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Research Article
Survey of Antimicrobial Residue in Table Eggs among Layer Poultry Farmers in Maiduguri Metropolis, Borno State

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Abstract

Objective: The objectives of this study were to survey for antimicrobial usage and to assess the antibiotic used pattern among poultry layer farmers in Maiduguri Metropolis Borno state Nigeria. **Methodology:** Multistage sampling technique was used together with structured interviewer questionnaire. Coordinates of each farm selected was recorded and map showing spatial distribution of randomly selected farm was constructed. Data were analyzed using Statistical Package for social science. **Results:** The result indicated that the majority of the farmers 30 (85.7%) admitted the use of antibiotic for disease prevention, 29 (82.9%) of the farmers were not aware of antibiotic residue in table eggs and 34 (97.1%) of the farmers were not aware of public health effect of antibiotic residue. **Conclusion:** It was deduced that there is indiscriminate use of most antibiotics in layer farms in Maiduguri Metropolis, There is poor knowledge of drug withdrawal period by farmers and poor awareness on passage of antibiotics from hen to eggs and its public health significance. Prohibited antibiotics for use in food producing animals such as nitrofurans, chloramphenicol and unapproved antibiotic for use in laying hens such as sulfonamide, doxycycline, streptomycin, gentamycin and ampicillin are very much in use in the study area.

Key words: Layer poultry farm, antimicrobial, survey, questionnaire, sampling

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Antibiotics are chemical substances derived from biological sources or by chemical synthesis in the laboratory and they are able to kill or inhibit the growth of microorganisms[1]. Antibiotics are administered parentally, orally or topically[2]. Antibiotics are classified according to their effects (bactericidal or bacteriostatic) and also according to their range of efficacy (narrow or broad spectrum) or based on their mode of action (inhibitors of cell wall synthesis, inhibitors of protein synthesis, inhibitors of membrane function, anti-metabolites and inhibitors of nucleic acid synthesis)[3].Antibiotics use in poultry farming started over a century for prevention, treatment of bacterial infection and growth promotion[2,4,5]. In layer hens, antibiotics are only used to treat and prevent bacterial infections[6].Currently, majority of all food-producing animals receive medication for part or most of their lives[7]. Over the years the problem of antibiotic residue in food producing animals and their effect on human health has been a major concern[5].The residue in chicken eggs are of concern because few drugs are label for used in laying hens even though several medications are approved for other classes of poultry production[8,9].The overall relationship between antimicrobial used in food animals and resistance have been established[10]. Self-medication with antibiotics, use of human antibiotics in food animals and non-regulated prescriptions are the most common causes of residue and may have contributed to antibiotic resistance scourge in the poultry industry in Nigeria[11]. Geidam *et al.*[12], reported in Maiduguri that antibiotics are freely marketed without veterinary prescription with tetracycline being the commonly abused antibiotic by poultry farmers. Layer farming as an entity in Maiduguri Metropolis Borno state of Nigeria have not been surveyed with regards to antibiotic usage. According to Codex Alimentarius Commission very few drugs are approved for used in laying hens and that prompted the need to assess the pattern of antimicrobial used among layer farmers in Maiduguri Metropolis, Borno state of Nigeria.

MATERIALS AND METHODS

Study area: This study was conducted in Maiduguri Metropolis the capital of Borno state in the North Eastern part of Nigeria in the month of January, 2016. It is the largest city in the North Eastern part of country[13]. The city is bounded in the North by Jere Local Government Area, in the West, South and South-West by Konduga Local Government Area, in the North-West by Mafa Local Government Area (Fig. 1)[14]. It has an altitude of about 300 m above sea level. Its geographical coordinates are 11°50′42″ North and 13°09′36″ East. The climate of Maiduguri is characterized by a long dry season with high evaporation rate from October-May and a short wet season for the remaining part of the year. However the native of the city identify four seasons. Crop production and livestock farming are the predominant occupation of the people[15]. Poultry layer production is a profitable business in Maiduguri Metropolis[15].

Study design: Multi stage sampling method was used in selecting layer farms for questionnaire survey.

Maiduguri metropolis is divided into 4 major areas by Borno state water board namely Bolori, Gwange, Kyarimi Park and Shehuri North[16]. In this study, these areas were taken as the primary sampling units. In each area mention above 50% of sub areas were selected and sampled as secondary sampling units. Fifty percent of laying poultry farms within each secondary sampling unit were randomly sampled and taken as tertiary sampling units. Geographical coordinates of the sampled areas were taken and recorded. A spatial distribution analysis of the layer farm sampled were constructed (Fig. 1).

