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Microorganisms associated with Gold Jewelries Worn by Students in the University of Benin, Ugbowo Campus, Nigeria

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Abstract

A total of 50 pieces of gold jewelries (17 necklaces, 17 earrings and 16 hand chains) worn by students in the University of Benin Ugbowo Campus were examined for the presence of bacteria and fungi. The samples were examined microscopically, culturally, morphologically and biochemically using standard microbiological techniques. The microorganisms recovered were Staphylococcus albus, Staphylococcus aureus, Bacillus subtilis, Micrococcus varians, Staphylococcus epidermidis, Streptococcus pyogenes, Proteus vulgaris, Serratia marcescens, Aeromonas sobria, Escherichia coli, Shigella sp., Corynebacterium sp., Bacillus firmus, Bacillus circulans, Rothia sp., Pseudomonas sp. for bacterial isolates and Trichoderma sp., Aspergillus niger, Trichophyton mentagrophytes, Epidermophyton sp., Alternaria sp., Microsporum gypseum, Diplococcium sp., Aspergillus flavus, Geotrichum candidum, and Penicillium sp. for fungal isolates. The mean population counts of bacteria and fungi isolated ranged from 1.07 x 10^5 to 1.61 x 10^5 Cfu/ml and 1.44 x 10^5 to 9.41 x 10^5 Cfu/ml respectively. Staphylococcus albus and Alternaria sp. were the most common encountered bacterial and fungal isolates in all the jewelries examined. This study revealed that human jewelries can habour microorganisms that can cause skin diseases. Therefore, it is important to sanitize the jewelries regularly.

Key words: Jewelries, bacteria, fungi, skin diseases.

Introduction

Jewelry is a form of personal adornment, manifesting itself as brooches, rings, necklaces, earrings and bracelets. Jewelry may be made from any material, usually gemstones, precious metals, beads or shells. Factors affecting the choice of materials include cultural differences and the availability of the materials. Jewelry may be appreciated because of its material properties, its patterns or for meaningful symbols[1].

The first pieces of jewelries were made from natural materials such as bone, animal teeth, shell, wood and carved stone[2]. Some jewelry throughout the ages may have specifically been as an indication of a social group. More exotic jewelry is often for wealthier people, with its rarity increasing its value. Due to its personal nature and its indication of social class, some cultures established traditions of burying the dead with their jewelry[3].

Jewelry is sometimes regarded as a way of showing wealth and might also possess some minimal functionality, such as holding a garment together or keeping hair in place. It has been made to adorn nearly every body parts, from hair pins to toe rings and many more types of jewelry[4]. While traditional jewelry is usually made with gemstones and precious metals such as silver or gold, there is also a growing demand for art jewelry where design and creativity is prized above material value. In addition, there is the less costly costume jewelry, made from lower value materials and often mass produced. Other variations include wire sculpture (wrap) jewelry, using anything from base metal work with rock tumbled stone to precious metals and precious gemstones[1]. Alloys of nearly every metal known have been encountered in jewelry. Bronze for example, was common in Roman times. Modern fine jewelry usually includes gold, white gold, platinum, titanium, or silver. Most American and European gold jewelry is made of an alloy of gold, the purity of which is stated in Karats, indicated by a number followed by the letter K. The silver used in jewelry is usually sterling silver, or 92.5 % fine silver. In costume jewelry, stainless steel findings are sometimes used[3,5].

Jewelry makes intimate contact with the skin or clothing of the person wearing it; as a result they easily get colonized by bacteria and fungi on the skin or clothes of the wearer thus serving as formites. These colonizing organisms can get established on jewelries using glycocalyx and later develop into a biofilm or microbial mat on or around the jewelry[4] causing skin diseases and can penetrate the blood system creating life-threatening diseases particularly in immune-suppressed individuals [6] .

This study therefore aims at isolating microorganisms associated with human jewelries (necklaces, earrings and hand chains) with a view to determining whether the organisms isolated are pathogenic or of normal skin flora.

