

Full Length Research Paper

Inappropriate antibacterial use in layer poultry farms in Gombe Metropolis, Northeast Nigeria, may constitute public health challenges

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Antibacterial is extensively used in poultry to enhance productivity. Inappropriate use could yield unsafe edible poultry products. The study aimed to investigate the pattern of antibacterial use in commercial layer poultry farms in Gombe metropolis. Semi-structured questionnaire was designed and validated. The questionnaire was administered to 38 layer poultry farms to obtain information on poultry farm practices. Data was analysed by inferential statistics using SPSS (Version 20). Of the 38 administered questionnaires, 33 (86.8%) were returned and analysed. Most farms had over 500 birds (69.7%, 23/33) and Isa Brown was the most predominant strain ($\chi^2= 63.11$, $df=3$, $p< 0.05$). Most farms conduct routine vaccination (93.9%, $p<0.05$) and use mixed formulations (78.6%, $p<0.05$) for prophylaxis (87.9%, $p<0.05$). Seven of the nine used formulations (77.8%, $p<0.05$) contain unapproved drugs. Farmers were aware of withdrawal period (84.8%) and the consequences of residues (60.6%) but most (75.8%) do not observe withdrawal period. The inappropriate antibacterial use in layer poultry in Gombe was high and oxytetracycline was the most predominant. Such practice could yield unsafe table eggs with dire health consequences.

Key words: Antibacterial, residues, public health risks, layer poultry farms, table eggs.

INTRODUCTION

Poultry egg production in Nigeria provides rich and affordable source of vital dietary remedy and contributes to national food security (Braun, 2000; FAO, 2008). In Gombe, Hamidu et al. (2004) reported that 90% of layer poultry farmers practice the intensive system (using locally made cages) and the mean flock size was 103

layers. Over a decade later, poultry farms have witnessed significant expansion in flock size and output. Antibacterial agents used in animals are quite similar to those for human use. However, some human-licensed drugs which are not indicated for use on the label (extra label) are being used in animals in many countries

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(Castanon, 2007; Davis et al., 2009; Mubito et al., 2014). Antibacterial drugs have invaluable role in animal husbandry (especially intensive poultry farming), with remarkable impact on improving productivity and feed efficiency. The use of antibacterial drugs has enabled farmers to produce animal-derived foods at relatively lower cost (Tollefson and Miller, 2000; Singer and Hofacre, 2006). Approximately 80% of food-producing animals receive one form of medication or the other for most or part of their lives (Tollefson and Miller, 2000; Pavlov et al., 2008). The continued extensive use of antibacterial on animals has increased the selection pressure for bacteria resistance. Most resistant pathogenic bacteria are of animal origin (Mellon et al., 2001; Inglis et al., 2005). Antibacterial resistance poses the main threat to antibacterial chemotherapy. With the rapid rate at which bacteria gain resistance as against the relatively slow rate at which newer antibacterial drugs are found, experts have warned of a possible post-antibacterial era should the ugly trend not curtailed (Alanis, 2005; Falagas and Bliziotis, 2007). Besides the development of antibacterial resistance, inappropriate use of antibacterial on food-producing animals may also give rise to edible animal products with toxic levels of antibacterial residues. In poultry, many medications are labelled for use in other birds but only few are approved in laying hens (Singer and Hofacre, 2006; Castanon, 2007). This is because the clearance of drug residues from treated laying hen usually requires several weeks and explains why eggs may be laid with drug residues (Goetting et al., 2011). In developing countries including Nigeria, reports have shown widespread and inappropriate use of antibacterial on farm animals without recourse to veterinary prescription (Sirdar et al., 2012; Darwish et al., 2013). For example, the use of Nitrofurans in all food producing animals had been banned by the National Agency for Food and Drug Administration and Control (NAFDAC) and WHO for their carcinogenic and mutagenic effects but are still being used in poultry in many Nigerian states (Kabir et al., 2004; Ezenduka et al., 2011; Omeiza et al., 2012; Geidam et al., 2012; Galadima, 2016). Commercial poultry farming activities in Gombe has been on the increase over the years. The intensive system of poultry farming is common with insufficient biosecurity measures and birds are prone to infections. Antibacterial drugs are commonly used to control infections and improve yield. Veterinary drugs are readily available and easily accessible in cheap formulations usually sold without veterinary prescriptions. Although veterinary regulations are in place, enforcement is very poor.

