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Bacterial Contamination of Medicated Glasses amongst Staff and Students of Michael Okpara University of Agriculture Umudike, Nigeria

Osaro-Matthew, Ruth Chiamaka
Assistant Lecturer, Department of Microbiology, College of Natural Science,
Michaeal Okpara University of Agriculture Umudike, Nigeria
Okorie, Pelagie. I.
Graduate Assistant, Department of Microbiology, College of Natural Science,
Michaeal Okpara University of Agriculture Umudike, Nigeria
Ohabasirim, Nancy. A.
Graduate Student, Department of Microbiology, College of Natural Science,
Michaeal Okpara University of Agriculture Umudike, Nigeria

Abstract:
Bacterial contamination of medicated eye glasses worn by members of the University community (Michael Okpara University of Agriculture, Umudike) Abia State, Nigeria was investigated. Of the one hundred and six samples screened [Handles (n=53), Lenses (n=53)] during the period of the research, ninety-nine (93.40%) were contaminated with bacteria. Escherichia coli(51.89%) was the most prevalent, followed by Staphylococcus aureus (28.30%) and Streptococcus species (16.98%), Pseudomonas aeruginosa (13.21%) and Bacillus species (13.21%) were equivalent, and Coagulase negative Staphylococcus (9.43%),while Klebsiella species(1.89%) were the least. Sex significantly affected the level of eye glass contamination in the sense that, eye glasses used by male were more contaminated (52.83%) than their female counterparts (26.42%). Workers had more contaminated eye glasses (47.17%) than students (32.08%). Handles were more contaminated (94.34%) than the lenses (92.45%) and this could be due to frequent contact of the handles with human hands, which are mostly contaminated and non-sanitized. The eye glass cleaners or disinfectants were not able to inhibit bacteria isolated from the eye glasses while antibiotics where able to inhibit the various bacteria isolated from the glasses.

Keywords: *Bacteria, Eyeglasses, lens cleaner, antibiotics sensitivity*

1. Introduction

Microorganisms are ubiquitous and they form major part of our environment. Some of these microorganisms are friendly in the sense that they are used in food industries in fermentation or as probiotics (Prescott *et al*., 2006). Furthermore, most of them are our foes or are harmful to the environment because they cause several diseases and spoilage of food. Ultimately, we are unknowingly exposed to microorganisms in our daily activities, whether in the supermarkets, comfort of our homes, banks or even in our offices. Consequently, there are various items which are used on regular basis that are rarely sanitized or kept clean and thus this gives rise to likely growth and colonization of these items by microorganisms.

Essentially, glasses, also referred to as eyeglasses/spectacles are frames bearing lenses worn in front of the eyes used for vision correction. Thus, glass handle/frame is the part of a pair of glasses which is designed to hold the lenses in proper position. Glass handles/frames come in a variety of styles, sizes, materials, shapes, and colors.A lens on the other hand is substance made of glass which focuses or defocuses the light that passes through it. It is made up of one or two curved surfaces; shaped and used as an optical instrument (Stern, 1998, Eisenhart, 1985). Nowadays, different individuals use eye glasses/lenses (spectacles) either for beautification/mark of fashion or for enhancing their sight capacity (Nwaugo *et al.,* 2007). Prevalently, contact lenses (without frames)are more in direct medical purposes as well.Various microorganisms, especially bacterial species have been recorded to colonize these lenses and these include: *Pseudomonas* species*,* various species of *Staphylococcus, Citrobacter* and *Aeromonas* (Umer *et al.,* 2012: Wilcox, 2007).

There are different types of eye infections attributed to Bacteria agents and this is quite concerning, because these bacteria are introduced on the spectacles through contacts with hands and other forms.Based on the extensive literature review conducted in the course of this study, it was ascertained that no work has been conducted to isolate bacteria from medicated glasses in Nigeria, but a similar work has been conducted by (Nwaugo *et al.,* 2007) where they isolated fungi from eye lenses and frames of optometry patients

at Abia State University, Uturu Nigeria. The primary aim of this research work is to examine the bacterial contamination of medicated eyeglasses/ lenses used by staff and students of Michael Okpara University of Agriculture, Umudike (MOUAU), Abia State, Nigeria.

2. Materials and Methods

2.1. Study Area

The study was carried out in Michael Okpara University of Agriculture, originally the Federal University of Agriculture Umudike, about 10 kilometres from Umuahia (capital of Abia State).

2.2. Collection of Samples

A total of 106 samples (one hundred and six) were collected, i.e.[frames(n=53) and handles (n=53)] of medicated eye glasses from members of MOUAU(Michael Okpara University of Agricultural Umudike) community ranging from students to workers who use medicated eye glasses lenses in the University.