Questionnaire survey: Structured interviewer administered questionnaire was designed and administered to 35 randomly selected layer poultry farmers for the purpose of collecting information on the use of antimicrobials, awareness of withdrawal period, awareness of antibiotic residue in table eggs and awareness of any known health effect of antibiotic residue to public health. Empty sachet and bottles of used antimicrobial drugs were collected and recorded.

Statistical analysis: Data were analysed using Statistical Package Social Science Version 21. Descriptive statistic and Chi-square at 95% confidence interval was used to determine the relationship between variables at p value <0.005.

RESULTS

Total of 35 layer poultry farmers were interviewed, 28 (80%) of the respondents have tertiary education, 5 (14.3%), 2 (5.7%) have secondary and informal education, respectively (Table 1). Majority of the farmers are small scale peasants (94.3%) having equal or less than 500 birds in their farms. Most of the interviewed participants (85.7%) acknowledged that they often apply antibiotics for prevention of diseases. 71.4% farmers were aware of drug withdrawal period,

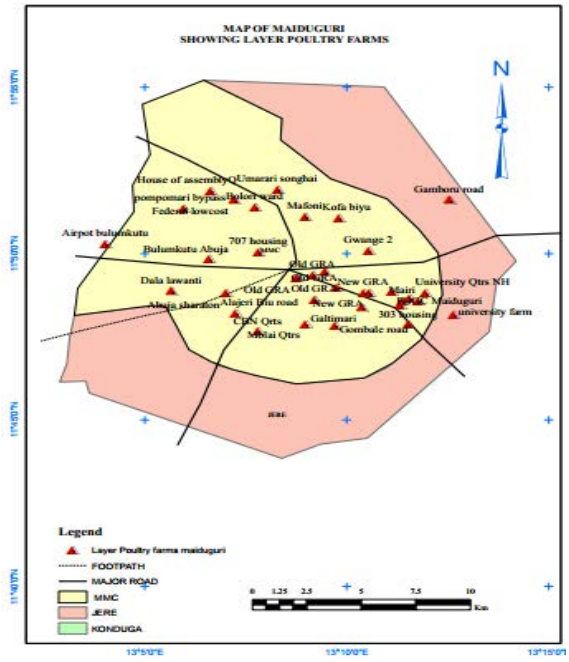

Fig. 1: Map showing spatial distribution of sampled farms in Maiduguri Metropolis, Nigeria

29 (82.9%) of them were not aware of antibiotic residue in table eggs and 97.1% were not aware of the public health importance of the residue. There is significance (p = 0.0004) association between level of education and awareness of public health implication of the residue.

DISCUSSION

Majority (85.7%) of the layer farmers in Maiduguri Metropolis use antibiotic for prevention of disease in their farms. The extensive use of antibiotic by the farmers in the study area might not be unconnected with the lack of knowledge on biosecurity mostly attributed to small scale poultry farmers in the study area. The same finding was reported by Omeiza *et al.*[17], which state that small scale farmers used drug more often due to frequent experiences of poultry diseases as a result of poor biosecurity. Other investigators in Nigeria, Sudan and Tanzania have findings that are different from the result of this work, who attributed the extensive antibiotic usage to large scale layer production farming[18-20]. Flake and Ashitey[21] had also noted that poultry farmers adopted antibiotics as preventive medication to compensate for biosecurity measures. High prophylactic use of antibiotic was reported in Nigeria[17,22], Sudan[23], Tanzania[24] and Uganda[25].

The study also revealed that despite strict observance of vaccination by majority of the farmers (82.9%), greater percentage of the farms (91.4%) had history of disease outbreaks which might be as a result of vaccine failure and/or poor management. Vaccine failure among poultry farmers was reported in Abia state[26].