Material and Methods

Collection of Sample: A total of 50 pieces of gold jewelries (17 necklaces, 17 earrings and 16 hand chains) that have not been washed for over 4 months pre-study were collected from volunteers (Students living within the University of Benin, Ugbowo Campus, Nigeria) and used for the study. Presence of skin rash (if any) was noted. All jewelry samples were collected in a piece of sterile papers, carefully folded, and then placed in an envelope for storage in air-tight containers to await microscopy and cultural analyses.

Microscopy and Culture of Sample: The jewelry samples were aseptically picked with sterile forceps and placed in 10.0 ml of sterile distilled water, shaken vigorously for uniform distribution to make a stock solution; after which they were aseptically removed using sterile forceps. 1.0 ml of the stock solution was serially diluted for up to 10^{-10} and 0.5 ml of the dilution samples was inoculated separately in duplicate plates of nutrient agar and potato dextrose agar using the pour plate method. All media were prepared according to manufacturer's instruction. The nutrient agar plates were incubated at 37^{o}C for 24 H while the potato dextrose agar plates were incubated at room temperature (28 ± 2^{o}C) for 5-7 days. Pure isolates of resulting growth were identified using the Bergey's Manual of Determinative Bacteriology [7] and Cowan and Steel's Manual for the identification of medical bacteria[8].

The fungal isolates were examined macroscopically and microscopically following staining with lactophenol cotton blue wet mount technique [9]. Dermatophytes species were identified by gross and microscopic morphology and by invitro tests, if required [10, 11]. Each fungal isolate was tested for the ability to ferment and / or assimilate different carbon sources. They were also tested for their ability to produce urease, utilize KNO_3 as the sole nitrogen source and grow at 37 ^{o}C.

Results and Discussion

From the investigation of the microorganisms associated with jewelries worn by students in the University of Benin, Ugbowo Campus, the following results were obtained: The mean population counts of bacteria and fungi isolated from the pieces of human jewelries ranged from 1.07 x 10^5 to 1.61 x 10^5 Cfu/ml and 1.44 x 10^5 to 9.41 x 10^5 Cfu/ml respectively (table - 1). A total of twenty six (26) distinct microorganisms were isolated from the different jewelries. Sixteen (16) of the microbial isolates were bacteria while ten (10) of the isolates were fungi (table-2). Of the ten fungal isolates, *Trichophyton mentagrophytes*, *Microsporum gypseum* and *Epidermophyton* sp. were confirmed to be dermatophytes.

Figure-1 shows the summary of the occurrence of bacterial isolates in the different types of jewelries investigated. *Staphylococcus albus* was the most common encountered bacterial isolate in all the three types of jewelries, while *Proteus vulgaris* and *Escherichia coli* were only encountered in hand chains. The occurrence of the 16 bacterial isolates varied slightly with a total of 53 isolates gotten from hand chains and earrings each and 50 isolates from necklaces. *Alternaria* sp. was the most common encountered fungal isolate in all the jewelries examined, while *Microsporum gypseum* was only encountered in necklaces. The occurrence of the 10 fungal isolates varied slightly with a total of 51 isolates gotten from hand chains, 57 isolates from earrings and 54 isolates from necklaces (figure-2).

This study revealed that necklaces, earrings and hand chains (jewelries) worn by students (humans) harbor varieties of bacteria and fungi (dermatophytes and non-dermatophytes). The highest mean bacterial counts were recorded in hand chains with 1.61 x 10^5 Cfu/ml, while the least was recorded in necklaces with 1.07 x 10^5 Cfu/ml. The highest mean fungal counts were recorded in necklaces with 9.41 x 10^5 Cfu/ml, while the least was in earrings with 1.44 x 10^5 Cfu/ml. This result is not at variance with the results obtained in previous studies by Kayode-Isola *et al* [5]., who reported that necklaces and hand chains were more heavily loaded with microorganisms than the other pieces of jewelries they analyzed. This finding may be due to the fact that hand chains and necklaces have tiny openings which can hold some moisture and they make intimate contact with the skin thus harboring more organisms than other jewelries.

