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Original Research Article

Evaluation of Bacteria Species Associated with the Skin and Oral Surface of Different Occupational Groups

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Abstract: The normal human skin is colonized by huge numbers of bacteria that live as commensals on its surface. At times bacteria not normally found there may colonize the epidermis and lead rapidly to disease. The oral cavity is comprised of many surfaces, each coated with a plethora of bacteria, the proverbial bacterial biofilm. Some of these bacteria have been implicated in oral diseases such as caries and periodontitis, which are among the most common bacterial infections in humans. In addition, specific oral bacterial species have been implicated in several systemic diseases, such as bacterial endocarditis, aspiration pneumonia, osteomyelitis in children, preterm low birth weight, and cardiovascular disease. The aim of this study is to evaluate the bacteria species associated with the skin and orals of different occupational groups in Ekpoma. This study was carried out in the Ekpoma, Esan West Local Government Area of Edo State. Participants were selected from the list of five (5) different occupational groups (Students, Office workers, Bike riders, Food handlers and Brick layers) in Ekpoma. Informed consent was sought from the various individuals. A total of one hundred (100) samples were collected from different occupational groups in the study area. The sample analysis was carried out using standard methods. Results obtained showed the rate of bacterial isolates from the skin and orals of the occupational groups studied is 63% and 43% respectively. Out of the 20 samples collected from the skin of each occupations, 9(45%) were positive for students, 16(80%) were for bike riders, 8(40%) for office workers, 17(85%) were for food handlers and 13(33%) for bricklayers. Food handlers appeared to be the occupation with the highest bacterial isolates on the skin followed by bike riders, bricklayers, students and office workers being the least. While out of the 20 samples collected from the mouth of each occupations, 7(35%) were positive for students, 11(55%) were for bike riders, 4(20%) for office workers, 12(60%) were for food handlers and 9(45%) for bricklayers. Office workers the highest bacteria isolates in the mouth followed by bike riders, food handlers and students been the least. In order to meet the huge challenge of occupational safety in the 21st century, a coordinative and cooperative approach is required. This will be a major task of the public health community and will require the use of new methods of identifying, monitoring and assessing of skin and oral infections, including the wide application of the hazard analysis and critical control point system.

Keywords: Skin, Oral, Bacteria, Occupational, Infections.

INTRODUCTION

The normal human skin is colonized by huge numbers of bacteria that live as commensals on its surface (Hay and Adriaans, 2004). At times bacteria not normally found there may colonize the epidermis and lead rapidly to disease. Apart from these pathogenic organisms, a wide range of bacteria land fortuitously on the skin, but are unable to multiply. Organisms not normally considered as skin flora may sometimes colonize it. When the skin is inflamed or abnormal, it is often difficult to determine whether an organism isolated is causing or contributing to the observed pathology. If the skin is damaged or the immune status of the subject impaired, bacteria usually regarded as non-pathogenic in body surface may assume the role of opportunist pathogens. Within a given species, there are also strain differences in virulence (Hay and Adriaans, 2004).

The oral cavity is comprised of many surfaces, each coated with a plethora of bacteria, the proverbial bacterial biofilm. Some of these bacteria have been implicated in oral diseases such as caries and periodontitis, which are among the most common bacterial infections in humans. In addition, specific oral bacterial species have been implicated in several systemic diseases, such as bacterial endocarditis, aspiration pneumonia, osteomyelitis in children, preterm low birth weight, and cardiovascular disease. Surprisingly, little is known about the microflora of the healthy oral cavity.

Microbes found on the skin are usually regarded as pathogens, potential pathogens or innocuous symbiotic organisms. Advances in microbiology and immunology are revising our understanding of the molecular mechanisms of microbial virulence and the specific events involved in the host–microbe interaction. Current data contradict some historical classifications of cutaneous microbiota and suggest that these organisms may protect the host, defining them not as simple symbiotic microbes but rather as mutualistic. This review will summarize current information on bacterial skin flora including *Staphylococcus*, *Corynebacterium*, *Propioni-bacterium*, *Streptococcus* and *Pseudomonas*. In the oral cavity, indigenous bacteria are often associated with the etiology of two major oral diseases, which are endemic in industrialized societies and are increasing in developing countries (Van Houte, 1994). Oral diseases seem to appear after an inbalance among the indigenous microbiota, leading to the emergence of potentially pathogenic bacteria. To define the process involved in caries and periodontal diseases, it is necessary to understand the ecology of the oral cavity and to identify the factors responsible for the transition of the oral microbiota from a commensal to a pathogenic relationship with the host.