The survey also found that most farmers (71.4%) are aware of drug withdrawal period in food animals but do not observe it in their farms. One possible reason for failure to observe withdrawal period by farmers is lack of knowledge on the public health implications of drug residues in animal by-product and lack of knowledge regarding the passage of drugs from chicken to eggs. This finding is similar to reports of Sirdar *et al.*[19] and Mubito *et al.*[20], who reported 89 and 100% awareness in Sudan and Tanzania, respectively but it is important to note that Salman *et al.*[23], reported awareness level of 36% in Sudan. In this study most farmers (82.9%) do not believe that drugs can pass from chicken to eggs and 97% are not aware of any public health problem related to antibiotics residue. This is contrary to the finding of Fagbamila *et al.*[18], who reported 87.1% awareness of antibiotic residue by poultry farmers in Jos which might not be unconnected with large scale layer production an attribute of farming in Jos Plateau state. In a similar finding in Sudan by Sirdar *et al.*[19], eighty five (85%) of the farmers are not aware of antibiotic residue and its public health effects on human also the findings of Salman *et al.*[23], in Sudan agree with the findings of this research with 94% of the farmers not aware of antibiotic residue in table eggs and its public health effects.

Table 1: Response to questionnaire survey on the use of antibiotics in layer farms in Maiduguri Metropolis, Borno sate, Nigeria

Survey questions	Respondents (%)
Source of birds	
Zartech	15 (42.9)
Full Hope	1 (2.9)
Crown Hatchery	2 (5.7)
B note	2 (5.7)
Otta farm	9 (25.7)
ECWA farm	6 (17.1)
Educational qualification	
Tertiary education	28 (80)
Secondary education	5 (14.3)
Informal education	2 (5.7)
Farm size	
$\leq$ 500 birds	33 (94.3)
$\geq$500 birds	2 (5.7)
Breeds of birds	
Black Harco	8 (22.9)
ISSA Brown	24 (68.6)
More than one breeds	3 (8.6)
Feed supplements and multivitamins	
Multivitamins	17 (48.6)
Antibiotic	2 (5.7)
Multivitamins and antibiotics	16 (45.7)
Vaccination	
Yes	29 (82.9)
No	6 (17.1)
History of disease outbreak	
Yes	32 (91.4)
No	3 (8.6)
Prophylactic use of antibiotic	
Yes	30 (85.7)
No	5 (14.3)
Awareness of drug withdrawal period	
Yes	25 (71.4)
No	10 (28.6)
Awareness of antibiotic residue in table eggs	
Yes	6 (17.1)
No	29 (82.9)
Awareness of public health effect of antibiotic residue	
Yes	1 (2.9)
No	34 (97.1)

The survey found that tylodox (tylosin and doxycycline) and neofuramycine plus (furazolidone, chloramphenicol, neomycine, erythromycine, oxytetracycline and streptomycine) are the most commonly used antibiotic by the farmers 51.4 and 34.3%, respectively. Table 2 and appendix. This may be attributed to availability of these antibiotics in most of the drug stores in the study area. The finding of Annan-Phrah *et al.*[27], in Ghana indicated the popularity of tylodox usage among layer poultry farms. Among the ingredient of tylodox and neofuramycine (appendix), doxycycline and streptomycine are unapproved antimicrobials in laying hens while furazolidone and chloramphenicol are prohibited substance in food animals due to their long withdrawal period, carcinogenic and mutagenic effect[6,28]. The study also showed that tetracycline (68.1%) and aminoglycoside (45%) were the most popular classes of antibiotics used by layer farmers in the study area (Fig. 2). The popularity of tetracycline and aminoglycoside might be due to their affordable price and availability either as single parent drug or in combinations with different antimicrobial agents, vitamins and minerals. In a similar study by Geidam *et al.*[12], in Maiduguri showed that tetracycline and aminoglycoside were the most popular classes of antibiotics used by poultry farmers. Other investigators from

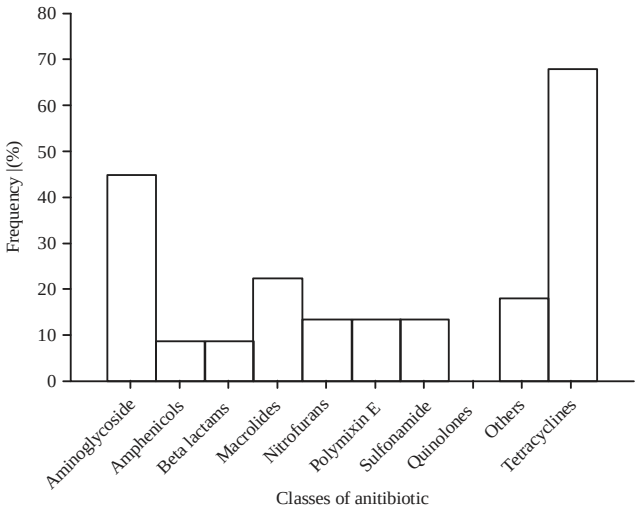

Fig. 2: Classes of antibiotics used in layer chicken farms in Maiduguri Metropolis, Borno state, Nigeria