In spite of reports on the increased use of antibacterial drugs in animal production, there is inadequate information on the pattern of antibacterial use in Gombe metropolis. Hence, this study will provide base-line information on antibacterial use pattern in layer poultry

farms in the area.

MATERIALS AND METHODS

Study area

The study was done in Gombe metropolis, the capital of Gombe State. Gombe is situated on latitude 10° 15' N and longitude 11° 10' E North-eastern Nigeria and covers a total area of 20,265 km². Gombe metropolis covers Gombe Local Government Area and parts of Akko Local Government Area of the State. It lies at a level of 460 m (1509 feet) above sea level and has two distinct climates comprising the dry season (November to March) and the rainy season (April to October) with a mean annual rainfall and temperature of 850 mm and about 32°C, respectively (Labaran, 2008; Ikusemoran et al., 2016). According to the National Population Census (2006), the total human population of Gombe Metropolis was 368,040.

Data collection

A semi-structured questionnaire was designed, validated and used for data collection. Reliability test was also done prior to the administration of the questionnaire. The questionnaire had two sections, A and B. Section A had six questions on the farm's basic information whereas section B had twenty four general questions on the farm's poultry practice and antibacterial use. The respondents comprised farm owners and their respective Veterinarians. The questionnaire sought among others, information on the nature and approval status of the antibacterial use, purpose of use, use of medicated feeds, strains of birds, knowledge and observance of antibacterial withdrawal period, awareness of antibacterial drug residues in table eggs and awareness of the public health risks related to the consumption of eggs with drug residues. A total of thirty eight layer poultry farms were randomly selected and the questionnaires were administered to the farm management staff and/or farm veterinarians. Information was also extracted from empty sachets and bottles of used antibacterial medications collected from the farm premises.

Data analyses

The data collected was compiled and analysed using SPSS statistical tools (IBM® SPSS® Statistics version 20). Chi-square was used to compare percentages. Results were presented using descriptive statistics (frequency and percentage). Differences with $p < 0.05$ were considered statistically significant.

RESULTS

A total of 33 farms out of the 38 farms sampled returned completed questionnaires and they were used for the subsequent analyses. The basic description of the farms indicates that most of the studied farms had over 500 birds (69.7%, $p < 0.05$), keep ISA brown strain (84.8%, $p < 0.05$), conduct routine vaccination (93.9%, $p < 0.05$) and use mixed antibacterial formulations (78.6%, $p < 0.05$) for prophylaxis (87.9%, $p < 0.05$). In addition, the management is aware of withdrawal period (84.8%), drug residues in

Table 1. Basic description of the selected layer poultry farms in Gombe metropolis.

Variable	Frequency (%)
Farm size	
≤500 birds	10 (30.3)
> 500 birds	23 (69.7)
Strain of birds	
ISA brown	28 (84.8)
Shika Brown	2 (6.1)
Brown pullet	2 (6.1)
Others	1 (3.0)
Vaccination	
Yes	2 (6.1)
No	
Prophylactic Antibiotic use	
Yes	29 (87.9)
No	4 (12.1)
Antibacterial formulation used	
Single	6 (21.4)
Mixed	22 (78.6)
Awareness of Antibiotic withdrawal period	
Yes	28 (84.8)
No	5 (15.2)
Observance of required withdrawal period	
Yes	8 (24.2)
No	25 (75.8)
Awareness of antibacterial residue in table egg	
Yes	24 (72.7)
No	9 (27.3)
Awareness of Public Health risk of antibacterial residues	
Yes	20 (60.6)
No	13 (39.4)
Visitation/Inspection by monitoring Team	
Yes	0 (0.0)
No	33 (100.0)

egg (72.7%), public health risk of antibacterial residues (60.6%) but do not observe required withdrawal period (75.8%) (Table 1).

