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Antibiotics in use in litter-based semi-intensive exotic layer rearing system in Abomey-Calavi district, Benin

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Abstract

Despite the importance of antibiotics in the successful control of bacterial poultry diseases, their therapeutic and non-therapeutic misuse is a threat to the production and users of poultry products and by-products. In order to promote a prudent and public health-friendly use of antibiotic drugs in Benin poultry production system, a preliminary cross-sectional observational study was carried out to evaluate the antibiotic molecules utilized by poultry producers in litter-based semi-intensive layer rearing system on 44 poultry farms in Abomey-Calavi district on the basis of a semi-structured questionnaire completed by direct observations made *in situ*. The results showed that all the surveyed layer farms make use of antibiotics in curative mode and half of them in addition, used them prophylactically. Eight (8) antibiotic molecules are routinely used by producers. These are tetracyclines (25.71%), fluoroquinolones (25.14%) and polypeptide antibiotics (20%) which are more frequent, followed by macrolides (10.29%), sulfonamides (7.43%), aminoglycosides (5.71), trimethoprim (2.29%) and finally beta-latamines (1.14%). The diversification of antibiotic drugs and molecules in the control of diseases is practiced by farmers who make use of 24 antibiotic drugs in total and spend $ 0.02 per month per chicken for the purchase of these drugs. Potential risks of allergic reactions are possible with residues of penicillins and those of sulfonamides. The use of fluoroquinolones molecules to control poultry diseases is a big public health concern, because of the induced-germs resistance characteristic of the residues in human; for fluoroquinolones is active both on certain poultry and human gastrointestinal pathogens.

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Introduction

The intensification of animal production in the world in recent decades was promoted by the use of veterinary drugs, particularly anti-microbial drugs in modern livestock (Tatsadjieu *et al.,* 2009).

The use of anti-microbials as drugs is recent in contemporary history; it is considered one of the major advances in medicine, as it has drastically reduced morbidity and mortality due to many infectious diseases of bacterial etiology (Sanders *et al.,* 2011). Thus, different veterinary products are used in poultry farming, under the responsibility or not of veterinarians in order to control diseases and improve animal productivity (Alambedji *et al.*, 2008). Among these products, antibiotics occupy a prominent place directed against infectious diseases of bacterial etiology.

From the Greek *anti*-meaning "against" and *bios* "life", antibiotics are substances of natural origin manufactured by microscopic fungi, bacteria and much more rarely plants, or synthetic substances which are able: either to destroy bacteria: bactericidal antibiotics; or to stop the replication of bacteria: bacteriostatic antibiotics (Chardon and Bruger, 2014). It is possible to distinguish the different antibiotic molecules based on their families: tetracyclines, nitrofurans, aminoglycosides, macrolides, sulfonamides, beta-lactams; origins: natural and semi-synthetic (beta-lactams, macrolides, tetracyclines, aminoglycosides), synthetic (nitrofurans, sulfonamides); based on their antibacterial activities: bacteriostatics (tetracyclines, macrolides, sulfonamides), bactericides (betalactamines, aminoglycosides) (Randrianomenjanahary, 2006). These antibiotics are used in different ways in farm animals, and for different purposes. Despite the importance of antibiotics in the successful control of bacterial poultry diseases, their therapeutic and non-therapeutic misuse is a threat to the production and users of poultry products and by-products.

The perverse use of antibiotics is increasingly associated with the occurrence of antibiotic-resistant bacteria (Ghosts and Lapara, 2007). Whatever the nature of the antibiotic administered, the risk of finding residues in animal food products (meat, milk, eggs) is present. It is for this reason that a threshold has been set for each drug beyond which the amount of residues present in food can jeopardize the consumer health status. It is the Maximum Residue Limits (M.R.L.) (Kantati, 2011). However, their uncontrolled use may lead to the occurrence of residues in animal-derived products, especially when the drug withdrawal period is not respected by the users. The potential risks associated with the presence of residues in animal food product are of several kinds: risks of cancers (nitrofurans), risks of allergies (penicillins, streptomycin), risks of toxicity (chloramphenicol), disturbance of the intestinal flora (tetracycline) selection of antibiotic-resistant human bacteria (several antibiotics are involved) (Blumenthal *et al.,* 2019). Veterinary drug residues prevalence in animal food products is less than 1% in Europe, while it reaches 94% in some African countries (Mensah *et al.,* 2014a). Urgent measures to reduce the misuse of antibiotics and therefore minimize the risk of development of bacterial resistance to antibiotics and the presence of antibiotic residues in poultry products and by-products are essential. This is to ensure the continued availability of effective antibiotics drug to control poultry bacterial diseases and at the same time preserve poultry product consumer health. The current study came up with the antibiotic molecules used in litter-based semi-intensive exotic layer rearing system in the district of Abomey-Calavi, South Benin.

