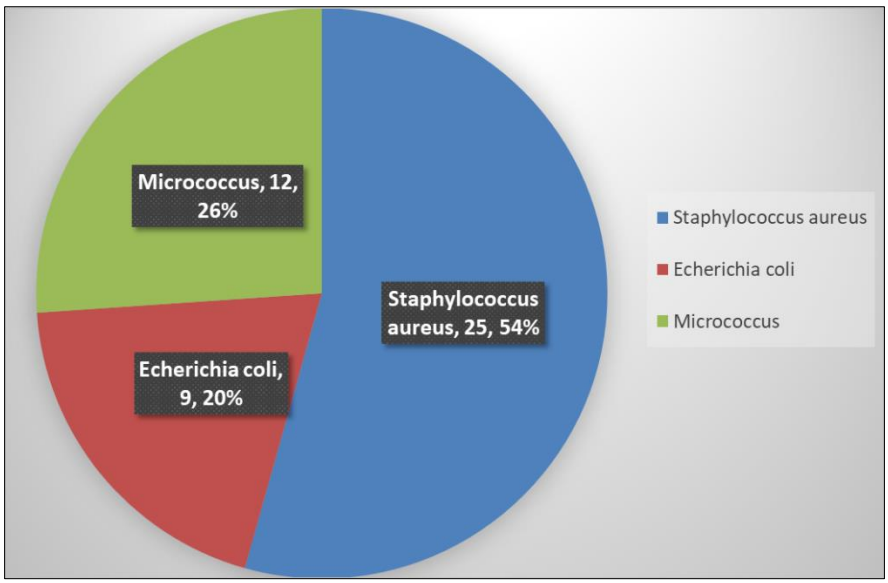


**Figure 1** Frequency of bacteria isolates from the face of the students

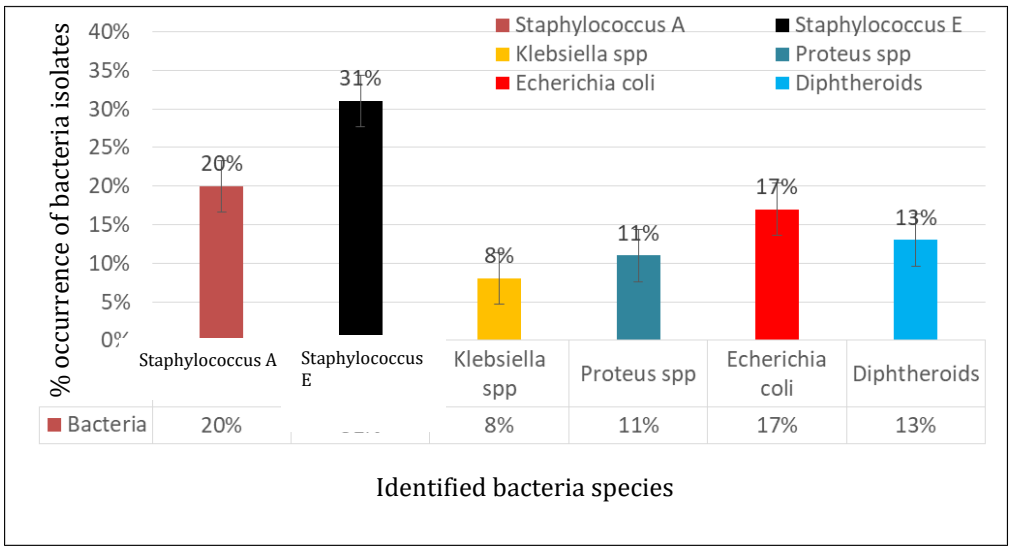


**Figure 2** Distribution of bacterial isolates from the student's hands

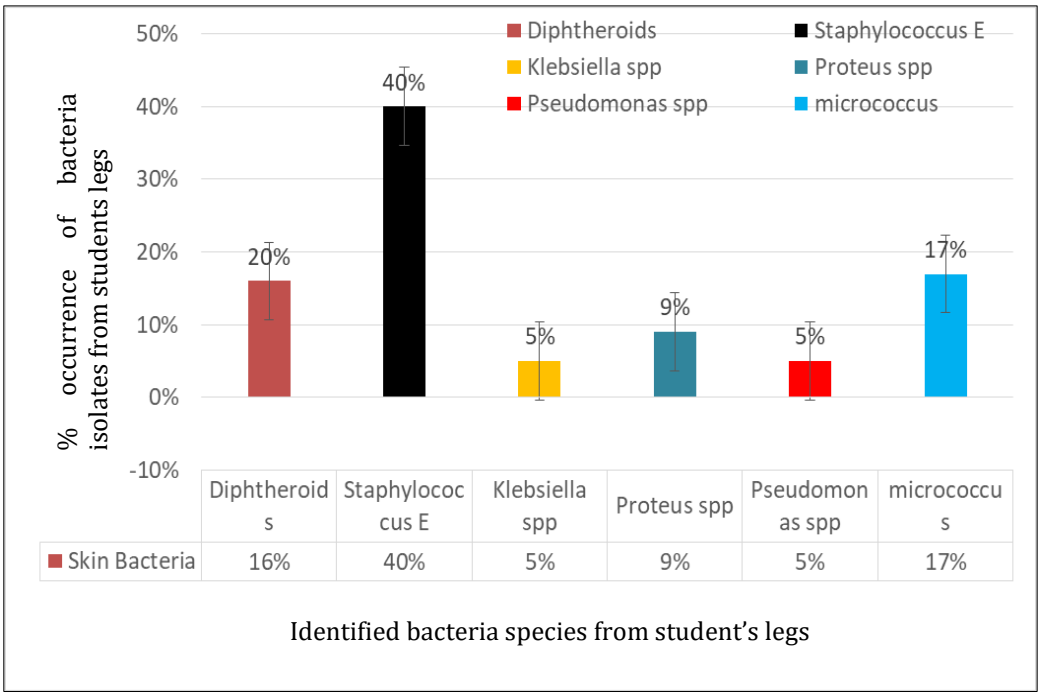


**Figure 3** Frequency of bacteria isolates from students legs

## 4. Discussion

Result from Table 1 shows that three (3) bacteria species; *Staphylococcus aureus, Echerichia coli* and *Micrococcus* were isolated from the face. The calculated percentage frequency shows that *Staphylococcus aureus recorded* 54%, *Echerichia coli* (20%) and *Micrococcus* (26%). This clearly shows that *Staphylococcus aureus* with a frequency isolation of 54% was the most predominant pathogen colonizing the human skin.

**Table 1** Bacterial isolates from the face

| S/no | Organisms | Total isolate | Frequency |
|---|---|---|---|
| 1 | *Staphylococcus aureus* | 25 | 54% |
| 2 | *Echerichia coli* | 9 | 20% |
| 3 | *Micrococcus* | 12 | 26% |
| | TOTAL | 46 | 100% |

Studies carried out by [4] revealed that among other human parts, the face is touched more than any other part, hence more bacterial growth and isolation was recorded from the face than other body areas.

In contrast, the coagulase-positive species *S. aureus* is commonly regarded as a major and dangerous human pathogen, although about one third of the population is colonized non-symptomatically by *S. aureus* and it is correlated with a higher chance of subsequent infection [3].

Result from table 2 shows that *Staphylococcus A* with a frequency of 20%, *Staphylococcus E* (31%), *Klebsiella spp* (8%), *Proteus spp* (11%), *Echerichia coli* (17%) and *Diphtheroids* (13%) were the bacteria species with the respective frequencies isolated from the hand.

**Table 2** Bacterial isolates from the right hands

| S/no | Organisms | Total isolate | Frequency |
|---|---|---|---|
| 1 | *Staphylococcus A* | 17 | 20% |
| 2 | *Staphylococcus E* | 26 | 31% |
| 3 | *Klebsiellaspp* | 7 | 8% |
| 4 | *Proteus spp* | 9 | 11% |
| 5 | *Echerichia coli* | 14 | 17% |
| 6 | *Diphtheroids* | 11 | 13% |
| | TOTAL | 84 | 100% |

The human skin harbors about 1012 microbes which include both commensal as well as pathogenic organisms [11]. Pathogenic organisms from colonised and infected patients can be carried from one patient to another by hand contact with each other and other materials. This could be due to lack of proper infection control measures like hand washing and lack of awareness to proper wash hands after handling materials [12].

