

**OCCURRENCE AND ANTIBIOGRAM OF SALMONELLAE IN EFFLUENT FROM
NSUKKA MUNICIPAL ABATTOIR**

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The occurrence and antibiogram of Salmonellae from Nsukka abattoir effluent were investigated. One hundred swab samples of the abattoir effluent were collected over a period of eight weeks. The samples were processed for Salmonella isolation and identification following standard cultural and biochemical procedures. Minimum inhibition concentrations (MIC) of ampicillin, chloramphenicol, ciprofloxacin, gentamicin and tetracycline against the isolates were determined using the agar dilution method.

Salmonellae were recovered from 10 (10%) of the samples cultured. The MIC values for ciprofloxacin ranged from <0.061g/ml to 1.953g/ml while the values for gentamicin, ampicillin, tetracycline and chloramphenicol ranged from 0.244g/ml to >125g/ml, 0.122g/ml to >125g/ml, 3.91g/ml to >125g/ml and 62.5g/ml to >125g/ml respectively. From the MIC values, 90% of the isolates were susceptible to ciprofloxacin and gentamicin while 60% 10% and 0% were susceptible to ampicillin, tetracycline and chloramphenicol respectively. Results of this study have highlighted the environmental and public health hazards posed by effluent from Nsukka abattoir in particular and other abattoirs across the country, as the effluent flows into parts of markets, major roads and farmlands.

KEY WORDS: Salmonellae, antibiogram, effluent, abattoir, Nsukka

INTRODUCTION

Each year, millions of people are affected by food and water-borne diseases and thousands die, especially children in developing countries, including Nigeria (WHO, 2002). The increased awareness of the problem of food borne infections has resulted in a large number of publications many of which indicate that *Salmonellae* have become the most frequent cause of food borne infection. All *Salmonella* infections except those caused by *Salmonella typhi* and *paratyphi A* and *C* are considered zoonotic. The main source of *Salmonella* infection to human is food of animal origin (FAO/WHO, 1967). Food animals are the reservoirs for many emerging and important foodborne diseases, including those caused by *Escherichia coli* 0157:H7, non-typhoidal *Salmonella* spp., *Campylobacter* spp. and *Yersinia* spp. (WHO, 2002).

The occurrence of *Salmonella* in trade cattle slaughtered for human consumption has been reported at the Nsukka Municipal Abattoir (Oboegbulem and Muogbo, 1981). The pollution of natural and artificial waters by waste matters resulting from human activities constituted one of the most important, difficult and complex problems confronting public health authorities in Nigeria (Adelegan, 2002). The presence of zoonotic *Salmonellae* in abattoir effluent and the discharge of such into the environment pose threat to human and animal life. In Nigeria, particularly in the southwestern part of the country, many slaughterhouses dispose their waste directly into streams or rivers and use water from the same source to wash slaughtered meat (Adelegan, 2002; Cadmus et al., 1999).

Antimicrobial drugs have undoubtedly saved the lives of millions of people and animals. However, the widespread use of such drugs in animals, hospitals and health centers, the community and agriculture has led to the emergence of resistance among bacteria (WHO, 2002). Antimicrobials are commonly used in food producing animals for treatment, prophylaxis and growth promotion. However, such use can also lead to the development of drug-resistant bacteria, which may be

transmitted to humans through the food supply.

Effluent from Nsukka Municipal abattoir flows into the market, major roads, farmlands, residential homes and underground water. Food hawkers stay close to the abattoir with their food items exposed to the poor hygienic environment at the Nsukka Municipal Abattoir. Although *Salmonellae* have been isolated from cattle slaughtered at this abattoir (Oboegbulem and Muogbo, 1981), the environmental and public health risk posed by effluent from the abattoir has not been evaluated. The present study therefore seeks to evaluate the effluent from this abattoir for presence of *Salmonella* and the antibacterial susceptibility profile of the isolates.

