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In-vitro Antibiotics Sensitivity Pattern of Some Bacteria Isolated from Nigerian Currency

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Abstract: Eighteen bacteria isolates from the Nigeria Currency belonging to five different species were selected for antibiotic susceptibility test using commercially available drugs. The antibiotics used are Tetracycline, Cetrimoxazole, Augumentin, Gentamicin, Amoxycillin, Ofloxacin and Nalidixic acid. The disc diffusion technique was employed and inhibition observed as clear zones around the antibiotics. Inhibition zones were measured using meter rule and measurement greater than 0.5 cm was regarded as susceptibility. *Bacillus* sp. was found to be resistant to all drugs except Ofloxacin. *Proteus* sp. was susceptible to all antibiotics except Nalidixic acid. *Enterobacter* sp. was found to be resistant to Amoxycillin, Cotrimoxazole, Augumentin and Tetracycline while it was susceptible to Gentamicin, Nalidixic acid and Ofloxacin. *Citrobacter* sp. was found to be resistant to Cotrimoxazole, Nalidixic acid and Tetracycline but susceptible to Amoxycillin, Gentamicin, Ofloxacin and Augumentin. Staphylococcus species was resistant to Amoxycillin, Cotrimoxazole, Nalidixic acid and Augumentin and Tetracycline but susceptible to Ofloxazole and Gentamicin. The general resistance was exhibited against the cheap, easily available and accessible antibiotics while susceptibility was to very expensive antibiotics, thus making the treatment of infections caused by money very expensive. The minimum inhibitory concentration of Ceftriazone on *Enterobacter* sp., *Citrobacter* sp. and *Staphylococcus* sp. are 0.5, 0.29 and 0.29 μg mL^{-1} while for Gentamicin it was 0.3, 0.07 and 5 μg mL^{-1} This reveals that infection or disease resulting from contaminated currency will be expensive to treat as common and affordable antibiotics may not be effective.

Key words: Antibiotics, bacteria, inhibition, ofloxacin, species, infections

INTRODUCTION

Currency is widely exchanged for goods and services in most countries worldwide, hence it is a formite that can easily spread harmful organisms from person to person and across borders. Depending on the hygienic practices of the people, it is very obvious that anything that gets on hand get on money.

There had been fewer studies to show that currencies are usually contaminated with harmful pathogens (Abrams and Waterman, 1972; Pope *et al*., 2002; El-Din El-Dars and Hassan, 2005; Oyero and Emikpe, 2006).

Pathogens associated with throat infection, pneumonia, tonsilitis, peptic ulcers, urino-genital tract infection, gastroenteritis and lung abscess had been reported (Pope *et al*., 2002).

It has been found however that contaminated money is not confined to developing countries as reports also revealed similar pattern of contamination in developed countries. This showed that the contamination is related to personal hygiene state of the populace.

However, in most of the studies, the antibiotics sensitivity pattern is lacking. This information is necessary as to the appropriate antibiotics to be employed in situation of infection or disease resulting from contaminated currency.

This study reveals the results and implications of the *in-vitro* antibiotic sensitivity to some of the bacterial isolates from Nigerian currency.

MATERIALS AND METHODS

Sample collection: Samples were obtained wearing sterile gloves on both hands from the different chosen occupational groups. Each currency was kept in separate sterile nylon and transferred to the laboratory for analysis.

Culturing, isolation, identification and characterization: Currencies of all the available denominations were processed for microbial isolation using the Mac conkey agar, blood agar and potato dextrose agar. The conventional methods of swabbing and streaking were

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Table 1: Zones of inhibition of antibiotics susceptibility testing of the chosen isolates

	Antibiotics						
	AMX (25 µg)	COT (25 µg)	GEN (10 µg)	NAL (30 µg)	OFL (30 µg)	AUG (30 µg)	TET (30 µg)
Enterobacter sp.	R	R	1.8	1.9	1.7	R	0.6
Enterobacter sp.	0.6	R	1.1	R	1.4	0.8	0.6
Enterobacter sp.	R	R	1	1.8	1.5	R	R
Enterobacter sp.	R	R	0.8	1.9	1.4	R	R
Enterobacter sp.	R	R	1.8	1.6	1.5	R	R
Enterobacter sp.	R	R	1.8	R	1.1	R	0.6
Enterobacter sp.	0.6	R	1.1	R	1.6	0.7	0.7
Enterobacter sp.	R	R	1.8	1.9	1.7	R	0.6
Staphylococcus sp.	R	R	1.7	1.7	1.8	R	0.7
Staphylococcus sp.	1.6	R	0.8	R	1.7	1.7	R
Staphylococcus sp.	R	R	1	1.7	1.5	R	R
Staphylococcus sp.	R	R	1.1	R	1.8	1.6	1.6
Bacillus sp.	R	R	R	R	1.3	R	R
Proteus sp.	1.0	0.8	0.9	R	1.6	1.1	0.7
Proteus sp.	R	R	0.9	R	1.6	0.8	R
Citrobacter sp.	1.2	R	1.4	R	1.7	1.6	1.8
Citrobacter sp.	0.6	R	0.9	R	1.1	0.8	R
Citrobacter sp.	0.6	R	1.3	R	1	0.9	R
Klebsiella sp.	0.6	1.7	1.2	R	1.8	1	1.2
Proteus sp.	1.5	1.8	1.1	1.7	1.7	0.4	0.8

