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RETROSPECTIVE STUDY OF ANTIMICROBIAL RESIDUES AND RESISTANCE IN SWINE IN ABA ABIA STATE, NIGERIA

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ABSTRACT: Antimicrobials are used by livestock farmers to prevent and control infection. Antimicrobials are also included at sub-therapeutic doses in animal feed as growth promoters and to improve feed efficiency in intensive farming. The aim of this study was to evaluate the antimicrobial residues and resistance that could arise due to antimicrobial use in swine. The study was carried out between September 10th and December 10th 2013 in some selected swine farms in Ogbor Hill water side in Aba, Abia state. The study involved visiting the various farms, evaluating the records of previous treatment. Also the state zonal veterinary clinics visited and record of farms was collected for analysis. From the result obtained, in raining season in a given year, the frequency of tetracycline usage recorded 83.3%, penicillin recorded 75.0%, while sulfonamide recorded 25.0%. Tylosin and ivermox were the least and recorded 8.4% usage each. The swine treatment was done by the farmers hence there was consistent over-dosage of antimicrobials to the pigs as the manufacture's guide was not complied with. The report from the records showed that some of the pigs were slaughtered and sold in the market at any time without recourse to drug with-draw. This result could be one of the responsible reasons for antimicrobial residues and resistance in swine and indeed livestock.

Keywords: Antimicrobial residues, Swine, Resistance, Abia state.

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INTRODUCTION

Antimicrobials are any substances including synthetic compounds which destroys microbes (Guardabasse and Courvalin, 2006). In piggery production in most countries of the world, antimicrobials are administered both for prophylaxis and therapeutic purposes. Some antimicrobials are used to prevent disease in fairly healthy animals more especially during perceived increase susceptibility period. Mastitis is a common disease suffered by lactating pigs and treatment is by the use of antimicrobial. Besides, lactating pigs, antimicrobial are also use for treating other infection disease. The use of antimicrobials to treat food animals has the potentials to affect human health via two mechanisms: increasing the risk of antimicrobial residues influencing the selection of antimicrobial resistant food borne pathogens (Yan and Gilbert 2004). The risk of antimicrobial residues is well known and there is increasing concern about the impact of antimicrobial usage in food animals on the development of antimicrobial resistance. Antimicrobial agents disrupt bacterial processes needed for growth. Compounds that inhabit bacterial growth are described as bacteriostatic while those that kill the bacteria are termed bactericidal. Antimicrobial agents can be bacteriostatic when they reach the minimum inhibitory concentration (MIC) but become bactericidal when they reach a higher concentration called the minimum bactericidal concentration (MBC). If the MIC and the MBC are distinctly separated, the agent is considered bacteriostatic. If the MIC is close to the MBC, the compound is said to be bactericidal (Prescott, 2000).

Bacterial resistance can be intrinsic or acquired. Acquired resistance occurs when a previously susceptible bacterium becomes resistant via mutation (Hall and Collis, 1995). There are several mechanisms of resistance that had been described. Some bacteria contain enzymes that inactivate antibiotics. The most well-known example is β-lactamase. These enzymes inactivate β-lactam antibiotics by clearing the β-lactam rings. Some bacterial develop resistance by preventing the antibiotic from entering the bacterial cell or by increasing the removal of the drug out of the cell.

Recently, Pol and Ruegg (2006) developed a method to quantify antimicrobials usage and treatment practices. The need for antimicrobial withdrawal from animals before slaughter or use as milk is very important since scientific experiment provide data that shows how long a drug is present in the body of animal and what the animal body does to the drug (Graham et al., 2009). The Food and Drug Administration (FDA) of United States Department of Agriculture and Centers for Disease Control and Prevention affirms that there is a definitive link

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between the routine, non therapeutic use of antibiotics in food animal production and the challenge of antimicrobial resistance in humans (Gilchrist et al., 2006). Some researcher reported use in livestock production was a factor in the high prevalence of antibiotic resistant bacteria in Korea (Pereira and Siqueira–Junior, 1995). The relatively high usage of antimicrobials in livestock production had lead to the banned use of antibiotics as growth promoters in livestock (Woo-Joo and Seung, 1998). The objective of the study is to evaluate antimicrobial usage in swine by pig farmers and possible resistance.

Concern for Antibiotic Resistance:

Of late, there has been increased concern about the use of anti – microbial in animals contributing to the rise in antibiotic resistant infections in humans. The use of antimicrobials has been linked to the rise of resistance in every drug and species where it has been studied, including humans and livestock. The role of antimicrobial use in food animals and resistant infection is gradually on the rise. The use of antimicrobials in various forms is widespread throughout the animal industry, and is presented as key to preventing animal suffering and economic loss.