MATERIALS AND METHODS

This study was conducted at the Nsukka Municipal Abattoir, Nsukka Local Government Area of Enugu State, Eastern Nigeria. This abattoir is located close to a section of the market where different types of foods, including ready to eat foods, are sold (Plate 1). Sterile swabs were dipped at different points along the collecting channels of the waste water (effluent) from the abattoir. When the swabs were fully soaked with the effluent they were removed, put into sterile plastic tubes and appropriately labeled. About 10 to 15 swabs were collected each week with a total of 100 swab samples collected over a period of eight weeks (January to March, 2003). They were processed for *Salmonella* isolation and identification following standard cultural and biochemical methods (Oboegbulem, 1993). Briefly, each swab sample was inoculated into peptone water and incubated at 37°C for 24 hours after which about 0.1ml of the peptone water culture was inoculated into 10ml of Rappaport-Vassilliadis broth. The broth was incubated at 43°C for 24 hours and the culture subcultured onto MacConkey agar (MCA). Inoculated plates were incubated at 37°C for 24 hours and three non-lactose fermenting colonies from each plate were Gram-stained. Gram-negative bacilli were subjected to

biochemical tests such as indole, methyl red, Simmons citrate, urease production, and hydrogen sulphide, fermentation of mannitol and dulcitol and gas production on Triple Sugar Iron (TSI) agar.

The minimum inhibitory concentrations (MICS) of five commonly available antibacterial agents (ampicillin, chloramphenicol, ciprofloxacin, gentamicin and tetracycline) against the Salmonella isolates were determined using the agar dilution method (Bryant, 1981). Stock solutions (containing 5000g/ml) of each of the five test antibacterial agents were prepared in sterile normal saline. Two-fold serial dilutions were made from each of the stock solution. A unit volume of each of the dilutions was added to 19ml of sterile molten but cool Mueller-Hinton agar, mixed and poured into sterile Petri dishes. The final concentrations of the

antibacterial agents in the agar ranged from 125g/ml down to 0.061g/ml. A plate containing no antibacterial agent served as a negative control. Each of the plates was divided into 10 sectors. Each test bacterium was spot inoculated onto each of the sectors, the plates incubated at 37°C for 24 hours and observed for growth or growth inhibition. The MIC of each drug for each isolate was the lowest concentration of the drug that prevented visible growth of the isolate.

RESULTS

Salmonella organisms were isolated from 10 (10%) of the 100 swab samples cultured. The weekly recovery rates of the salmonellae are shown in Table I.

TABLE I: Weekly recovery rates of Salmonella from Nsukka abattoir effluent

Sampling period	No. of swabs cultured	No. positive for Salmonella	%*
Week 1	10	5	50
Week 2	10	0	0
Week 3	15	1	6.6
Week 4	15	2	13.3
Week 5	15	2	13.3
Week 6	5	0	0
Week 7	15	0	0
Week 8	15	0	0
Total	100	10	10%

* Percentage of total number of swabs cultured in the week.

The Minimum Inhibitory Concentration of ciprofloxacin ranged from <0.061µg/ml to 1.953µg/ml while the values for gentamicin, ampicillin, tetracycline and chloramphenicol ranged from 0.244µg/ml to >125µg/ml, 0.122µg/ml to >125µg/ml, 3.91µg/ml to >125µg/ml and 62.5µg/ml to >125µg/ml respectively. The MIC of the test antibacterial agents against the Salmonella strains is shown in Fig. 1.



Plate 1: A cross section of the Nsukka abattoir
Position of the drainage is indicated by the arrow head

