Available online at http://www.journalijdr.com

ISSN: 2230-9926

International Journal of Development Research
Vol. 4, Issue, 10, pp. 2029-2032, October, 2014

International Journal of
DEVELOPMENT RESEARCH

Full Length Research Article

OCCURRENCE OF ANTIBIOTIC RESISTANT ENTERIC *ESCHERICHIA COLI* IN MARKETED CHICKEN IN IBADAN METROPOLIS, SOUTHWEST NIGERIA

[1]Adekemi F. Fagbohun, [2,*]Adebowale I. Adebiyi, [1]Matthew Ojo, [1]Azeez A. Oyelese and [1]Tosin B. Ojokan

[1]Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan Nigeria
[2]Department of Veterinary Microbiology & Parasitology, University of Ibadan, Ibadan Nigeria

ARTICLE INFO

Article History:
Received 01st July, 2014
Received in revised form
31st August, 2014
Accepted 20th September, 2014
Published online 25th October, 2014

Key words:
Antibiotics;
Resistance;
Marketed chicken;
E. coli

ABSTRACT

In most developing countries including Nigeria, indiscriminate use of antibiotics in food animals could be incriminated as a critical factor leading to antimicrobial resistance. Intestines from marketed chicken in fifteen market locations in Ibadan metropolis were randomly sampled to examine for antibiotic resistant enteric bacteria to some commonly used antibiotics. Bacteriological examination of intestinal samples was done using standard methods, followed by in-vitro antibiotic sensitivity test by agar gel diffusion technique. The enteric bacteria, *Escherichia coli* that were multi-drug resistant to different combinations of aminoglycosides, cephalosporins and fluoroquinolones group of drugs were isolated. The intestines were also noticed being scavenged on by animals and collected by some small hold farmers to feed their animals. These commensal bacteria present in fresh marketed chicken may serve as reservoirs for resistant genes that could potentially be transferred to pathogenic organisms in animals and humans. Thus, the occurrence of antibiotic resistance in enteric bacteria isolated from marketed chicken in Ibadan metropolis calls for veterinary and public health concern, and may suggest a potential involvement in the occurrence of resistance food-borne pathogens in the study area. Therefore, responsible therapeutic use of antibiotics against infections should follow appropriate diagnosis and antibiotic susceptibility assessments.

INTRODUCTION

The high population density of modern intensively managed livestock operations have resulted in sharing of both commensal flora and pathogens, which can be conducive to rapid dissemination of infectious agents (Landers *et al.*, 2012). As a result, livestock in these environments commonly require aggressive infection management strategies, which often include the use of antibiotic therapy (McEwen and Fedorka-Cray, 2002). However, extensive use of antibiotics in poultry production as growth promoters, prophylaxis and treatment of infections have led to misuse of antibiotics and consequent generation of sufficient genomic selective pressure that enable microbes to adapt and acquire resistance (Witte, 2001). There is substantial argument regarding use of antibiotics in food animals raised for human consumption (Landers *et al.*, 2012).

Corresponding author: Adebowale I. Adebiyi
Department of Veterinary Microbiology & Parasitology, University of Ibadan, Ibadan Nigeria

The potential threat to human health resulting from inappropriate antibiotic use in food animals is significant, as pathogenic resistant organisms proliferated in these livestock are poised to enter the food supply and could be widely spread in food products (Cuis *et al.*, 2005; Parveen *et al.*, 2007). Commensal bacteria found in livestock are frequently present in fresh meat products and may serve as reservoirs for resistant genes that could potentially be transferred to pathogenic organisms in humans (Diarrassouba *et al.*, 2007; Mena *et al.*, 2008). Antibiotic use plays a major role in the emerging public health crisis of antibiotic resistance (Landers *et al.*, 2012). Although the majority of antibiotic use occurs in agricultural settings, relatively little attention has been paid to how antibiotic use in farm animals contributes to the overall problem of antibiotic resistance. There is strict regulation on the use of antibiotics in food animals in developed countries. However, in developing countries, poultry farmers' access to antibiotics is unrestricted and imprudent administration of antibiotics without veterinary prescription is common practice (Kabir *et al.*, 2004; Okeke *et al.*, 2007).

The World Health Organization (WHO) stated that antimicrobial use is associated with the risk of transfer of resistant pathogens between humans and animals. Currently, it is the general consensus that even slight traces of antibiotics in food for human consumption should not be tolerated (WHO, 2000), and this should be extended to food for animal consumption. Hence, there is need for regular investigation and monitoring of the use of antibiotic in food producing animals as well as the prevalence of resistant pathogens. Therefore, a survey was carried out to evaluate the occurrence of antibiotic resistant strains of enteric bacteria in chicken sold in some major markets in Ibadan metropolis, Nigeria.