Antimicrobial Susceptibility Tests;

Antimicrobial susceptibility tests measure the ability of an antimicrobial agent to inhibit bacterial growth invitro and are performed using methods that are based on diffusion (Walker, 2000). The agar disc diffusion is one of the most common methods and is referred to as the Kirby – Bauer method. A standardized suspension of bacteria is streaked over a Muller – Hinton ager plate and antimicrobial impregnated discs are applied. During over-night incubation, a gradient of antimicrobial concentration is closest to the disc and progressively lower concentrations occur as distance from the disc increase. If the bacteria are susceptible to the antimicrobial tested, a distinct inhibition zone will be observed. If the bacteria are resistant to the antimicrobial, bacterial growth will be observed close to the antimicrobial disc. The diameter of each inhibition zone is recorded and the outcome is interpreted for each antimicrobial using standards based on the size of the zone of inhibition (Walker, 2000).

MATERIALS AND METHODS

Five pig farms were randomly selected out of over seventeen different pig farm all located within and around Ogbor Hill River at Aba Abia State in Nigeria. The choice of the farm was due to the good record keeping Obtained from the State Zonal veterinary clinics Aba. To confirm the report in the document, visit was paid to the five farms and the total number of pigs in each farm was recorded. The records of the antimicrobial used, the various dosages use, the season of usage and frequency of usage were all taken for analysis. From the available documented case file both by the veterinarian and more especially by the individual pig farmers.

RESULTS AND DISCUSSION

Antimicrobial are used by the pig farmers for therapeutic and prophylaxis control of the infection. Table 1 shows a class representation of a pig farm. The ratio of the sow to the boar was best presented by ventures farm and all the farms except new-hope which has no piglet as at the time of visit

Antimicrobial were used throughout the year, however the number of antimicrobial used during the rain season as represented in Table 2. Global farms and Orcharkk farms recorded the highest antibiotic usage per year than all others. Tetracycline recorded 83.3% usage annually penicillin 75.0%, while ivermox and tylosin recorded 8.4% each which was the lowest as shown in Table 3. The relative humidity and water logged site of the pen could contribute to the multiplication of microorganism.

The use of antimicrobial by the farmers was regardless of the manufactures recommendation similar result was reported (Erskine et al., 2002). The treatment was carried out by the farmers. The veterinarians are consulted when the situation of the animal is in deplorable condition. However, there were farmers who adhere strictly to the manufactures guide. In Table 4, dosages of sulfonamide and Tetracycline given were 2-2.5ml/10kg and 2.5-3ml/10kg compared to the recommendation dosage of 1ml/10kg and 1-1.5mi/10kg which is of higher range. Similar result was reported (Kirk et al., 2005). The prescription close to the manufactures guide was ivermox and ampicillin which was 1ml/10kg and recorded usage was 1-2ml/10kg.The rampant use of antimicrobials in high doses lead to high quantities of residues released when the animals are slaughtered without any withdraw thereby posing health hazard to humans on consumption of the meat (Makovec and Ruegg, 2003) reported similar conclusion in a larger study.

Table 1 - Average Farm Size of Five Selected Pig Farms Located In Ogbor Hill, Aba

Name of Farms	Total Number of Swine	Sow	Boar	Grower	Piglets
Ventures	210	160	20	11	09
Global	124	54	23	25	22
El-shaddi	67	31	12	13	11
Orchakk	42	18	07	11	06
New-hope	28	14	06	08	00

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Table 2 - Average number of different antimicrobial used per year in five farms

Name of Farms	Dry Season	Raining Season	Total/year
Ventures	1	4	5
Global	1	7	8
El-shaddi	1	3	4
Orchakk	2	6	8
New-hope	1	5	6

Table 3 – Frequency of antimicrobial usage per year

Types of Antimicrobials	Frequency of Occurrence	Percentage usage/year
Ampicillin	3	25.0% (3/12x100/1)
Penicillin	9	75.0% (9/12x100/1)
Streptomycin	2	16.6% (2/12x100/1)
Tetracycline	10	83.3% (10/12x100/1)
Tylosin	1	8.40% (1/12x100/1)
Sulfonamide	3	25.0% (3/12x100/1)
Ivermox	1	8.40% (1/12x100/1)

Table 4 – Recommended Dosage for Antimicrobial and Dosage used by Swine Farmers

Types of Antimicrobials	Recommended dosage ml/kg	Average Dosage used ml/kg
Ampicillin	1ml/10kg	1-2ml/10kg
Penicillin	1ml/10kg	2.5-3ml/10kg
Streptomycin	1ml/10kg	1-2ml/10kg
Tetracycline	1ml/10kg	2.5-3ml/10kg
Tylosin	1.5ml/20kg	1-2ml/10kg
Sulfonamide	1ml/10kg	2.0-2.5ml/10kg
Ivermox	1ml/10kg	1.5-2ml/10kg

CONCLUSION

The populace will continue to be concerned about the development and transfer of antimicrobial resistance in livestock and veterinarians will need to be responsive to the occasion. The amount of exposure to some antimicrobial has been linked to increase resistance. The is the need to educate swine farmers on the importance of consulting the veterinarians on time for expatriate advice and treatment in the event of outbreak of disease can not be over-emphasis. Antimicrobial sensitivity test should be recommended before antimicrobial could be administered to animals.

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