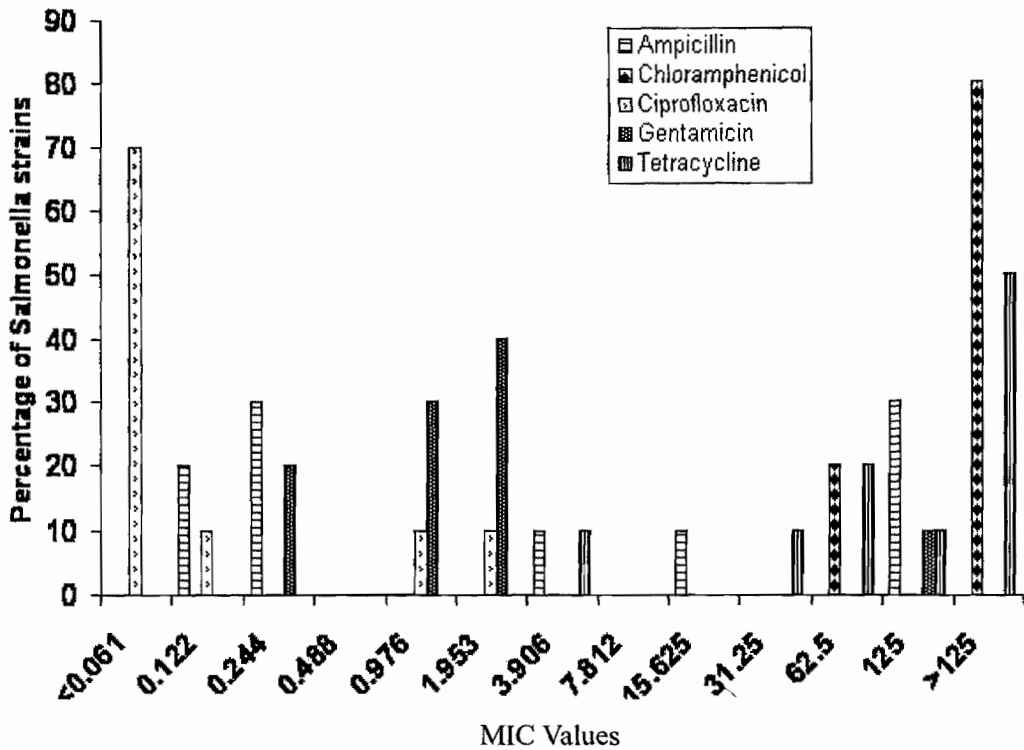


Fig. 1: Minimum inhibitory concentration of some antibacterial agents against Salmonella strains from Nsukka abattoir effluent

The antibacterial resistance profile of the Salmonella isolates is presented in Table 2. Least resistance was demonstrated against ciprofloxacin and gentamicin while the highest resistance was against chloramphenicol followed by tetracycline.

TABLE II: Antibacterial resistance profile of Salmonellae isolated from Nsukka abattoir effluent

Antibacterial agent	No resistant	% resistant
Ampicillin	4	40
Ciprofloxacin	1	10
Gentamicin	1	10
Chloramphenicol	10	100
Tetracycline	9	90

DISCUSSION

The results of this study show that the effluent at the Nsukka Municipal Abattoir is contaminated with Salmonella organisms. Oboegbulem and Muogbo (1981) had earlier isolated Salmonella from trade cattle slaughtered at the studied abattoir. The uncontrolled disposal of heavily contaminated waste water into streams and the environment poses both a public and environmental health hazard including threat to animal life. In Nigeria, the awareness of waste pollution is very low, thus pollution of natural and artificial waters and the environment by waste matters has continued to be one of the most important and complex problems confronting public health authorities (Adelegan, 2002). The proximity of food items displayed for sale to this salmonella-contaminated waste water drains (Plate 1) constitute a serious public health problem as these food items may become contaminated with salmonellae. Since salmonellae are zoonotic bacteria, consumption of such salmonella-contaminated foods may result in human salmonella food-borne infections. In the study area there seems to be no available reports on human salmonella infection established to be associated with consumption of food item sold around the abattoir. However, this does not suggest that such situations may not exist but could rather be attributed the fact that such cases are never reported and epidemiological association are

hardly followed up.

Indiscriminate use of antibacterials in animals has been shown to cause increases in the incidence of resistant bacteria in the intestines of animals exposed to these drugs (Helmuth and Protz, 1997; Rao, 1998; Witte, 1998, WHO Report, 2000). Tetracycline and ampicillin are widely used in the treatment of animal diseases in Nigeria. The high rates of resistance to these drugs recorded in this study may be attributed to their frequent use in the country. However, the 100% resistance to chloramphenicol found in this study is rather surprising considering the fact that this agent is rarely used in animal treatment. Human infection with these chloramphenicol resistant Salmonella strains may lead to horizontal transfer of the resistant factors to other human pathogens.

CONCLUSIONS

Results of this study have highlighted the environmental and public health hazards posed by effluent from Nsukka abattoir in particular and other abattoirs across the country, as the effluent flows into parts of markets, major roads and farmlands. There is need to relocate the abattoir so as to avoid close proximity with the market.

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