The study recovered bacteria, dermatophytes and other skin mycoses from the jewelries and these include; *Staphylococcus albus, Staphylococcus aureus, Bacillus subtilis, Micrococcus varians, Staphylococcus epidermidis, Streptococcus pyogenes, Proteus vulgaris, Serratia marcescens, Aeromonas sobria, Escherichia coli, Shigella* sp., *Corynebacterium* sp., *Bacillus firmus, Bacillus circulans, Rothia* sp., and *Pseudomonas* sp. for bacterial isolates; while fungal isolates were *Trichoderma* sp., *Aspergillus niger, Trichophyton mentagrophytes, Epidermophyton* sp., *Alternaria* sp., *Microsporum gypseum, Diplococcium* sp., *Aspergillus flavus, Geotrichum candidum,* and *Penicillium* sp. This finding is in accordance with the results of Ifesan *et al.* [3] and Kayode- Isola *et al*.[5] that isolated similar bacteria and fungi except the dermatophytes (*Trichophyton mentagrophytes, Microsporum gypseum, and Epidermophyton* sp.) from human jewelries.

The occurrences of the bacteria on the jewelries suggest a relationship with the amount of moisture at the body sites where they are worn. The presence of the *Staphylococci, S. pyogenes, Pseudomonas* sp., *Micrococcus varians, Corynebacterium* sp., is attributable to colonization of the jewelry by skin flora, while the Bacilli, *E. coli, Shigella*, sp., *P. vulgaris, Rothia* sp., *Aeromonas* sp. are likely to be contaminants from environmental sources. They can be shed into food during handling; their presence is significant because they are associated with gastrointestinal tract infections [12] . *S. pyogenes* is capable of causing lesions on skin where prior injuries have occurred. Infant and young children can get infected by

exfolatin-producing *S. aureus* from pieces of Jewelry which they tend to put in the mouth. This can result in scalded skin syndrome, which could be fatal. This mode of transmission above applies to other pathogenic strains of all these organisms isolated resulting to a sequel of diseases [6] .

Furthermore, most of the fungal isolates are the major culprits of dermatophytoses. *Epidermophyton* sp., *Microsporum gypseum* and *Trichophyton mentagrophytes* are the major cause of ringworm (*Tinea corporis, Tinea capitis, Tinea pedis, Tinea unguium*, e.t.c.). These infections could be contagious. They are acquired from active ringworm lesions on humans. The fungus settles on the skin, germinates, and forms a mass of branching hyphae, which grows out radially to produce circular lesions[13]. Pieces of jewelries harbouring these organisms could serve as a vehicle for transmission to immunocompromised patients. *Aspergillus* spp. has been associated with human infection (*A. flavus* is a common cause). Immunocompromised patients exposed to sources contaminated with *Aspergillus* sp. may become colonized and subsequently infected. It may present as allergic bronchopulmonary aspergillosis, necrotizing skin ulcers (in immune compromised patients), endocarditis, post operative infections, Otomycosis, sinus infection, eye infection and so on [14] . *G. candidum i*s a widespread species in soil, water and air. It frequently causes, pulmonary infection but have also been reported to cause bronchial, oral, vaginal, cutaneous and alimentary infection. Infections caused by *Penicillium* spp. due to species other than *P. marneffei* is rare. Superficial infections (Keratitis and Otomycosis) are commonly caused by *Penicillium* spp. *Trichoderma species* are common fungal species usually found in humid soil, decaying wood, and water related sites. They have been linked to several cases of human invasive infection in immunocompromised host [14].

Conclusion

In a nutshell, this study supports suggestions made by other scientists that pieces of jewelry could be colonized by pathogenic microorganisms and can serve as a vehicle of transmission of infectious diseases as earlier suggested by the 14th century Arabian Physician: Ibn al-Khatib that earrings can serve as vehicles of transmission of pathogens [15] . Some of these organisms produce very toxic substances that could be very fatal when ingested. Hence, it is very important to sanitize the jewelry regularly.