MATERIALS AND METHODS

Sampling and sample collection

The study was carried out in three main markets (designated A, B and C) in each of the five local government areas that make up Ibadan metropolis. Ibadan is located in southwest Nigeria at 8°00′N 4°00′ E with estimated population of 5.6 million people (NPC, 2006). Chicken intestines were sampled by systematic random method whereby samples from every third chicken seller in each market in the study area were collected. A total of 1,200 chicken intestines were sampled between February and April 2014. The samples were processed bacteriologically by streaking the sample suspension onto nutrient agar, MacConkey agar and Eosin Methylene Blue agar and incubated aerobically at 37°C for 24-48 hours. The isolates were identified morphologically and biochemically based on standard bacteriological methods as described by Barrow and Feltham (1993) and Garcia and Isenberg (2007). Successively, the in-vitro antibiotic sensitivity test using agar-disc diffusion methods (Matsen and Barry, 1974) were carried out for the isolated bacteria with the antibiotic disc (Abtek biologicals, UK) of the commonly used antibiotics in Nigeria specifically; Erythromycin; ERY (10µg), Ciprofloxacin; CPR (10µg), Gentamicin; GEN (10 µg), Augmentin; AUG (30 µg), Nitrofurantoin; NIT (300 µg), Ofloxacin; OFL (10 µg), Levofloxacin; LEV (10 µg), Cloxacillin; CXC (5 µg), Ceftriaxone; CTR (30 µg), Ceftazidime; CAZ (30 µg), Ampicillin; AMP (10 µg) and Cefuroxime; CRX (30 µg) for Gram positive and negative organisms (Matsen and Barry, 1974). The zones of inhibitions produced by the bacteria isolates to the respective antibiotics were compared with the recommended standards published by CLSI (2008) for the determination of the sensitive and resistant bacteria.

RESULTS

Escherichia coli (*E.coli*) was mainly isolated from the fifteen markets in the study area (Fig. 1) with mean values of 3.22±0.89, 3.63±0.26, 3.63±0.36, 3.14±0.65 and 2.70±0.28 ($\times 10^6$) cfu/ml for Ibadan southwest, north, northwest, southeast and northeast respectively. Resistances to multiple antibiotics were common especially to (second and third generation) cephalosporins, aminoglycosides and fluoroquinolones group of drugs (Table 1). It was also observed that the chicken intestines were scavenged on by feral carnivores and birds, and also collected by some small hold farmers to feed their pigs and fish.

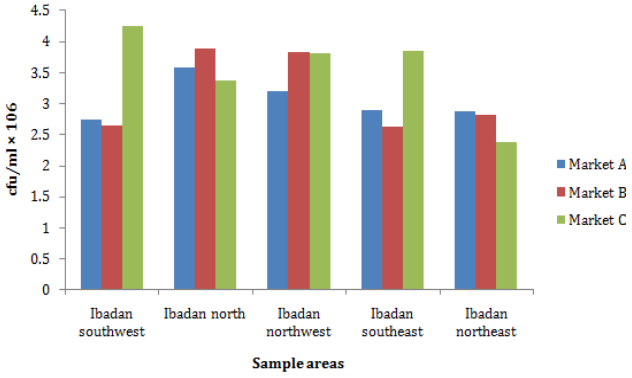

Fig. 1. Prevalence of Escherichia coli in marketed chicken in Ibadan metropolis

DISCUSSION

In most developing countries including Nigeria, indiscriminate administration of antibiotics to food animals is a common practice due to unregulated distribution and access of farmers

Table 1. Antibiotic resistance and sensitivity profiles from selected chicken markets in Ibadan

LGA	MARKET	RESISTANT PROFILE	SENSITIVITY PROFILE
Ibadan southwest	A	AMP,CAZ,CRX,GEN,CPR,OFL,AUG	NIT
	B	AUG,GEN,AMP,OFL,CPR	CAZ,NIT,CRX
	C	AUG,CAZ,CRX,GEN,CPR,AMP,OFL,NIT	-
Ibadan north	A	AUG,OFL,AMP,CAZ,GEN,CPR	CRX,NIT
	B	GEN,AUG,AMP,CPR,ERY,CXC	OFL,CRX,CAZ
	C	AMP,CAZ,CRX,GEN,CPR,OFL,AUG	NIT
Ibadan northwest	A	CPR,AUG,LEV,CRX,CAZ,GEN,CXC,OFL,NIT	-
	B	AUG,CRX,CAZ,LEV,CTR,GEN,OFL,CXC,ERY,CPR,NIT	-
	C	CRX,CPR,GEN,NIT,LEV,OFL,CXC,AMP,CAZ	AUG
Ibadan southeast	A	OFL,CRX,LEV,GEN,CPR,AUG,NIT,CXC,CAZ	-
	B	OFL,CRX,CXC,AUG,GEN,NIT,CAZ,CPR	LEV
	C	CPR,GEN,CXC,OFL,CRX,LEV,CAZ,AUG	NIT
Ibadan northeast	A	GEN,CXC,OFL,AUG	CAZ,CRX,CPR,NIT
	B	CPR,GEN,CRX,AMP,OFL,AUG,NIT	CAZ
	C	CRX,GEN,CXC,OFL,AUG,NIT	CPR,CAZ