Some strains have a particular tendency to cause disease, perhaps due to greater adherence to epithelial cells or enzyme production (Hay and Adriaans, 2004). There are some studies investigating skin flora on healthy and ill population to find out any possible relation between disease and microbial flora of skin (Zell *et al.*, 2008). In this study, we studied the species of bacterial colonization on the skin of the different occupational groups (Berlau *et al.*, 1999). Specifically, this review will discuss our current understanding of the cutaneous microbiota as well as shifting paradigms in the interpretation of the roles microbes play in skin and oral health and disease.

MATERIALS AND METHODS

This study was carried out in the Ekpoma, Esan West Local Government Area of Edo State. Ekpoma is a semi- urban town with the major occupation of farming, trading, civil servants and students. The samples were examined in the Research Diagnostic Laboratory, of the Department of Medical Laboratory Science, College of Basic Medical Sciences, Ambrose Alli University, Ekpoma, Edo State. Informed consent was sought from the various individuals before collection.

This study was a descriptive/ analytical study. It was designed to evaluate the bacteria species associated with the skin and orals of the different occupational groups stated in Ekpoma, Edo State. One hundred subjects were selected with 20 each from the different occupational groups (Office workers, students, bricklayers, food handlers and bike riders). Specimens such as skin and mouth swab was collected and analyzed in the laboratory using standard methods. Results are presented in tables.

Study Population

Participants were selected from the list of five (5) different occupational groups (Students, Office workers, Bike riders, Food handlers and Brick layers) in Ekpoma.

Students include students of Ambrose Alli University and residing in Ekpoma and its environs. Office workers include those working in the banks, hospitals, lecturers and other corporate firms in Ekpoma and environs.

Bike riders include motorcycle riders, both public and private riders in Ekpoma and environs. Food Handlers include restaurants and fast food business centres in Ekpoma and its environs.

Brick layers includes those builders and moulders in Ekpoma and environs involved in building and moulding different blocks and structures in Ekpoma.

Sample Size: A total of one hundred (100) samples were collected from different occupational groups in Ekpoma, Edo State. The sample size (N) shall be calculated from the formula below using prevalence from previous studies (Ekejindu *et al.*, 2002).

Research Design

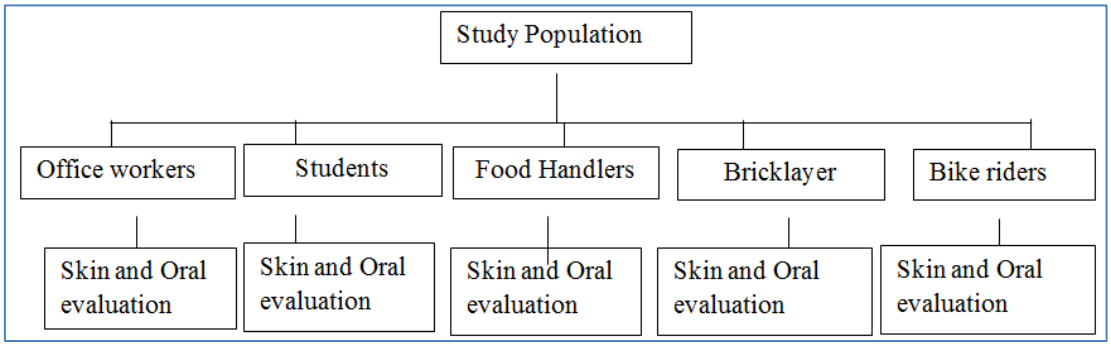

Fig-1: Research Design Chart

Sample Collection

One hundred subjects were enrolled for this study without skin and oral infections with 20 samples from each occupational group. Samples were taken by cotton swab from skin (arm and forearm) and mouth (gum and teeth) of the different occupational groups. Swabs were cultured on Nutrient agar and Blood agar and incubated at 37°C. Moreover, different tests were applied; catalase test, Oxidase test, Indole test and coagulase test. Microorganisms were recognized on the basis of macroscopic, microscopic and differential tests.

Sample Analysis/Methods

The sample analysis was carried out in the Research Diagnostic Laboratory, of the Department of Medical Laboratory Science, College of Medicine, Ambrose Alli University, Ekpoma, Edo State by bacteriological examination.

Bacteriological Examination

The skin swab stick was inoculated on each plate of Nutrient and Blood agar by making a primary inoculum on a small area of the agar plate and then streaked out. The inoculated media was incubated aerobically at 37^{o}C for 24 hours. Identification of bacteria was done by carrying out biochemical tests (Cheesbrough, 2006).