References

1. Greenbaum F. and Tom K., Silver Speaks: Traditional Jewelry from the Middle East, *Readers Dig.,* **24(1),** 56 **(2004)**

2. Kunz D. and George F., Magic of Jewels and Charms, *Readers Dig.,* **39**, 401-406 **(1917)**

3. Ifesan B.O., Adetuyi F.C., Onifade A.K. and Agarry O.O., Microorganisms Associated with Human Jewelry, *J. Food, Agric. and Env. Microbiol.,* **2(1),** 14 – 16 **(2004)**

4. Yildirim I., Ceyhan M., Cengiz A.B., Bagdat A., Barin C., Kutluk T. and Gur D., A Prospective Comparative Study of the Relationship Between Different Types of Ring and Microbial Hand Colonization Among Pediatric Intensive Care Unit Nurses, *Int. J. Nurs. Stud.,* **45(11),** 1572 –1576 **(2008)**

5. Kayode-Isola T.M., Eniola K.I.T., Awe S. and Admiju J.A., Sensitivity of bacteria isolated from jewelry to linear alkylbenzene sulfonate, *Nig. J. Microbiol.,* **24(1),** 2193 – 2196 **(2010)**

6. Cogen A.L., Nizet V. and Gallo R.L., Skin Microbiota: A Source of Disease or Defence, *Brit. J. Dermat.,* **158(3),** 442 – 455 **(2008)**

7. Holt J.G., Krieg N.R., Smeath P.H.A., Stanley J.T. and Williams S.T., *Bergey's Manual of Determinative Bacteriology*. (9th edn.), Williams and Williams Company, Baltimore, 783 **(1994)**

8. Barrow G.I. and Feltham R.K.A., *Cowan and Steel's Manual for the Identification of Medical Bacteria*. (3rd edn.), Cambridge University Press, 331 **(1999)**

9. Cheesbrough M., *District Laboratory Practice in Tropical Countries*. Cambridge University Press, 434 **(2002)**

10. Rebell G. and Taplin D., *Dermatophytes: Their Recognition and Identification*. University of Miami Press, Coral Gables, Florida, USA, 355 **(1979)**

11. Frey D., Old-field R.J. and Bridger R.C.A., *Colour Atlas of Pathogenic Fungi*, Wolfe Medical Publications Ltd., London, 450 **(1979)**

12. Grice E.A., Kong H.H. and Conlan S., Topographical and Temporal Diversity of the Human Skin, *Microbiome Sci.*, **324**, 1190 – 1192 **(2009)**

13. Oyeka C.A. and Gugnani H.C., Skin Infection Due to *Hendersonula toruloidea, Scytalidium hyalinum, Fusarium solani* and Dermatophytes in Cement Factory Workers, *J. Med. Mycol.* **2**, 192-201 **(1992)**

14. Bethesda M.D., Epidemiology and Clinical Aspects of Universal Fungal Nosocomial Infection, *J. Infect. Dis.*, **143(3)**, 325 – 345 **(1999)**

15. Syeed I.B., Islamic Medicine: 1000 Years Ahead of its Times, *J. Int. Society History Islamic Med*. **12(2),** 2 – 9 (**2002)**

Table - 1
Mean Population Counts of Bacteria and Fungi Isolated from the Human Jewelries

Jewelry Samples	Bacterial count (Cfu/ml)	Fungal count (Cfu/ml)
Necklaces	1.07×10^5	9.41×10^5
Earrings	1.54×10^5	1.44×10^5
Hand chains	1.61×10^5	3.14×10^5