CRX: Cefuroxime; NIT: Nitrofurantoin; AUG: Augmentin; OFL: Ofloxacin; AMP: Ampicillin; CAZ: Ceftazidime; GEN: Gentamicin; CPR: Ciprofloxacin; ERY: Erythromycin; CXC: Cloxacillin; CTR: Ceftriaxone; LEV: Levofloxacin

to veterinary drugs in the open markets or over the counter without veterinary prescription and supervision (Dipeolu, 2002). This misuse or abuse in food animals could be incriminated as a critical factor leading to antimicrobial resistance as well as posing health risks to consumers (both humans and animals) due to the presence of antibiotic residues in animal products. The results of this study revealed the occurrence of antibiotic resistance in enteric *E. coli* isolated from marketed chicken in Ibadan metropolis. The majority of the bacterial strains possessed resistance to multiple antimicrobials such as fluoroquinolones, cephalosporins and aminoglycosides. It was observed that the enteric *E. coli* isolated in the study area were highly resistant to second generation (cefuroxime) and third generation (ceftazidime and ceftriaxone) cephalosporins, and also fluoroquinolones (ofloxacin and ciprofloxacin). This is similar to earlier reports (Chiu *et al.,* 2002; Endimiani *et al.,* 2012) that documented increasing enteric bacterial infections due to resistance to fluoroquinolone and cephalosporin groups of antibiotics. This resistance spectrum of market samples could have been caused by farmers adding low doses of antibiotics to livestock feed to enhance feeding efficiency so that the animals need less food to reach marketable weight (Manie *et al.*, 1998). This practice may lead to the development of antibiotic-resistant bacteria which could cause diseases in animals untreatable with conventional antibiotics.

It was observed that the chicken intestines were scavenged on by neighbourhood dogs and cats, as well as feral birds and also used to feed small hold pigs and fish. Hence, the occurrence of multiple antibiotic resistances among the enteric bacterial isolates from marketed chicken in the study area may make their offal of public health and veterinary significance because the resistance factors may be transmitted to the dogs, cats and scavenging feral birds, as well as the pigs and fish fed with the offal. These findings highlight the serious implications of misuse of antibiotics as frequently practiced in some livestock production in Nigeria. Also, of interest is the fact that these antibiotics are used in human medicine and may suggest the possibility of indiscriminate usage of these antibiotics in poultry production in the study area which is noted as a commercial poultry hub in Nigeria.

The analysis of antibiotic resistance has demonstrated that identical elements are found in animals and humans and the occurrence applies to pathogenic (e.g. foodborne), opportunistic and commensal bacteria (Teuber, 2001). The potential threat to human health resulting from inappropriate antibiotic use in food animals is significant, as pathogenic-resistant organisms propagated in these livestock are poised to enter the food supply and could be widely disseminated in food products (Ramchandani *et al.,* 2005; Garofalo *et al.,* 2007). Commensal bacteria found in livestock are frequently present in fresh meat products and may serve as reservoirs for resistant genes that could potentially be transferred to pathogenic organisms in humans (Diarrassouba *et al.,* 2007; Mena *et al.,* 2008) and other animals. Hence, the occurrence of antibiotic resistance in enteric bacteria isolated from marketed chicken in Ibadan metropolis calls for veterinary and public health concern, and may suggest a potential involvement in the occurrence of resistance food-borne pathogens in the study area. There has been a global concern on the possible development of resistance to antimicrobial agents in organisms studied as a result of misuse of drugs without carrying out appropriate sensitivity test (Aarestrup, 2005). Therefore, the high occurrence of antimicrobial resistance in the study area could have resulted from misuse or misapplication of these drugs by the poultry farmers. Consequently, indiscriminate use of antibiotics and feeding of poultry offal to animals should be discouraged. Similarly, responsible therapeutic use of antibiotics against infections should follow appropriate diagnosis and antibiotic susceptibility assessments.