Table 2: Types of antibiotics used and their approval status by Codex Alimentarius Commission(CAC) in laying hens in Maiduguri, Metropolis, Borno state Nigeria

		*Regulatory status by CAC	
Antibiotics	Number of farms positive (%)	Allowed	Not allowed
Keproceryl®	2 (5.7)	No	Yes
20% CTC®	2 (5.7)	Yes	No
Tylodox®	19 (51.4)	No	Yes
Neofuramycin®	12 (34.3)	No	Yes
Oxyfuravite®	7 (20)	No	Yes
Samoxine®	4 (11.4)	Yes	No
Oxywin®	1 (2.9)	Yes	No
EST®	5 (14.3)	No	Yes
Neotreat®	5 (14.3)	Yes	No
Bidox®	2 (5.7)	No	Yes
Ancoceryl®	2 (5.7)	Yes	No
NCO®	7 (20)	No	Yes
Centre-flor®	2 (5.7)	No	Yes
Triple powder®	1 (2.9)	No	Yes
Tetracin®	1 (2.9)	Yes	No
Amoxitin®	1 (2.9)	No	Yes
EmbaZin Forte®	2 (5.7)	No	Yes
Amprococ®	1 (2.9)	No	Yes
Neoceryl®	5 (14.3)	Yes	No
Doxy-Gen20/20WSP®	2 (5.7)	No	Yes
Admacine®	1 (2.9)	No	Yes
Lodoceryl®	2 (5.7)	No	Yes
Total	22	7	15

*CAC: Codex alimentarius commission

different parts of Nigeria have also reported the popularity of tetracycline among layer farmers[17,18,29-32].

The popularity of tetracycline in other countries among poultry industry was also reported in Tanzania[24,33], Sudan[19,23], Kenya[34], Kuwait[35] and Saudi Arabia[36].

The study observed that antimicrobial agents that are prohibited for use in food-producing animals like nitrofurans (furazolidone, furaltadone, nitrofurazone and nitrofurantoin) and chloramphenicols were used in layer poultry farms in Maiduguri Metropolis which is similar to the report of Geidam *et al.*[12], which confirmed the use of furazolidone by poultry farmers in Maiduguri, Adebowale *et al.*[11], in Ogun state and Ezenduka *et al.*[30], in Enugu State. While the use of chloramphenicol by poultry farmers was reported in Kaduna[17]. These antibiotics are prohibited within European (Commission Regulation 1995), USA, Codex Alimentarius Commission and Nigeria[37] for administration in food producing animals due to their carcinogenic and mutagenic effects. The study also

Appendix: Antibiotics in Use in Maiduguri metropolis trade names and their compositions