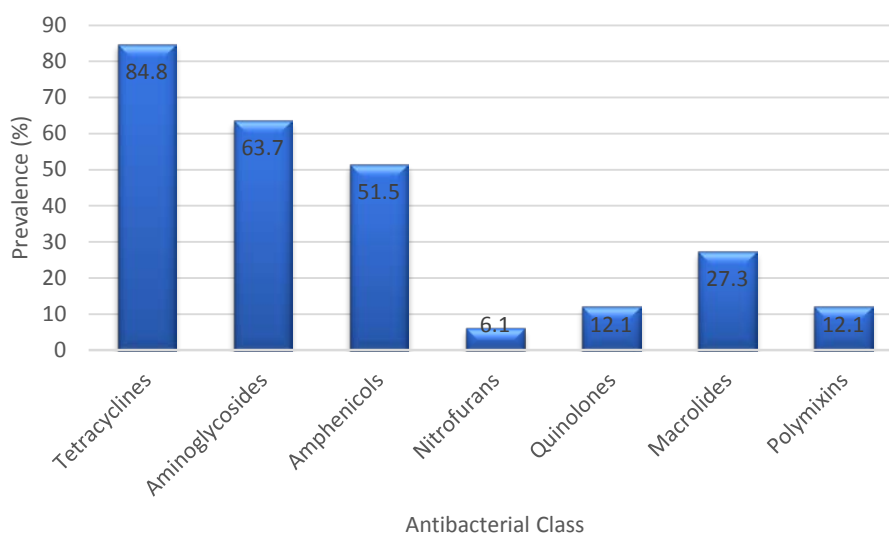
Furthermore, the survey revealed that nine antibacterial formulations (Table 2) belonging to 7 antibacterial classes

are used in the selected farms with the tetracyclines (84.8%) and nitrofurans (6.1%) being the highest and least, respectively (Figure 1). Seven of the nine formulations (77.8%) contain unapproved drug (Table 2) as against 2 approved formulations (22.2%, $p < 0.05$). Two

Table 2. Codex regulatory status of antibacterial use in layer poultry farms in Gombe metropolis.

Antibacterial composition	Frequency (%)	Status
Oxytetracycline, **Chloramphenicol and Neomycin	15 (45.5)	Unapproved
Oxytetracycline, Erythromycin, *Streptomycin and Colistin	2 (6.1)	Unapproved
Oxytetracycline	6 (18.2)	Approved
Oxytetracycline and **Furaltadone	2 (6.1)	Unapproved
Oxytetracycline and Neomycin	1 (3)	Approved
*Doxycycline	7 (21.2)	Unapproved
*Doxycycline and Tylosin	5 (15.2)	Unapproved
*Doxycycline and *Gentamicin	5 (15.2)	Unapproved
*Enrofloxacin	4 (12.1)	Unapproved

*----Unapproved antibacterial in layer poultry, **---- Prohibited antibacterial in layer poultry.

**Figure 1.** The prevalence of antibacterial use in layer poultry farmers in Gombe metropolis.

of the nine formulations (22.2%) contain prohibited drugs. Oxytetracycline is the most frequently used drug (84.8%) and is often combined with other drugs like chloramphenicol, neomycin, erythromycin, streptomycin and furaltadone (Table 2).

DISCUSSION

The present study revealed that majority (69.7%) of the surveyed farms had layer birds between five hundred to a few thousand and such farms are classified as small-medium scale commercial farms (Abimiku, 2008; FAO, 2008). This indicates a significant growth on the previous mean flock size of 103 layer birds reported by Hamidu et al. (2004) in the same study area. Increased antibacterial used in large scale farming across some Nigerian states

and African countries have been reported (Fagbamila et al., 2010; Sirdar et al., 2012; Mubito et al., 2014). Prophylactic use of antibacterial in poultry helps to improve productivity and serves as remedy to deficient biosecurity measures in farms (El-Nasir et al., 2012; Omeiza et al., 2012; Mubito et al., 2014). Possible reasons for tetracyclines preference as observed in this study might be due to its broad spectrum of activity, efficacy, availability and relative affordability within the study area. Similar studies have reported tetracyclines as the most widely used antibacterial in poultry in Enugu (Ezenduka, 2014), in Kaduna (Kabir et al., 2004), in Jos (Fagbamila et al., 2010), in Maiduguri (Geidam et al., 2012; Galadima, 2016) and in Ibadan (Olatoye and Saraye, 2012). Similar findings were observed in other African countries by El-Nasir et al. (2012) and Sirdar et al. (2012) in Sudan, Mitema et al. (2001) in Kenya, Nonga