The results was analysed statistically. The mean values of each product were determined against the different parameters. Analysis of variance was used to determine any significant difference between the products. The least significance (LSD) was used to compare the means of any significance difference (Spiegel, 2005).

RESULTS

Table 1 presents the socio-demographic profile of the different occupational groups Ekpoma. The results showed that, 60% of participants are male while 40% are females. 6% of the participants are between the age 16-20 years, 30% within 21-25 years, 29% within 26-30 years and 35% above 30 years. Based on religion, 71% of the participants are Christians, 29% are Muslims while none reported for traditional and others. While 38% of participants are married and 62% are single. However, there were no divorced, separated or widowed participants in this study. Based on educational status, 30% are graduate or undergraduate, 12% are primary school students, 38% are secondary school students while 20% had no formal education. Concerning the place of residence, participants who reside in urban areas are 10%, 28% reside in semi-urban and 62% reside in the rural areas. Also, none of the participants reside in duplex, 10% in bungalow, 25% in block of flat, 37% in room in general compound and 28% reside in native compound. Concerning the financial status of the family, none of the participants had high (₦ 200,000-500,000) financial status, 20% live on moderate (₦ 50,000-150,000) financial income and 80% live on low (₦1,000-5,000) financial income.

Table 2 presents the response on the knowledge of skin and oral diseases. The results showed that 52% of the respondents know that bacteria can reside on oral surfaces, 33% do not know that bacteria resides on oral surfaces and 15% are not sure that bacteria resides on oral surfaces. On knowledge of skin diseases, 35% of the respondents have knowledge of skin disease, 49% do not have knowledge of skin disease and 16% are not sure about their knowledge of skin diseases. On the type of tooth brush use, 32% use hard tooth brush and 68% use soft tooth brush. On the type of tooth paste use, 25% use herbal tooth paste while 75% use non-herbal tooth paste. Also, on the knowledge on the risk with bacteria invasion, 32% of the respondents have knowledge on the risk with bacteria invasion, 50% do not have knowledge on the risk with bacteria invasion and 18% are not sure.

Table-1: Socio-Demographic Characteristics of the different occupational groups in Ekpoma

Variables	Categories	No. Encountered	Percentage (%)
Sex	Male	60	60
	Female	40	40
	Total	100	100
Age	16 – 20	06	06
	21-25	30	30
	26-30	29	29
	Above 30	35	35
	Total	100	100
Religion	Christian	71	71
	Muslim	29	29
	Traditional	00	0
	Others	00	0
	Total	100	100
Marital Status	Married	38	38
	Single	62	62
	Divorced	00	0
	Separated	00	0
	Widowed	00	0
	Total	100	100
Educational Status	Graduate	30	30
	Primary	12	12
	Secondary school	38	38
	No formal education	20	20
	Total	100	100
Place of Residence	Urban	10	10
	Semi urban	28	28
	Rural	62	62
	Total	50	100
Nature of Residence	Duplex	0	0
	Bungalow	10	10
	Block of Flat	25	25
	Native Compound	28	28
	Room in Compound	37	37
	Total	100	100
Financial Status of the Family	High (₦ 200,000-500,000)	0	0
	Moderate (₦ 50,000-150,000)	20	20
	Low (₦1,000-5,000)	80	80
	Total	100	100

Table-2: Knowledge of Skin and Oral Diseases

Knowledge	Response	No Encountered	Percentage (%)
Do you know bacteria can resides on oral surfaces	YES	52	52
	NO	33	33
	NOT SURE	15	15
	Total	100	100
Do you have knowledge of skin disease	YES	35	35
	NO	49	49
	NOT SURE	16	16
	Total	100	100
What type of tooth brush do you use?	HARD	32	32
	SOFT	68	68
	Total	100	100
What type of toothpaste do you use?	HERBAL	25	25
	NON-HERBAL	75	75
	Total	100	100
What type of bathing soap do you use?	MEDICATED	53	53
	NON-MEDICATED	17	17
	LOCAL SOAP	30	30
	Total	100	100
Do you have knowledge on the risk as with bacteria invasion	YES	32	32
	NO	50	50
	NOT SURE	18	18
	Total	100	100

Table 3 presents the personal hygiene practice of the respondents in the study. 40% of the respondents agreed that they take their bath once a day, 52% agreed they take their bath twice a day and 8% take their bath thrice a day. 40% of the respondents agreed that they brush their teeth once a day, 55% brush their teeth twice a day and 5% brush their teeth thrice a day. On how often respondents change their tooth brush, 4% of the respondents agreed that they change their tooth brush daily, 46% change their tooth brush monthly, 15% change their tooth brush yearly and 35% change their tooth brush quite often but not specific. On how often respondents' change their bathing sponge, 11% of the respondents agreed that they change their bathing sponge monthly, 29% change their bathing sponge yearly, 60% change their bathing sponge quite often but not specific and none changes their bathing sponge daily.