Drugs (Trade name)	Antibiotic ingredients
Iodosteryl	Active iodine 55mg/100 mL
Keproceryl	Colistin sulphate 225000 I.V, Oxytetracycline HCL 50 mg, Erythromycine thiocyanate 35 mg, Streptomycin sulphate 35 mg, Vitamins and Minerals.
20% CTC	Chlortetracycline hydrochloride 20%
Tylodox Extra WSP	Tylosin tartarate 20 g and Doxycycline hyclate 15 g
Admacine	Ampiciline Trihydrate 64% and Aluminum magnesium silicate.
Neo-furamycine plus	Furazolidone 6000 mg, Neomycine sulphate 200 mg, Oxytetracycline 50 0mg, Streptomycine sulphate 200 mg, Erythromycine 3500 mg, chloramphenicol 2000 mg, vitamins and Minerals.
Oxyfuravite	Oxytetracycline HCL 2000 0 mg, Furaltadone HCL 20000 mg and Vitamins.
Samoxine	Oxytetracycline HCL 55 mg
Oxywin	Oxytetracycline HCL 55 mg
EST	Erythromycine thiocyanate 180 mg, sulphadiazine sodium 150 mg and trimethoprim 30 mg
Neotreat	Oxytetracycline 60 mg, Neomycine sulphate 40 mg, Vitamins and Minerals.
Bidox	Neomycine sulphate 100 mg and Doxycycline hydrochloride 100 mg
Ancoceryl	Oxtetratcycline HCL 100 mg, Neomycine sulphate 20 mg, Vitamins and minerals
NCO	Neomycine sulphate, Chloramphenicol and Oxytetracycline HCL
Centre –flor	Florfenicol soluble powder 20%
Amoxy-COL WSP	Amoxycillin trihydrate and Colistin sulphate
Triple powder	Chlortetracycline HCL 100 mg, Neomycine sulphate 30 mg and Furaltadone 75 mg.
Tetracin	5% Oxytetracycline Hydrochloride
Amoxitin	Amoxicillin trihydrate114.8 mg and Colistin Sulphate 0.25 M.I.U.
Embazin forte	Sulphaquinoxaline 9.4 g, Diaveridine 0.98 g and Vitamin K 0.05 3 g
Amprocox	Amprolium chlorohydrate 200 mg, Sulfaquinoxaline 150 mg and Vitamins
Topcoc Forte	Sulphaquinoxaline 9.4 g, Diaveridine B.P.V 0.98 g and Vitamin K.
Neoceryl plus	Erythromycine thiocyanate 3500 mg, Oxytetracycline 5000 mg, Stretomycine sulphate 3500 mg, Neomycine sulphate 1000 mg and Colistin sulphate 2500,000 I.U and Vitamins.
Amprocox	Amprolium 200 mg, Sulphadimidine sodium 200 mg and Vitamin K 30 mg
Tylo 200 WSP	Tylosin tartrate 200 mg
Neimycine egg formular	Oxytetracycline HCL 55 mg, Vitamin and Minerals
Neo-oxy egg formular WSP	Oxytetracycline HCL 6000 mg, Neomycin sulphate 4000 mg and Vitamins and Minerals and Amino Acids
Intergendox	Doxycycline hyclate 100 mg and Gentamycine sulphate 50 mg
Antibacterial	Chloramphenicol
Coryl SP	Chlortetracycline 500 mg, Erythromycine 3000 mg, streptomycine 2000 mg, Neomycine sulphate 2000 mg, Vitamins and Minerals.
Anidone (CRD)	Erythromycine 200mg, Tylosin tartarate 200 mg, Eluesin Extract 200 mg and Excipient
Lay Wright Egg formular	Oxytetracycline HCL 6.5 g. Vitamins and Minerals and Excipients
BIO-ETS	Erythromycine thiocynanate 180 g, Trimethoprim 33.3 g and sulfadiazine sodium 166.6 g
Vitaseryl	Colistin sulphate 30,000,000 IU, Oxytetracycline HCL 50,000 mg, Erythromycine 25,000 mg, Streptomycine sulphate 3400 mg, Neomycine sulphate 1000mg, Vitamins and Mineral
Interseryl	Erythromycine thiocyanate 35 mg, Oxytetracycline HCL 50 mg, Streptomycine sulphate 35mg, colistin sulphate 200,000 I.U, Vitamins and Minetals
Biocox	Amprolium hydrochloride 400 mg ascorbic acid 150 mg, sulphadimidine Na, Menadion and sodium bisulfide 50 mg.
Doxy-Gren 20/20 WSP	Doxycycline 200 mg and Gentamycine 200 mg

observed that unapproved antibiotics in laying hens such as sulfonamides, doxycycline, streptomycin, gentamycin and ampicillin were widely use in laying farms in the study area. This might not be unconnected with the lack of awareness among farmers and unqualified staff and poor regulation on the use of such agents.

CONCLUSION

From this study it was concluded that:

- There is small flock size (back yard) farm in Maiduguri with 94.3% of the farmers holding equal or less than 500 birds in their farms
- There is poor knowledge of drug withdrawal by farmers and poor awareness on passage of antibiotics from chicken to eggs and its public health significance
- Prohibited antibiotics for use in food producing animals such as nitrofurans, chloramphenicol and unapproved antibiotic for use in laying hens such as Sulfonamide, doxycycline, streptomycin, gentamycin and ampicillin are very much in use in the study area

RECOMMENDATION

Based on the findings of the study the following recommendation should be put into practice:

- Farmer education on the use of antibiotics and its public health implication
- Antibiotics being a prescription drug should not be freely sold to farmers over the counter
- The established Veterinary Directorate in NAFDAC should ensure the control of importation and subsequent use of antibiotics prohibited for use in food animals

SIGNIFICANCE STATEMENT

The study discover that prohibited antibiotics like nitrofurans and chloramphenicol are patronized by layer poultry farmers in their laying hens and this study help the researchers to quantify the residue level of nitrofurans, chloramphenicol and unapproved antibiotics like sulfonamide, gentamycin and doxycycline in commercial eggs meant for human consumption.

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