et al. (2010) and Mubito et al. (2014) in Tanzania, and in the Middle East by Al-Ghamdi et al. (2000) and Al-Wabel (2011) in Saudi Arabia and by Al-Mazeedi et al. (2009) in Kuwait. In spite of the regulations on veterinary drug use in poultry, the unapproved and prohibited antibacterial still constituted a larger proportion of the antibacterial used in the surveyed farms. This is similar to a report by Olatoye et al. (2012) who observed the continued use of chloramphenicol in poultry farms in Ibadan. Many antibacterial used in the farms (Fluoroquinolone, Gentamicin, Doxycycline and Streptomycin) are not approved for layer poultry because of the slow clearance of their residues in laying hens (Goetting et al., 2011). Other antibacterial used (Furaltadone and Chloramphenicol) are prohibited in layer poultry because the safe level of their residues couldn't be established (Davis et al., 2009). This portends a serious public health risk regarding the safety of table eggs produced in the study area. Chloramphenicol use has been banned for its detrimental health effects including bone marrow toxicity, reproductive disorders and hepatotoxicity (Settepani, 1984; WHO, 1988; Waltner-Toews and McEwen, 1994; Pavlov et al., 2008; Nisha, 2008). Owing to its adverse effect, chloramphenicol was withdrawn almost immediately after licensing. Its major toxicity is dose-dependent bone marrow toxicity with significant reduction in all the cellular components of the blood. The toxic effect is more pronounced in infants resulting in idiosyncratic aplastic anaemia and cardiovascular collapse (Nisha, 2008). Similarly, furaltadone (a nitrofurans) was still in use in some (6.1%) layer poultry farms in Gombe despite prohibition for its carcinogenic and mutagenic effects (Pavlov et al., 2008; Nisha, 2008). In addition, furaltadone residues may result in transmission of antibacterial resistant organisms to humans and failure of chemotherapy. The residues of furaltadone and oxytetracycline can trigger immunopathological reactions such as autoimmune and carcinogenic responses (Nisha, 2008). Similar reports on nitrofurans use in poultry farms in Enugu State (Ezenduka et al., 2011), Kaduna (Omeiza et al., 2012) and Maiduguri (Geidam et al., 2012; Galadima, 2016). In Nigeria, the National Agency for Food and Drug Administration and Control has placed a ban on the use of chloramphenicol and nitrofurans in poultry and livestock since 1996 (NAFDAC, 1996). Toxic effect of the tetracyclines residues include gastrointestinal disturbances, teratogenic risk to the foetus, allergic reactions, development of resistant pathogens for human and animals, permanent discoloration of teeth of young children and immunopathological effects (Shahid et al., 2007; Nisha, 2008).

The observance of antibacterial withdrawal period in this study was low (24.2%) in spite of the high (84.8%) level of awareness. This is in contrast with some studies that attributed the non-observance of antibacterial withdrawal periods to ignorance of the presence of

residues in edible eggs and their health effects (El-Nasir et al., 2012; Sirdar et al., 2012; Galadima, 2016). However, it is similar to report from Jos by Fagbamila et al. (2010) who observed high (87.1%) level of awareness of antibacterial residues in eggs and their health implications. The poor observance of withdrawal periods in the present study could be attributed to the absence of monitoring by the state to regulate the activities of layer poultry farmers. Since the regulations on poultry farming activities are not enforced, farmers' excesses and inappropriate practices are inevitable to maximize yields and profit.

The study concludes that the use of antibacterial in layer poultry was high (mainly for prophylaxis) and oxytetracycline was the most predominantly used. Inappropriate use of antibacterial was common with poor observance of withdrawal periods and the use of unapproved and prohibited antibacterial. The inappropriate use of antibacterial could lead to the emergence and transmission of resistant bacteria, and egg produce with toxic levels of drug residues. The continued use of unapproved and prohibited antibacterial portends toxicological consequences on public health. The study recommends adequate enforcement of the regulations on appropriate farm practices by all concerned stakeholders.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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