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Antibiotic Susceptibility Pattern of *Staphylococcus aureus* Isolated from Abattoir Effluents from Meat Market Abakaliki

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ABSTRACT

The poor state of most Nigerian abattoirs, meat processing plants, ineffective meat inspection service and the resultant risk of consuming unwholesome meat have been issues of public health and global environmental concerns. This study was designed to isolate Staphylococcus aureus from abattoir effluents within Meat Market in Abakaliki Metropolis and also to ascertain their antibiotic susceptibility pattern of the S. aureus isolated. 12 abattoir effluent samples (2 from each: cow intestinal effluent, cow body effluent, goat intestinal effluent, goat body effluent, chicken intestinal effluent and chicken body effluent) were collected and analyzed. 10 S. aureus were isolated from the abattoir effluents. The S. aureus were most sensitive to ciprofloxacin (80.0%), followed by ampicillin (60.0%), tetracycline (50.0%) and cefotaxime (30.0%), while chloramphenicol (0.0%) showed the least. Chloramphenicol (100.0%) was found to be the most resistant, followed by cefotaxime (70.0%), tetracycline (50.0%), ampicillin (40.0%), while ciprofloxacin (20.0%) showed the least. Hence it is possible that abattoir effluent constitute a reservoir for distributing antibiotic resistance into the community. Hence, there is therefore an urgent need to discourage the use contaminated water for meat processing by butchers so as to safe guards the health of the populace. Subsequently, there is need to put in place effluent treatment facilities to treat wastes from abattoirs in Ebonyi State and also in Nigeria.

Keywords: Abattoir effluents, *Staphylococcus aureus*, Antibiotic susceptibility, Abakaliki

INTRODUCTION

Effluent is defined by the United States Environmental Protection Agency as “wastewater - treated or untreated - that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters” (EPA, 2006). The abattoir is a specialized facility approved and registered by the regulatory authority for inspection of animals, hygienic slaughtering, processing and effective preservation and storage of meat products for human consumption

(Alonge, 2001). In addition, appropriate facilities to ensure safe disposal of abattoir wastes in a manner that will not constitute a potential hazard to public health, animal health and the environment is considered very essential. Most abattoirs in Nigeria have no facilities for waste treatment; wastes are either disposed on open dumps or are discharged into nearby streams, hence constituting an environmental menace (Adeyemo *et al*., 2002).

Abattoirs are known all over the world to pollute the environment either directly or indirectly from their variousprocesses (Girards, 2005). Ouinn and McFarlane (1989) observed that effluent discharged from slaughter-houses has caused the deoxygenation of rivers. Effluent from slaughter-houses has also been known to contaminate ground water (Sangodoyin and Agbawhe, 1992). Trift and Schuchardt (1992) reported during a study that blood, one of the major dissolved pollutants in slaughter effluent, have a chemical oxygen demand (COD) value of 375,000 mg/L. This impacts high organic pollutants, on the receiving waters and consequently creating high competition for oxygen within the ecosystem. This chemical oxygen demand (COD) value is far higher than the maximum limit of 80 mg/L set by Federal Environmental Protection Agency/Federal Ministry of Environment, Nigeria (FEPA, 2007).

Coker *et al*. (2001) showed that abattoir waste can affect water, land and air qualities if proper practices of management are not followed. In Nigeria, many abattoirs dispose their effluents directly into streams and rivers without any form of treatment and slaughtered meats are washed by the same river water (Adelegan, 2002). Such is the situation in several private and government abattoirs in most parts of the country. Reports have also shown that indiscriminate disposal of abattoir waste may introduce enteric pathogens into surface and ground water (Ruiz *et al*., 2007) and the pathogens isolated from abattoir waste - waters can survive in the environment and pose danger to humans and animals (Coker *et al.*, 2001).