Materials and methods

Study area

The study was carried out in the district of Abomey-Calavi a southern region of Benin which lies within 6° 26′ 55″ N, 2° 21′ 20″ E, the total territory is 650 km². The climate is subequatorial marked by two rainy seasons and two dry seasons. The average mean annual minimum temperatures is 20 °C and the maximum 30 °C with the relative humidity range from 70 to 80%.

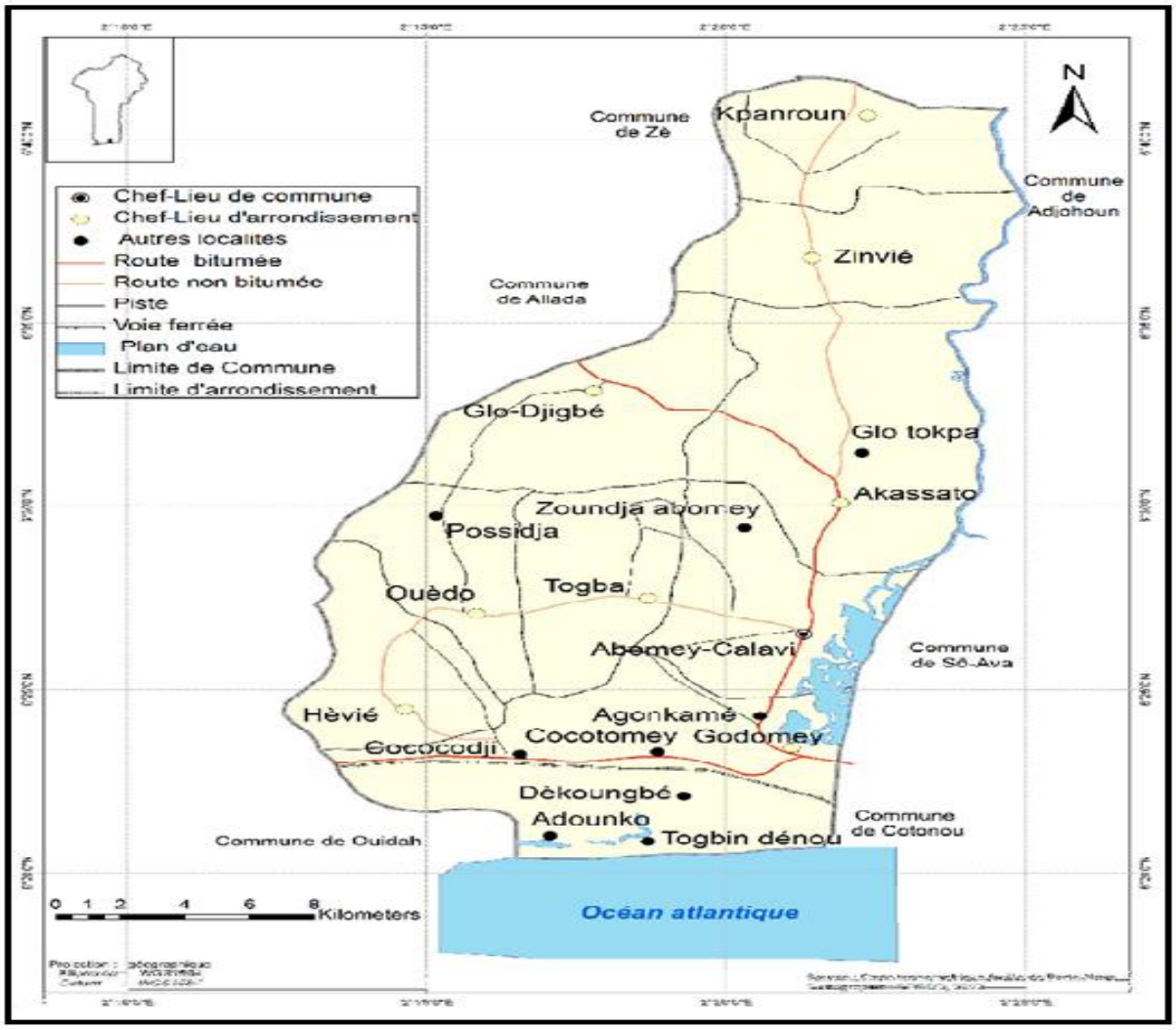

Fig. 1. District of Abomey-Calavi.