Table 2: Minimum inhibitory concentration of ceftriazone in µg mL^{-1} to the three chosen most occurring isolates

Organism	150	75	37.5	18.75	9.38	4.69	2.34	1.17	0.59	0.29	0.15	0.07
Enterobacter sp.	NG	NG	NG	NG	NG	NG	NG	NG	G	G	G	G
Citrobacter sp.	NG	NG	NG	NG	NG	NG	NG	NG	NG	G	G	G
Staphlylococcus sp.	NG	NG	NG	NG	NG	NG	G	G	G	G	G	G
Klebsiella sp.	NG	NG	NG	NG	NG	NG	NG	NG	G	G	G	G

Key: NG No Growth; G Growth

Table 3: Minimum inhibitory concentration of gentamycin in µg mL^{-1} to the three chosen most occurring isolates

Organism	20	10	5	2.5	1.25	0.62	0.31	0.15	0.07
Enterobacter sp.	NG	NG	NG	NG	NG	NG	G	G	G
Citrobacter sp.	NG	NG	NG	NG	NG	NG	NG	NG	NG
Staphlylococcus sp.	NG	NG	NG	G	G	G	G	G	G
Klebsiella sp.	NG	NG	NG	G	G	G	G	G	G

Key: NG No Growth; G Growth

used (Abrams and Waterman, 1972). Pure colonies of isolate organisms were identified and characterized using standard microbiologic technique (Cheesbrough, 1984).

Antibiotic sensitivity test: The disc diffusion technique was employed and inhibition observed as clear zones around the antibiotics. Inhibition zones were measured using meter rule and measurement greater than 0.5 cm was regarded as susceptibility (Table 1).

Minimum inhibitory concentration determination: The Minimum inhibitory concentration of some selected bacterial isolates from currency was determined using the broth dilution method using stocked solution of Ceftriazone and Gentamycin (Table 2 and 3).

RESULTS AND DISCUSSION

From this study, the bacterial isolates that were found were usually associated with oral, nasal and feacal contamination. This showed that money contamination is associated to unhygienic practice of people. These practices include indiscriminate sneezing, coughing and defecation with indecent handling of currency.

The bacterial contaminants of money when subjected to antibiotic sensitivity test were found to be

resistant to the first generation antibiotics which are (Tetracycline and Co-trimoxazole) while they are susceptible to third generation antibiotics which are Amoxycillin, Gentamicin, Nalidixic acid, Ofloxacin and Augumentin.

The resistance of the isolates to the first generation antibiotics may be due to the fact that the antibiotics are first line drug. The antibiotics are also cheaper and easily accessible as they are easily bought off shelf without an appropriate prescription in Nigeria. This abuse and indiscriminate use may lead to the resistance observed. Another probable reason for the resistance may be because the first generation antibiotics are more prone to adulteration which may lead to under-dosage over time.

Resistance may also be as a result of the carriers of some diseases as they would have been exposed to different antibiotics over time which may induce resistance in the bacterial isolates.

The susceptibility of the isolates to the third generation antibiotics may be due to the fact that the drugs are expensive and not easy to come as they are often purchased with prescription, which limits the indiscriminate use of the drugs. The antibiotics are also less prone to adulteration and abuse because their components are new and its formulation may be difficult to adulterate.

The mechanisms of the action of the drugs are new and cognizance is also given to the attendant problem of resistance before their production hence the ability of the drug to the isolates. The people that are mostly exposed to infection by money are the poor masses as they are involved in most transaction involving the use of smaller denomination which has been reported to be highly contaminated. The infections cause by these isolates may be very expensive to treat because the newer drugs are quite expensive.

CONCLUSION

The Nigerian currencies are dirty and highly contaminated with pathogenic organisms. The pathogenic organisms are resistant to the antibiotics that is cheap and easy to come by, but susceptible to very expensive antibiotics.

Also, on the monetary aspect, the antibiotics to which the micro-organisms are susceptible are exorbitant e.g., Augumentin cost about £4 while Tetracycline cost £0.5. These results suggest paper currency contamination may play a role in the transmission of antibiotic resistant or potentially harmful organisms.

It also showed that the treatment of infections caused by Nigerian currency bacterial isolates may be very expensive and may also be a death trap. The economic implication of the presence of antibiotic resistance human pathogens on paper money is questionable as many immunosuppressed individuals due to HIV infection, malnutrition and drug abuse may become sick now or in future as a result of pathogens contracted from money.

Even though treatment is achievable but more efforts should be made at putting forward preventive measures which should includes:

- Enhancement of the public awareness (e.g., use of Television, Radio jingles, Posters etc) of the fact that treasured dirty currency could be a source of infection and could be dangerous to health.
- The Banking authority should find a means of inscribing the need to properly handle money on every currency as this will serve as a reminder to everyone.
- The individual should be educated on the proper way to handling money i.e. hands should not be taken into mouth without washing and hands should be washed before and after handling money.

It should be noted however, that Central Bank in Nigeria is currently on the campaign for the need to properly handle Naira.

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