Table 4 and 5 shows the total number and percentage of positive samples isolated from the skin and the mouth; with Food handlers being the occupation with the highest bacterial isolates on the skin followed bike riders. While the bacterial isolated from the mouth, food handlers was the highest followed by bike riders, they were not statistically significant ($p>0.05$). These are illustrated in the tables below.

Table 6 and 7 shows the distribution of isolates according to occupation for both the Skin and the mouth, they were not statistically significant ($p>0.05$). Table 8 and 9 shows the distribution of the bacteria isolated from each occupational group for both the Skin and the Mouth.

Table 10 and 11 shows the Mean±SD of the bacteria isolated from each occupational group for both the Skin and the Mouth and they were not statistically significant ($p>0.05$).

Table 12 shows the similar bacteria species present in both the skin and the mouth of the different occupational groups enrolled in this study, with *Neisseria* spp., *Lactobacillus* and *S. aureus* found to be present in both the skin and mouth of the respondents.

Table-3: Personal Hygiene Practices

Personal hygiene	Response	No encountered	Percentage (%)
How many times do you take your bath daily	ONCE	40	40
	TWICE	52	52
	THRICE	08	08
	OTHERS	00	00
	Total	100	100
How many times do you brush your mouth daily	ONCE	40	40
	TWICE	55	55
	THRICE	05	05
	OTHERS	00	00
	Total	100	100
How often do you change your tooth brush?	EVERYDAY	04	04
	EVERY MONTH	46	46
	EVERY-YEAR	15	15
	OTHERS	35	35
	Total	100	100
How often do you change your bathing sponge	EVERYDAY	00	00
	EVERY MONTH	11	11
	EVERY-YEAR	29	29
	OTHERS	60	60
	Total	100	100

Table-4: Total number and percentage of the various occupational groups that bacterial were isolated from their skin.

Occupation	Total No. of Sample	No. of Positive Sample (%)	X^2	p-value
Student	20	9(45)	0.999	>0.05
Bike riders	20	16(80)	1.0	>0.05
Office workers	20	8(40)	0.996	>0.05
Food handlers	20	17(85)	1.0	>0.05
Bricklayers	20	13(33)	0.963	>0.05
Total	**100**	**63(63)**		

Key: $p<0.05$=Significant; $p>0.05$= Not significant

Table-5: Total number and percentage of the various occupational groups that bacterial were isolated from their mouth.

Occupation	Total No. of Sample	No. of Positive Sample (%)	X^2	p-value
Student	20	7(35)	0.980	>0.05
Bike riders	20	11(55)	0.999	>0.05
Office workers	20	4(20)	0.458	>0.05
Food handlers	20	12(60)	0.999	>0.05
Bricklayers	20	9(45)	0.999	>0.05
Total	**100**	**43(43)**		

Table-6: Number positives samples and negative samples isolated from the Skin.

Occupation	Total No. of Sample	Positive Sample (%)	Negative Sample (%)	X^2	p-value
Student	20	9(45)	11(55)	1.998	>0.05
Bike riders	20	16(80)	4(20)	1.458	>0.05
Office workers	20	8(40)	12(60)	1.995	>0.05
Food handlers	20	17(85)	3(15)	1.172	>0.05
Bricklayers	20	13(65)	7(35)	1.943	>0.05
Total	**100**	**63(63)**	**37(37)**		

Table-7: Number of positives samples and negative samples isolated from the mouth.

Occupation	Total No. of Sample	Positive Sample (%)	Negative Sample (%)	X^2	p-value
Student	20	7(35)	13(65)	1.979	>0.05
Bike riders	20	11(55)	9(45)	1.998	>0.05
Office workers	20	4(20)	16(80)	1.458	>0.05
Food handlers	20	12(60)	8(40)	1.996	>0.05
Bricklayers	20	9(45)	11(55)	1.998	>0.05
Total	**100**	**43(43)**	**57(57)**		

Table-8: Distribution of bacteria isolates according to occupation of respondents (Skin)

Parameters	Student	Bike riders	Office workers	Food handlers	Bricklayers
S. epidermidis	5	9	4	4	3
Corynebacterium	-	5	1	-	4
Baumanni acinobacter	-	2	-	-	-
S. aureus	4	-	2	6	2
Lactobacilli	-	-	-	1	-
Micrococci spp.	-	-	-	6	4
Neisseria spp.	-	-	1	-	-
Total	**9**	**16**	**8**	**17**	**13**