Study design and farms selection

The present study is a cross-sectional observational study whose main purpose was to evaluate the antibiotic molecules used in litter-based semi-intensive exotic laying hens rearing system. The study took place in June 2018 on the basis of a semi-structured questionnaire. Also direct observations made in poultry farms during the visits helped in data collection.

A sample of 44 poultry farms in Abomey-Calavi district were selected to participate in this study using a simple random sampling method in collaboration with the National Professional Poultry Producers Association (UNAP-Benin) database. The final stage was a non-probabilistic selection based on the obvious willingness of the poultry farmers to participate in the study.

Data collection

Antibiotic drugs (trade names) used by farmers, the monthly cost of buying antibiotics, the method of controlling bacterial diseases were recorded. The antibiotic molecules were identified using the trade name of the drugs collected in the visited poultry farms with the help of some veterinary practitioner in charge of the selling of these drugs.

Statistical analysis

The collected data was stored with the facilities of Excel of Microsoft Corporation version 2010. The descriptive analysis was carried out in the SAS software (Statistical Analysis System) version 9.2. and graphs made in SPSS version 16.0. The multinomial test (Chi squared) was used to assess and compare the antibiotic molecules used in the surveyed poultry farms.

Results

The results in Table 1 show that all the poultry farmers use antibiotics to cure diseases in the production system. 48% of them, in addition use antibiotic drugs prophylactically. A total of 8 different antibiotic molecules were in use in this production system with an average of 3.42 different antibiotic molecules per poultry farm. 24 different antibiotic drugs were in use in the surveyed farms with a mean of 3.58 antibiotic drugs used per farm. Each farmer spends 17 FCFA per month per hen for the purchase of antibiotic drugs an equivalence of 0.02 US Dollars per hen per month.

Table 1. Antibiotics mode of utilization and financial cost.

Antibiotics	Types	Means (M ± SE)	Cost/hen/ month (USD)	Mode of utilization	
				Curative (%)	Preventive (%)
Molecules	8	3.42 ± 0.28	0.02	100	48
Drugs	24	3.58 ± 0.29			

M : Mean, SE : Standard Error, USD : United States Dollars.

The molecules used in litter-based semi-intensive exotic layer rearing system in the surveyed zone were: beta-lactams, tetracyclines, macrolides, aminoglycosides, polypeptide antibiotics, fluoroquinolones, sulfonamides and finally trimethoprim (Fig. 2). Tetracyclines, fluoroquinolones and polypeptide antibiotics almost equally ($p > 0.05$) accounted for 70% of the total antibiotics used in the surveyed area, followed by Macrolides (10%), sulfonamides (7%) and aminoglycosides, (6%).

Discussion

All poultry producers in the surveyed farms make use of antibiotic drugs in curative mode and half of them in addition used them prophylactically. Our results are consistent with those obtained by Dibner and Richards (2005), Guardabassi *et al.* (2008), Bowater *et al.* (2009), Nickell and White (2010) and Mensah *et al.* (2014b). According to Sander *et al.* (2011), drugs are used either as a curative treatment applied individually or collectively to animals suffering from microbial diseases, or as a preventive treatment to prevent the appearance of certain pathologies or, in some extreme cases, to compensate for inadequacies in hygiene in livestock farming. A total of 8 molecules of antibiotics are used by poultry producers in Abomey-Calavi district in the following proportions: tetracycline (25.71%); fluoroquinolones (24.14%); polypeptide antibiotics (20%); macrolides (10.29%); sulfonamides (7.43%), aminoglycosides (5.71%); trimethoprim (2.29%); beta-lactams (1.14%). Four of the antibiotics used by poultry producers such as tetracyclines, penicillin, macrolides and sulfonamides are also used by cattle producers (Mensah *et al.*, 2014a), with tetracyclines as the most used molecule. Ogunleye *et al.* (2008) and Adebowale *et al.* (2016) reported the use of gentamicin, tetracyclines, enrofloxacin, ciprofloxacin, streptomycin and furaltadone in Ogun State in Nigeria. Allergic risk exists in particular, some antibiotics such as penicillins, sulfonamides and fluoroquinolones, may be the cause of human allergic reactions (Chardon and Brugere, 2014). The diversification of antibiotic drugs and molecules in the control of poultry diseases is practiced by farmers who make use of 24 different antibiotic drugs in total, with an average of 3.42 and 3.58 different antibiotics molecules and drugs used per poultry farm respectively. Ogunleye *et al.* (2008) reported that seven of the eight farms studied used between three and seven different antimicrobial agents at different times for prophylaxis or treatment purposes in Nigeria. Each farmer spends 17 FCFA per month per hen for the purchase of antibiotic drugs in veterinary pharmacies, an equivalence of 0.02 US Dollars. 35% of disease control costs are used to control bacterial diseases in Nigeria with the use of antibiotics (Adebowale *et al.*, 2016). In 2001, the