Waste water or effluent generated from the abattoir is characterized by the presence of a high concentration of whole blood of slaughtered food animals and suspended particles of semi-digested and undigested feeds within the stomach and intestine of slaughtered and dressed food animals (Coker *et al*., 2001). In addition, there may also be the presence of pathogenic microorganisms, such as *Salmonella*, *Eschericia coli* (including serotype O157:H7), *Shigella*, parasite eggs and amoebic cysts (Bull *et al*., 2001) which are of public health importance. Recent studies have shown that zoonosis from abattoir wastes are yet to be fully controlled in more than 80% public abattoirs in Nigeria (Cadmus *et al*., 1999).

These pathogens isolated might threaten public health by migrating into ground water or surface water, wind or vectors like animals, birds and arthropods which can help to transmit diseases (Gauri, 2004). The risk of epidemics, water contamination and pollution, annihilation of biotic life, global warming and soil degradation by waste materials are real problems confronting developing countries where issues concerning waste management have been grossly neglected (Adedipe, 2002; Adeyemi and Adeyemo, 2007). In Nigeria, adequate abattoir waste management is lacking in most public abattoirs. Hence this work is carried out to detect the prevalence and current antimicrobial patterns of *Staphylococcus aureus* in abattoir effluent from Meat Market, Abakaliki, Ebonyi State.

MATERIALS AND METHODS

Sample Collection

Abattoir waste-water samples were collected from three sampling points at Meat Market Abattoir located in Abakaliki Metropolis, Ebonyi. The two effluent sampling points depict different activities within the abattoirs. Sampling points A (intestinal effluent), and B (body effluent) were located at channel within the slaughterhouses. The abattoir effluents were collected within a period of 30 days (June, 2013).

The bottles were filled leaving a top space of about 2.5cm.Sampleswere processed and incubated within 5 hours of sampling. Samples were transported in isothermal boxes with ice to the laboratory of Applied Microbiology Department for bacterial analyses.

Preparation of Sample for Culture

Extracts from these samples were first diluted in peptone water 0·1%; 10ml of the sample were added to 90ml of the diluents, producing a dilution of 10^{-1}. Successive decimal dilutions were obtained, and then prepared for the analyses.

Isolation, Enumeration, and Identification of *Staphylococcus aureus*

The isolation and enumeration of *S. aureus* was carried out using standard microbiological/biochemical methods (Cheesbrough, 2006 and Abrahim *et al*., 2010).

Antibiotic susceptibility studies

Susceptibility patterns of the isolated organisms were tested against a wide range of antibiotics namely ciprofloxacin (5 mg), chloramphenicol (10 mg), cefotaxime (30 mg), ampicillin (25 mg) and tetracycline (30 mg) using Kirby and Bauer disc diffusion methods of determining susceptibility (Bauer *et al*., 1966). No control strain was used.

RESULTS AND DISCUSSION

Identification of *S. aureus* was carried out using standard microbiological/biochemical methods as shown in Table 1. The identification battery included Gram staining, oxidase, lndole, Voges Proskauer, motility and sugar fermentation test (glucose, lactose and fructose).

Table 1: Morphological and biochemical Characterization of isolated *Staphylococcus aureus*

Morphological characterization		Gram staining	Catalase Test	Oxidase Test	Indole Test	Voges Proskauer	Motility Test	Sugar Fermentation Test			Suspected Organism
Colour	Shape							Glucose	Lactose	Fructose	
Pink	Cocci	-	+	-	-	-	-	+	-	-	*Staphylococcus aureus*

Ten *Staphylococcus aureus* isolates were obtained from 12 abattoir effluents (2 cow intestinal effluent, 2 cow body effluent, 2 goat intestinal effluent, 2 goat body effluent, 2 chicken intestinal effluent and 2 chicken body effluent) collected from Meat Market in Abakaliki Metropolis as shown in Table 2 below.