Table - 2
Microorganisms Isolated from the Pieces of Human Jewelries

Bacteria	Fungi
Staphylococcus albus *Staphylococcus aureus*	*Trichoderma* sp. *Aspergillus niger*
Bacillus subtilis *Micrococcus varians*	*Trichophyton mentagrophytes** *Epidermophyton* sp.*
Staphylococcus epidermidis	*Alternaria* sp.
Streptococcus pyogenes	*Microsporum gypseum**
Proteus vulgaris	*Diplococcium* sp.
Serratia marcescens	*Aspergillus flavus*
Aeromonas sobria	*Geotrichum candidum*
Escherichia coli	*Penicillium* sp.
Shigella sp.	-
Corynebacterium sp.	-
Bacillus firmus	-
Bacillus circulans	-
Rothia sp.	-
Pseudomonas sp.	-

***= Dermatophytes**

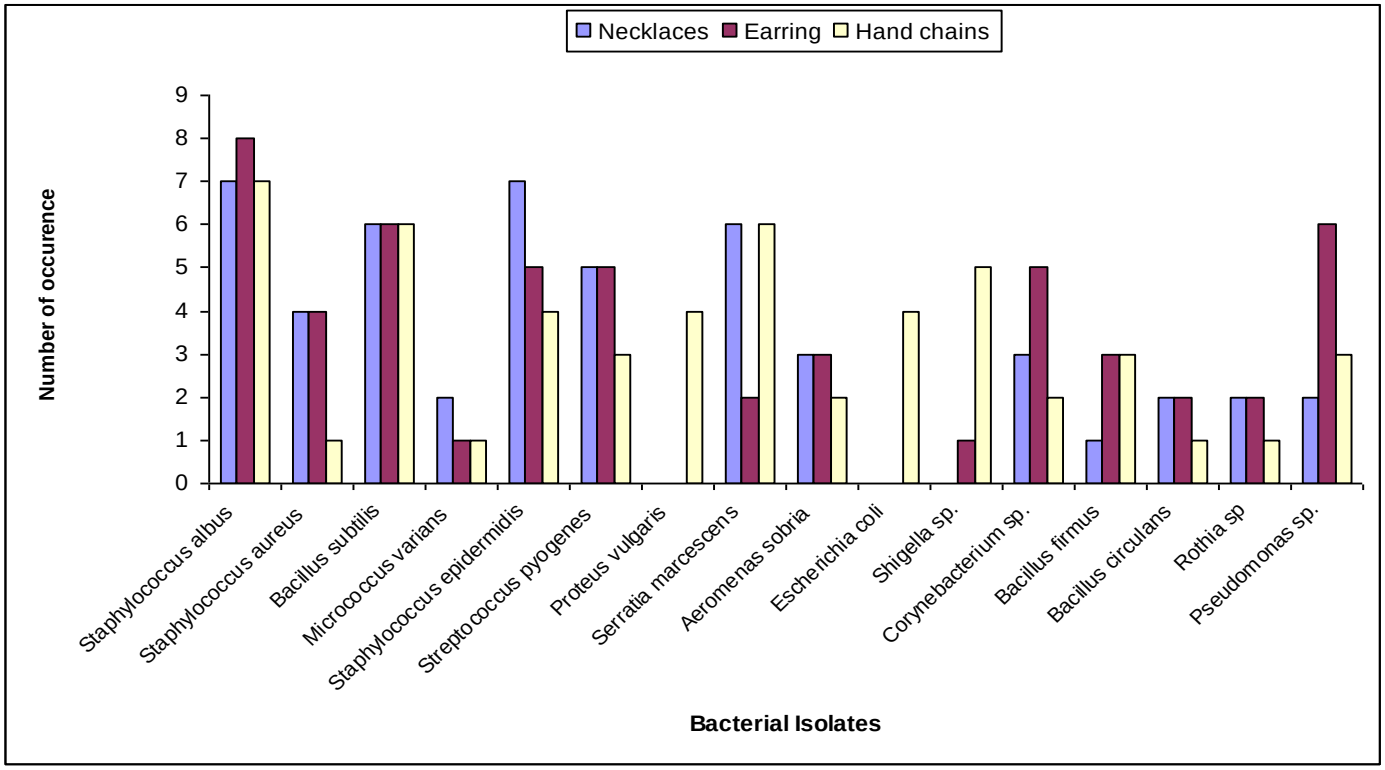

Figure – 1
Occurrence of bacterial isolates in different types of jewelries

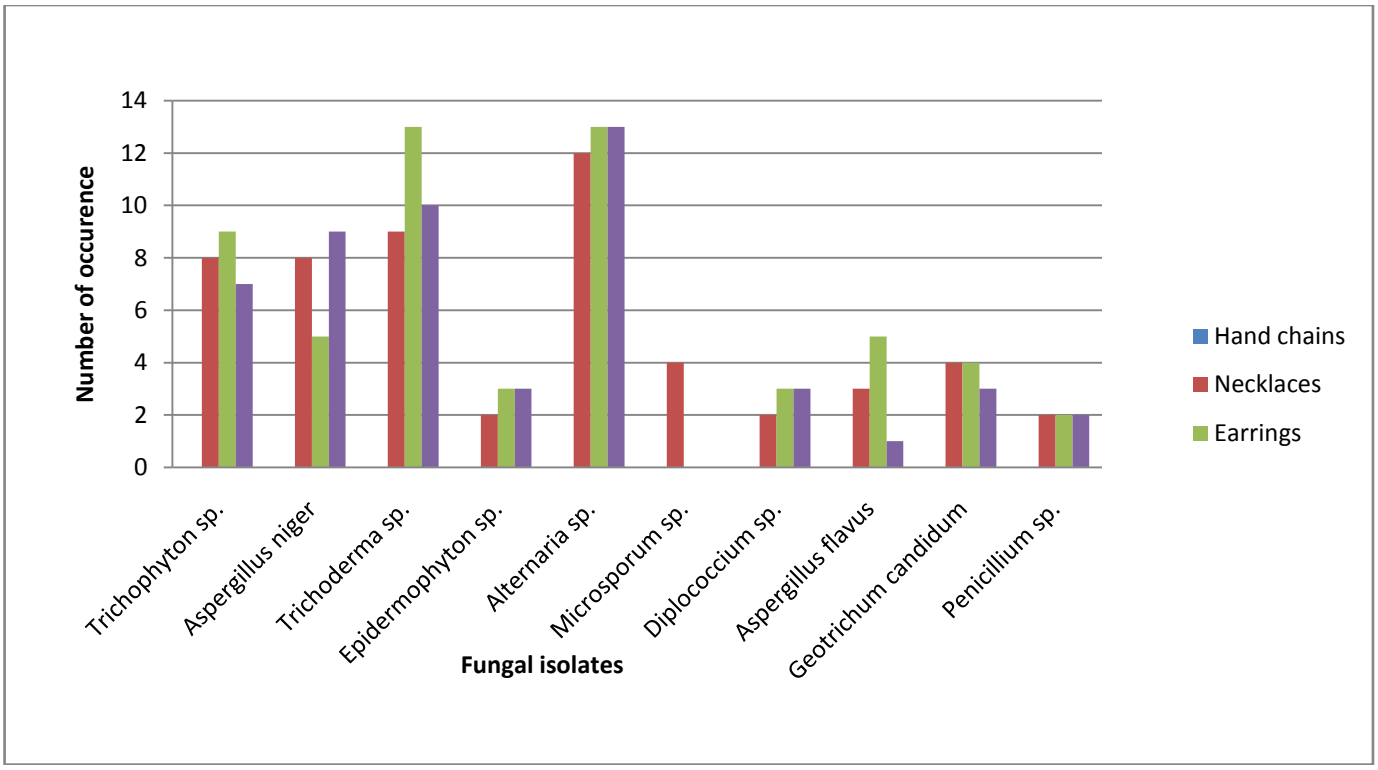

Figure – 2
Occurrence of fungal isolates in different types of jewelries