2.3. Sample Preparation

The spectacles (eyeglasses) were swabbed at two points (lenses and handles/frames) using a sterile cotton tipped applicator (swab stick), moistened with sterile normal saline.The swab sticks containing the samples were covered aseptically and inserted in a plastic bag and then taken to the laboratory for examination.

2.4. Isolation and Identification of Organism

The culture media used includes; Blood agar, MacConkey agar and manitol salt agar, they were prepared according to manufacturer's standard. The specimens collected were inoculated on the prepared agar using the streak plate method and incubated for 24 hours at 37^0C. The isolates were firstly differentiated by macroscopic examination. Several biochemical tests were carried out to differentiate the colonies, and these includes. Motility, Indole, Urease (MIU) catalase test, coagulase test, citrate test, triple Sugar Iron test and oxidase Test. The bacteria isolates were differentiated according to their various Gram reaction (Gram positive and Gram negative) using Gram staining reagent and method (Cheesbrough, 2006).

2.5. Antibiotic Susceptibility Testing

The antibiotic susceptibility of the isolates was tested against the following antibiotics, namely; ofloxacin, Peflacin, Ceftriazone, Augumentin, Gentamicin, ceporex, Septrin, etc. Using Kirby Bauer antibiotics disc method. A colony of the test organism was picked with a sterile wire loop and immersed in peptone water. The turbidity of the suspension was compared against a reference 0.5 macfarland tube. The suspension of the organism was streaked on the entire plate of nutrient agar and the antibiotic disc was placed on the plate using a sterile forcep. The plates were incubated at 37^0C for 24 hours, the diameter of the zone of inhibition was measured using CLSI standard guidelines (Cheesebrough, 2006)

2.6. Determination of Antimicrobial Assay of Lens Cleaners

Different lens cleaner used by the individuals were bought from different pharmacy shops and were used to carry out antimicrobial susceptibility tests against various bacteria isolates.

The cloth-like material found in lens casein were aseptically sliced and placed on a subculture containing pure cultures of the isolated bacteria and was incubated for 24 hours at 37^0C. Different lens cleaning solutions were also tested against the isolated bacteria using disc method. Filter papers were perforated aseptically using a perforator. 0.1ml each of the liquid lens cleaners were dropped on each disc (perforated filter paper) and then placed on the culture plates containing the organisms. The plates were incubated for 24 hours at 37^0C. After 24 hours, the plates were observed for zone of inhibition.

3. Results and Discussion

3.1. Results

The biochemical identification of different bacterial isolates from the glass lenses and handles with their various Gram reactions shows that the isolates includes *Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella* species*,Bacillus* species*, Streptococcus* species*, and* Coagulase negative *Staphylococcus* as represented in table 1

Table 2 shows the prevalence of bacterial contamination according to sex and occupation. There was a greater prevalence in males (52.83%) than in females (26.42%) and also the workers eyeglasses (47.17%) were more contaminated with (32.08%) than the students.

The Frequency of bacterial contamination on lenses and handles shows that *Escherichia coli* (51.89%) and *Staphylococcus aureus* (28.30%) were more prevalent in the lens and handles, while *Klebsiella* species (1.89%)were the least prevalent as shown in table 3.

Table 4 shows the degree of bacterial contamination on the lenses and handles

The Antimicrobial susceptibility tests of the bacterial isolates described that *E. coli was* sensitive to most of the antibiotics, followed by coagulase negative *Staphylococcus aureus,* while *Staphylococcus aureus* was the least susceptible in table 5.

Table 6 represents the antimicrobial susceptibility test carried out using various eyeglass cleaners/ disinfectants against the bacterial isolates.

	Isolates	Gram Reactions	Cat	Coagulase	TSI	Lactose	Motility	Indole	Urease	Citrate	H_2S	Oxi	Gas
1	*E. coli*	-	-	N/A	A/A	+	+	+	-	-	+	-	+
2	*S. aureus*	+	+	+	A/A	-	-	-	-	N/A	-	-	-
3	*Streptococcus* species	+	-	-	K/A	-	-	-	N/A slow +	N/A	-	N/A	-
4	*Klebsiella* species	-	-	N/A	A/A	+	-	-	-	-	-	-	+
5	*Bacillus* species	+	-	N/A	A/A	-	-	-	N/A	-	-	-	-
6	*Pseudomonas* species	-	-	N/A	K/NC	+	+	N/A	-	N/A	-	-	-
7	Coagulase negative *Staphylococcus*	+	+	-	-	-	-	-	-	N/A	-	-	-