Table 2: Frequency of *Staphylococcus aureus* isolated from the abattoir effluents

Sample	Number of Sample collected	Frequency of *S. aureus* Isolated
Cow intestinal effluent	2	2
Cow body effluent	2	2
Goat intestinal effluent	2	2
Goat body effluent	2	2
Chicken intestinal effluent	2	1
Chicken body effluent	2	1
Total	**12**	**10**

The *Staphylococcus aureus* isolates from abattoir effluent showed highest level of resistance to chloramphenicol (100.0%) followed by cefotaxime (70.0%), while highest level of sensitivity was recorded with ciprofloxacin (80.0%), followed by ampicillin (60.0%) as shown in Table 3.

Table 3: Percentage resistant of *S .aureus* to antibiotics

Antibiotics	Resistant (%)	Sensitive (%)
Ciprofloxacin	20.0	80.0
Cefotaxime	70.0	30.0
Ampicillin	40.0	60.0
Chloramphenicol	100.0	0.0
Tetracycline	50.0	50.0

The ten *Staphylococcus aureus* isolates were subjected to antimicrobial susceptibility testing and the zones of inhibition of the *S. aureus* isolates were shown (Figure 1).

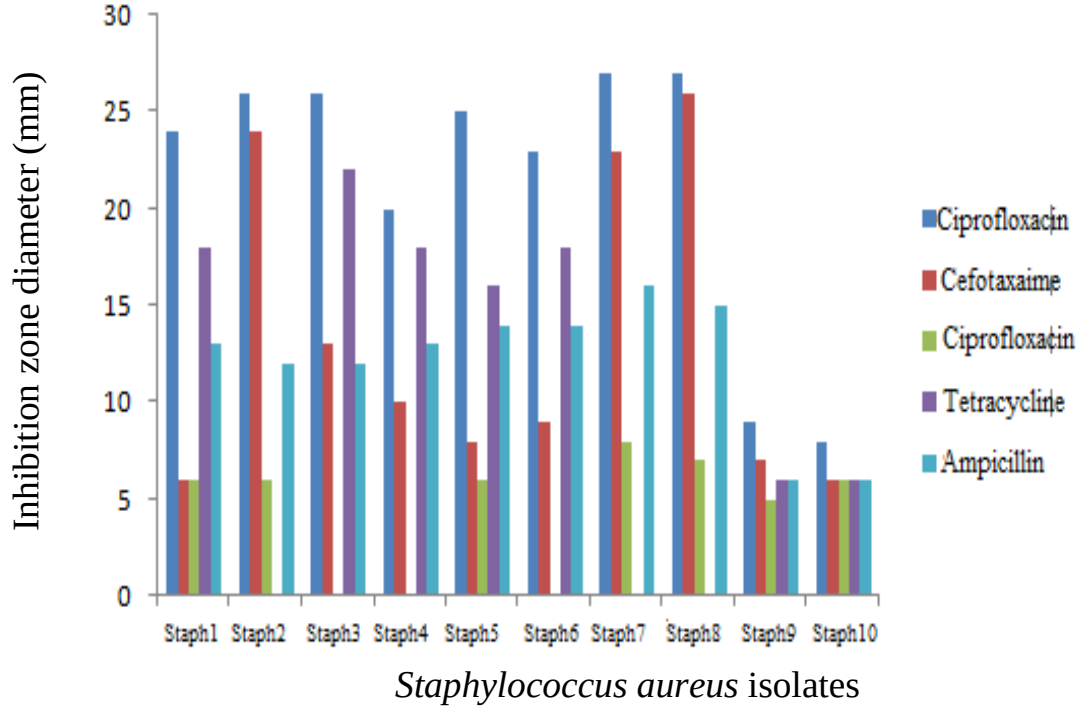

Figure 1: Antibiogram profile of *Staphylococcus aureus* isolated from abattoir effluents

DISCUSSION

In Nigeria, climatic elements pose serious challenges to abattoir operations as they encourage rapid deterioration of meat under conditions of high temperature and high humidity (Nwanta *et al*., 2008). According to Gourou (1961), the steady, high temperatures, high humidity of the air, many water surfaces fed by rains are necessary for the maintenance of pathogenic complexes in which man; insects and microbes are closely associated.