World Health Organization (WHO) estimated that at least 50% of the world's antibiotics were for livestock and companion animals (Chardon and Brugere, 2014). Antibiotic molecules banned from use in the European Union such as chloramphenicol, nitrofuran and furazolidone (Berendsen *et al.,* 2010) are not used in poultry farms in the district of Abomey-Calavi. Regardless of the antibiotic molecule used, the difficulty of respecting the drug withdrawal period in laying hen farms in a continuous production cycle will lead inevitably to the presence of residues in table eggs that can be prejudicial to consumer health. Marcincak *et al.* (2006) detected sulfadimidine residues by the PREMI TEST method 8 days after treatment in animal food products. The administration of a drug to an animal may result in residues or drug metabolites in animal-derived foodstuffs such as meat, milk and eggs (Chardon and Brugere, 2014). According to the same authors, certain antibiotics, especially penicillins, sulfonamides and fluoroquinolones, may be the cause of allergic-type reactions.

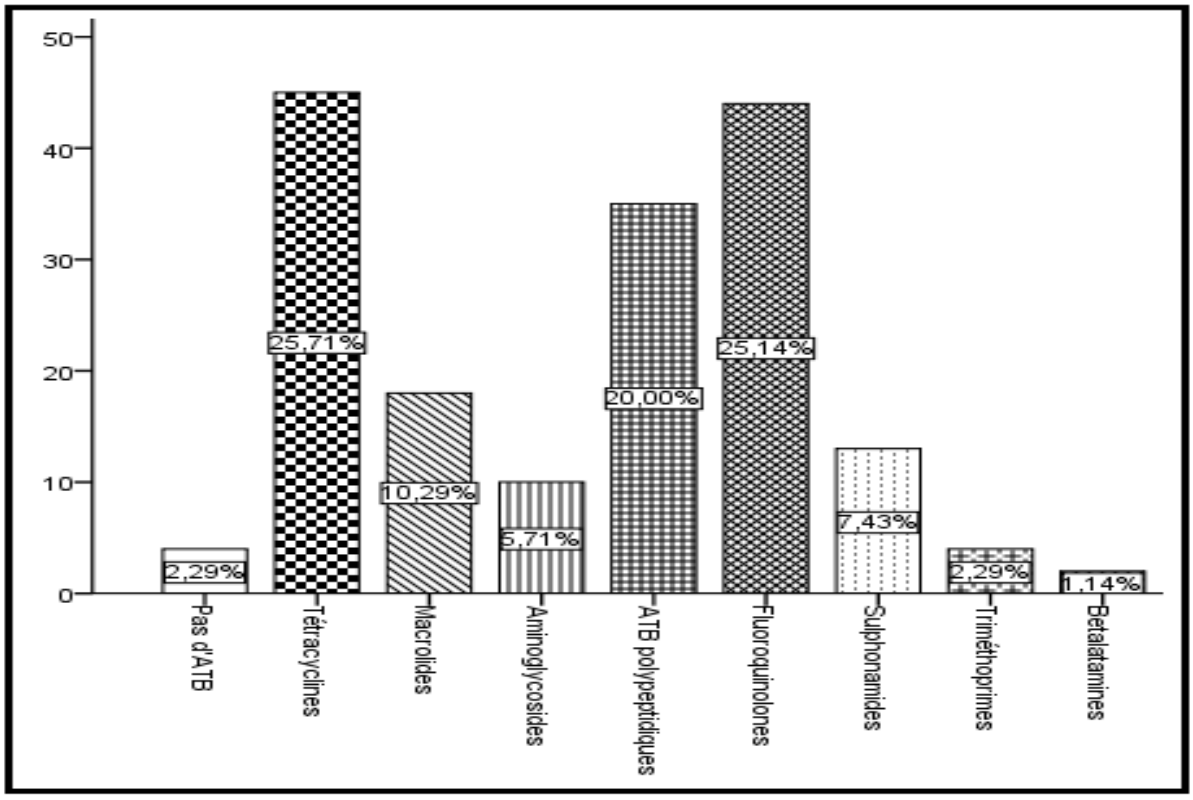

Fig. 2. Antibiotic molecules used in layer farms in Abomey-Calavi district.

The present study has thus, made it possible to highlight and evaluate the different antibiotic molecules used in litter-based semi-intensive exotic layer rearing system in Abomey-Calavi district in Benin. The residues of certain antibiotic molecules such as penicillins, and especially fluoroquinolones are big public health protection issues.

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