Table 1: Identification and Characterization of Isolates

KEY:

- N/A = not applicable
- A/A =acid/acid
- \+ = positive
- \- = negative
- Cat = catalase
- H_2S = Hydrogen sulphide
- Oxi =oxidase
- NC = No change
- K =alkaline
- TSI =Tipplesugar ion

Variables	Parameters	No Screened	Number Infected	
			Handle %	Lens %
Sex	Male	30	28(52.83%)	27(50.94%)
	Female	25	14(26.42%)	12(22.64%)
	Total	53	42(79.25%)	39(73.58%)
Occupation	Students	25	17(32.08%)	16(30.19%)
	Workers	28	25(47.17%)	23(43.40%)
	Total	53	42(79.25%)	39(73.58%)

Table 2: Prevalence According to Sex

Gram Reaction	Isolates	Lens(%)	Handle (%)	Total(%)
NEGATIVE	*E. Coli* *Klebsiella* species *Pseudomonas* species	32 (60.38%) - 3 (5.66%)	23 (43.40%) 1 (1.89%) 4(7.55%)	55 (51.89%) 1 (1.89%) 7(13.21%)
POSITIVE	*Staphylococcus aureus* *Bacillus* species *Streptococcus* species Coagulase negative *Staphylococcus*	7 (13.21%) 4(7.55%) 2 (3.77%) 1(1.89%)	8(15.09%) 3(5.66%) 7(13.21%) 4 (7.55%)	15(28.30%) 7(13.21%) 9(16.98%) 5(9.43%)
Total		49 (92.45%)	50(94.34%)	99(93.40)

Table 3: Frequency of Bacterial Contamination on Lenses and Handles

Total number screened 106
Handle (n=53)
Lens (n-53)

Surface	Bacterial Diversity Isolated	Mean no. of Colonies per Swab	Degree of Bacterial Contamination
Lens	*Escherichia coli*	4±62	+++
	Staphylococcus aureus	2±27	+
	Bacillus species	5±7	+
	Streptococcus species	2±12	+
	Pseudomonas species	6±2	+
	Coagulase negative *Staphylococcus*	0±13	
Handle	*Escherichia coli*	7±82	+++
	Staphylococcus species	5±53	+++
	Bacillus species	3±8	+
	Streptococcus species	28±19	+
	Pseudomonas species	0±6	++
	Coagulase negative *Staphylococcus*	2±22	+

Table 4: Degree of Bacterial Contamination of Lenses and Handles

Key:

- **+** (1-20 colonies)
- ++ (21-50 colonies)
- +++ (50 and above)

		Number sensitive (%)								
Bacterial isolate	**No. Tested**	**OFX**	**PEF**	**CRO**	**AU**	**CN**	**S**	**CEP**	**SXT**	**PN**
E. coli	55	50(90.91)	28(50.91)	53(96.36)	19(34.55)	48(87.27)	16(29.10)	31(56.36)	7(12.73)	27(49.10)
S. aureus	15	8(53.33)	6(40)	14(93.33)	9(60)	15(100)	2(13.33)	11(73.33)	4(26.67)	12(80)
Streptococcus species	9	7(77.78)	9(100)	6(66.67)	8(88.89)	3(33.33)	1(11.11)	4(44.44)	0	7(77.78)
Klebsiella species	1	1(100)	1(100)	1(100)	0	1(100)	0	1(100)	0	0
Pseudomonas species	7	1(100)	6(85.71)	2(28.57)	5(71.43)	2(28.57)	3(42.86	4(57.14)	1(14.29)	2(28.57)
Coagulase negative *staphylococcus*	5	5(100)	5(100)	4(80)	3(60)	1(20)	2(40)	1(20)	2(40)	1(20)

Table 5: antibiotic Sensitivity of Bacterial Isolates

Key:

- OFX = Ofloxacine
- PEF = Peflacin
- CRO = ceftriaxone
- AU = Augmentin
- CN =Gentamicin
- CEP = Ceporex
- SXT = Septrin
- PN =Amplicin
- S = Streptomycin

ISOLATES	Lens cleaners	Sensitive	Resistance
E. coli	Liquid Cleaners and Cloth Material	NIL	POSITIVE
S. aureus			
Bacillus species			
Streptococcus species			
Klebsiella species			
Pseudomonas species			
Coagulase negative *Staphylococcus*			

Table 6: antimicrobial Sensitivity Using Different Lens Cleaners

3.2. Discussion

The bacteria species observed in this work includes: *Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, Streptococcus* species*, Bacillus* species*, Klebsiella* species and Coagulase negative *Staphylococcus.* Among the bacteria contaminants isolated, *Escherichia coli* was the most prevalent (51.89%) and this could be attributed to poor hygiene amongst Africans. Most persons in Africa exhibit poor toilet hygiene, i.e. failure to wash hands thoroughly with soap and water after making use of the toilets or urinary, and because our hands harbours a lot of pathogenic organisms when not sanitized or washed properly, it becomes a perfect tool for transfer of organisms to various places, especially on glasses for individuals who use them.