Serge [13] carried out a study and recorded high bacterial count in the hands with a cfu range of $1.2x\ 10^2$ to $1.3\ x\ 10^2$ cfc/g. Roth & James [3] stated that hand washing reduces the level of contaminating flora by 2 to 3 log10 and has also proved that proper hand washing reduces the risk of nosocomial infection.

Data from result presented in table 3 shows that a total of six (6) bacterial were isolated from the legs.

The bacteria includes: *Diphtheroids* with a frequency of 16%, *Staphylococcus E* recorded a frequency of 40%, *Klebsiella spp* (5%), *Proteus spp* (9%), *Pseudomonas spp* (3%) and *Micrococcus* (17%). This result is in agreement with previous studies carried out by [14]. It was found that the rate of bacterial contamination of human legs was cumulatively 100%. Microbiological standards and good hygiene practises are necessary for a healthy life, and therefore regular washing of the foot and legs should be encouraged. Although, It is not common, it is necessary to observe practices that suit normal standards of hygiene in any part of our body.

**Table 3** Bacterial isolates from the legs

| S/no | Organisms | Total isolate | Frequency |
|---|---|---|---|
| 1 | Diphtheroids | 9 | 16% |
| 2 | Staphylococcus E | 23 | 40% |
| 3 | Klebsiellaspp | 5 | 5% |
| 4 | Proteus spp | 8 | 9% |
| 5 | Pseudomonas spp | 3 | 5% |
| 6 | *Micrococcus* | 10 | 17% |
| | TOTAL | 58 | 100% |

## 5. Conclusion

This study has demonstrated that various bacteria species are associated with human skin, and constantly being isolated from different parts of the body at different frequencies of occurrence. With *Staphylococcus A* (54%) *Staphylococcus E* (31%) and *Staphylococcus E* (40%) recorded the most frequencies for the face, hand and leg respective. Therefore, proper and regular body hygiene should be observed as these pathogens could cause infectious disease. It is therefore recommended that Proper and regular body hygiene should be done to reduce bacteria load on the skin and also to prevent infectious diseases from these pathogens.

## Compliance with ethical standards

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We wish to acknowledge the permission granted us by the Management of the Biological Science Department, Ignatius Ajuru University of Education, Port Harcourt, Nigeria. to use the Laboratory.

*Disclosure of conflict of interest*

Both researchers state that there is conflict of interest.

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