Table-9: Distribution of bacteria isolates according to occupation of respondents (mouth)

Parameters	Students	Bike riders	Office workers	Food handlers	Bricklayers
Eubacteria	1	5	1	3	3
Actinomyces	4	6	1	4	3
Lactobacilli	-	-	1	-	-
S. aureus	2	-	-	3	2
Strep. spp	-	-	-	2	-
Neisseria spp.	-	-	1	-	1
Total	**7**	**11**	**4**	**12**	**9**

Table-10: Mean±SD of bacteria isolates according to occupation of respondents (Skin).

Parameters	Mean±SD	P-value
Student	1.3±2.21	>0.05
Bike riders	2.3±3.49	>0.05
Office workers	1.1±1.46	>0.05
Food handlers	2.4±2.75	>0.05
Bricklayers	1.9±1.85	>0.05

Table-11: Mean±SD of bacteria isolates according to occupation of respondents (Mouth).

Parameters	Mean±SD	p-value
Students	1.2±1.60	>0.05
Bike riders	1.8±2.86	>0.05
Office workers	0.7±0.52	>0.05
Food handlers	2.0±1.67	>0.05
Bricklayers	1.5±1.38	>0.05

Table-12: Showing the similar bacteria species present in both the skin and the mouth of the different occupational groups enrolled in this study.

Bacteria isolates	Skin	Mouth
S. aureus	+	+
Lactobacilli	+	+
Corynebacterium	+	-
Micrococci spp.	+	-
Strep. Spp	-	+
S. epidermidis	+	-
Baumanni acinetobacter	+	-
Neisseria spp.	+	+
Actinomyces	-	+
Eubacterium	-	+

Keys: + = Present; - = Absent

DISCUSSION

The study provides the assessment of microbiological examination of skin swab and mouth swab for bacteria species associated with the skin of different occupational groups in Ekpoma, Edo State. From the results obtained, it showed the rate of bacterial isolates from the skin and the of various occupational groups for the population under study is 63% and 43% respectively which is similar to those of several previous studies by (Berlau *et al.*, 1999; Oluwadiya, 2004; Ogaraku and Onovo, 2007). Out of the 20 samples collected from the skin of each occupations, 9(45%) were positive for students, 16(80%) were for bike riders, 8(40%) for office workers, 17(85%) were for food handlers and 13(33%) for bricklayers. Food handlers appeared to be the occupation with the highest bacterial isolates on the skin followed by bike riders, bricklayers, students and office workers being the least. While out of the 20 samples collected from the mouth of each occupations, 7(35%) were positive for students, 11(55%) were for bike riders, 4(20%) for office workers, 12(60%) were for food handlers and 9(45%) for bricklayers. Food handlers also appeared to be the occupation with the highest bacterial isolates in the mouth, followed by bike riders, bricklayers, students and office workers being the least. The distribution of isolates according to occupation and the mean±SD of the bacteria isolated from the skin of each occupational group were 1.3±2.21 for students, 2.3±3.49 for bike riders, 1.1±1.46 for office workers, 2.4±2.75 for Food handlers and 1.9±1.85 for bricklayers. While the distribution of isolates according to occupation and the mean±SD of the bacteria isolated from the mouth of each occupational groups were 1.2±1.60 for students, 1.8±2.86 for bike riders, 0.7±0.52 for office workers, 2.0±1.67 for Food handlers and 1.5±1.38 for bricklayers. Also its was shown that *S. aureus*, *Lactobacillus* and *Neisseria* spp. were the bacteria isolated from both the Skin and the Mouth for all the occupational groups.

CONCLUSION

In order to meet the huge challenge of occupational safety in the 21st century, a coordinative and cooperative approach is required. This will be a major task of the public health community and will require the use of new methods of identifying, monitoring and assessing of skin and oral infections, including the wide application of the hazard analysis and critical control point system. Both traditional and new technologies for occupational safety should be improved and fully exploited. This needs to be done through public/private partnership, legislative measures where suitable but much greater reliance will have to be placed on voluntary compliance and on education of the different occupational safety tips and care. Establishments should ensure compulsory and proper treatment of staff with active illness. In a view to maintain good health, different occupations skin care methods should be adhered to. Establishments should train and re-train staff in good hygienic practices. Any behaviour that could result in the distorting the skin should be prevented.

Conflict of interest

The authors declare no conflicts of interest. The authors alone are responsible for the content and the writing of the paper.

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