Staphylococcus aureus was the second most prevalent (28.30%) of the isolated bacteria. *Staphylococcus aureus* is the normal flora of the nasopharynx. The organism is pathogenic when found outside the nasal region, it has various insolent factors which enables it to elicit so many attacks to the host, which includes mastitis, conjuctivitis, pimples, rashes, etc. in this research, it was ascertained that various glass users, use their handkerchiefs usually employed for blowing of noses and cleaning the nasal mucous to wipe their glasses, thereby transmitting *Staphylococcus aureus* to the glass (handle/lens) which is known to be the normal flora of the nose. More so, *Staphylococcus aureus* can easily be contaminated through hand shaking as some persons are known to blow their nostrils with bare hands without washing, which enhances the transmission of this organism from one person to another through hand shaking.

Pseudomonas aeruginosa with a prevalence of 13.21%, has the ability to utilize wide range of nutrient. It was found in this work as a contaminant. Microorganisms like *Bacillus* species with a prevalence of13.21% were present and these are spore formers, explaining why they are found everywhere. Due to the spore formation which enables them to survive in all environments, they have the ability to colonise surfaces (Wilcox, 2007).

At the course of this research, it was observed that the males were more infected than the females, though both were infected by the same microorganisms which explain that they were exposed to the same environment and organisms. It has been proven that females observe and maintain good personal hygiene more than the males and this was confirmed in this story, as most males screened justified that they rarely clean their glasses unlike the females. According to Nwaugo *et al.,* 2007 who worked on fungal contamination of eye lenses, explained that males are more contaminated than the females because they engage in more outdoor works/ activities than the females.

On the other hand, among the workers and students screened in this research, it was observed that the workers were more infected than the students. This could be attributed to the fact that most workers were parents and are too busy to take care of their eye glasses unlike the students that are more privileged to only care for themselves and their studies.

From this research, it was discovered that the percentage of the medicated glass users in the university community was about 5. It was prevalent among the workers than the students and more so, it was higher in males than in females.

Most of these glass users (about 60%) do not clean their glasses. About 20% of individuals use their handkerchief or running water to clean their glass while the remaining 20% make use of lens Cleaner or mostly the cloth material contained in their glass case.

From this research, it was ascertained that cleaning of medicated glasses with fomites like clothes and handkerchief helps in contamination of the eye glasses especially when the water used is not sterilized. However, most persons thought that using of lens cleaners were the best option, but that was put in doubt as bacteria was isolated from eye glasses of the individuals who use lens cleaners as discovered in this research.

Various antibiotics used for the antimicrobial susceptibility tests were able to inhibit a wide range of the bacterial isolates. The different commercial liquid lens cleaners tested against the various bacteria isolated where not able to inhibit the organisms. This explains why the user's eye glasses were still contaminated. This experiment explains that either the ingredients used in the preparation of these lens cleaners were not active against bacteria, or the different products sold within the environment are not original and should not be reevaluated.

Further observation showed that bacteria contamination was more prevalent in handles than in the lenses. This can be linked to the fact that the hands are often employed to adjust the glass handles at intervals unlike the lenses, and pathogenic organisms harbored in the hands are easily transferred from the hands to the handle through touching.

However, Nwaorie *et al.,(*2012) in their research ascertained that female door handles were more contaminated than their male counterparts, which was attributed to certain habits exhibited by females such as carrying of several cosmetics. But unlike their research result, in this research, it was ascertained that the female's eyeglasses were less contaminated than the males, which was due to a high level of care given to their medicated eyeglasses unlike the males.

3.3. Conclusion

Personal hygiene and especially hand cleaning or hand sanitation plays a major role in bacterial contamination of frequently used objects like medicated eye glasses. Sanitation campaigns should be carried out to enable people maintain good personal hygiene and avoid spreading of pathogenic organisms. Many individuals wear eye glasses these days, thus it is necessary that we maintain good hygiene habits, especially medicated glass users should clean their eye glasses and handles always before use. Also, good disinfectant (eye glass cleaners) of reputable quality should be used for cleaning of glasses.

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