Identification of *S. aureus* was carried out using standard microbiological/biochemical methods (Cheesbrough, 2006) as shown in Table 1. The identification battery included Gram staining,

oxidase, lndole, Voges Proskauer, motility and sugar fermentation test (glucose, lactose and fructose).

In this study 10 *Staphylococcus aureus* isolates were obtained from 12 abattoir effluents (2 cow intestinal effluent, 2 cow body effluent, 2 goat intestinal effluent, 2 goat body effluent, 2 chicken intestinal effluent and 2 chicken body effluent) collected from Meat Market in Abakaliki Metropolis as shown in Table 2. This study is in line with the work of Adesemoye *et al.* (2006) in Lagos State, who reported the presence of *Staphylococcus aureus* in abattoir effluents. Subsequently, this work is also in agreement with the work of Yakubu *et al*., (2007) in Sokoto, Adebowale *et al.,* (2010) in Ibadan, Iroha *et* al., (2011) in Abakaliki, Adebowale *et al.,* (2012) in Abeokuta and Atuanya *et al*., (2012) in Benin City. It is important to emphasize the presence of *S. aureus* on a worker's hand before slaughtering; humans are in fact considered an important potential reservoir of this microorganism (Adesiyun *et al*., 1998 and Capita *et al*., 2002).

The prevalence and degree of antimicrobial resistance are increasing worldwide (Werckenthin *et al*., 2001). Because of the ability of *Staphylococci* to change over time, the resistant *Staphylococcus aureus* will continue to be a problem in the future. The 10 *Staphylococcus aureus* isolates were subjected to antimicrobial susceptibility testing and the zones of inhibition of the *S. aureus* isolates were shown (Figure 1).

In this study, the *Staphylococcus aureus* from abattoir effluent showed highest level of resistance to chloramphenicol (100.0%) followed by cefotaxime (70.0%), as shown in Table 3, while highest level of sensitivity was recorded with ciprofloxacin (80.0%), followed by ampicillin (60.0%). The result of this work is in line with work of Losito *et al*., 2012 who reported the resistance of *S. aureus* isolated from a pigeon slaughterhouse in Italy to chloramphenicol (68.0%). Subsequently, the results of this study are quite similar to the data of Moller *et al*. (2000) and White *et al*. (2003), who conducted studies on the susceptibility to antimicrobial agents among clinical poultry *Staphylococci* isolates. In fact, *S. aureus* is one of the most common causes of infections in birds and antimicrobial agents are widely used in the treatment and the control of *Staphylococcal* infections (Losito *et al*., 2012).

Some strains of *S. aureus* showed some level of susceptibility to ciprofloxacin (80.0%) and ampicillin (60.0%), even at that it still posse some public health problems because when this antibiotics are misused this organism will develop resistant against it (Iroha *et al*., 2011).

CONCLUSION

Abattoir effluent can provide a favorable environment for the survival and transmission of *S. aureus* and other pathogenic microorganisms. The results obtained from the investigation showed high prevalence of *S. aureus*, which might be attributed to the use of contaminated water for meat processing by butchers which is likely to portend a serious public health risk to consumers who purchase their meat from this abattoir.

From the result of this study, it is possible abattoir effluent constitute a reservoir for distributing antibiotic resistance into the community.

Thus, there is an urgent need to put in place effluent treatment facilities to treat wastes from abattoirs in Ebonyi State and also in Nigeria. There is therefore an urgent need to discourage the use contaminated water for meat processing by butchers so as to safe guards the health of the populace.

Further studies are necessary to investigate the antibiotic resistance of *S. aureus* present in abattoirs in wider geographic locations.

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