REFERENCES

Aarestrup, F.M. 2005. Veterinary drug usage and antimicrobial resistance in bacteria of animal origin. *Basic Clin. Pharmacol. Toxicol.*, 96: 271-281

Barrow, G.H. and Feltman, R.K.A. 1993. Cowan and Steel's manual for identification of medical bacteria, 3rd edition, Cambridge University Press, U.K, pp. 331

Chiu, C.H., Wu, T.L., Su, L.H., Chu, C., Chiu, J.H., Kuo, A.J., Chien, M.S. and Lin, T.Y. 2002. The emergence of fluoroquinolone resistance in Salmonella enterica serotype cholerasuis. *N. Engl. J. Med*., 346: 413-419

Clinical and Laboratory Standards Institute: CLSI (2008). Performance standards for antimicrobial disk and dilution susceptibility tests for bacteria isolated from animals: Approved standard. 3rd edition, CLSI document M31-A3, Clinical and Laboratory Standards Institute, Pennsylvania, USA, 28(8): 1-99

Cuis, S., Ge, B., Zheng, J. and Meng, J.2005. Prevalence and antimicrobial resistance of Campylobacter spp and Salmonella serovars in organic chickens from Maryland retail stores. *Appl. Environ. Microbiol*., 71:4108-4111

Diarrassouba, F., Diarra, M.S., Bach, S., Delaquis, P., Pritchard, J., Topp, E., et al. 2007. Antibiotic resistance and virulence genes in commensal E.coli and Salmonella isolates from commercial broiler chicken farms. *J. Food Prot*., 70: 1316-1327

Dipeolu, M.A. 2002. Residues of tetracycline antibiotic in marketed goats and pigs in Lagos and Ogun states Nigeria. *Trop. J. Anim. Sci*., 5: 47-51

Endimiani, A., Rossano, A., Kunz, D., Overesch, G. and Perreten, V. 2012. First country wide survey of third-generation cephalosporin-resistant Escherichia coli from broilers, swine and cattle in Switzerland, Diagnostic Microbiol., Infect. Dis., 73: 31-38

Garcia, L.S. and Isenberg, H.D. 2007. Clinical microbiology procedures handbook. 2nd edition, update ASM press American Society for Microbiology, Washington DC, USA, 1: 2036-2904

Garofalo, C., Vignaroli, C., Zandri, G., Aquilanti, L., Bordoni, D., Osimani, A., et al. 2007. Direct detection of antibiotic resistance genes in specimens of chicken and pork meat. *Int. J. Food Microbiol*., 113: 75-83

Kabir, J., Umoh, J.U. and Umoh, V.J. 2004. Veterinary drug use in poultry farms and determination of antimicrobial drug residues in commercial eggs and slaughtered chicken in Kaduna state, Nigeria. *Food Control*. 15: 3-10

Landers, T.F., Cohen, B., Wittum, T.E. and Larson, E.L. 2012. A review of antibiotic use in food animals: perspective, policy and potential. *Pub. Hlth. Rep*., 127(1): 4-22

Matsen, J.M. and Barry, A.L. 1974. Manual of Clinical Microbiology, 2nd edition, American Society for Microbiology, Washington, DC, USA, pp. 418-427

Mc Ewen, S.A. and Fedorka-Cray, P.J. 2002.Antimicrobial use and resistance in animals. *Clin. Infect. Dis*., 34 (Suppl 3): 93-106

Mena, C., Rodrigues, D., Silva, J., Gibbs, P. and Teixeira, P.2008. Occurrence, identification and characterization of campylobacter species isolated from Portuguese poultry samples collected from establishments. *Poult. Sci*., 87:187-190

National Population Commission. 2006 Population and housing census. Abuja, Nigeria. National Population Commission, 2006. [Online] Available from: http://www.ibenaija.org/uploads/1/0/1/2/10128027/vol_03_table_dsx_lgapop_by_sdistrictpdf.pdf [Accessed on 4th June, 2014]

Okeke, I.N., Aboderin, O.A., Byarugaba, D.K., Ojo, K.K. and Opintan, J.A. 2007. Growing problem of multidrug-resistant enteric pathogens in Africa. Emerg. Infect. Dis. [Online] Available from http://www.cdc.gov/EID/content/13/11/1640.htm

Parveen, S., Taabodi, M., Schwarz, J.G., Oscar, T.P., Harter-Dennis, J. and White, D.G. 2007. Prevalence and antimicrobial resistance of Salmonella recovered from processed poultry. *J. Food Prot.*, 70: 2466-2472

Ramchandani, M., Manges, A.R., DebRoy, C., Smith, S.P., Johnson, J.R. and Riley, L.W.2 005. Possible animal origin of human associated multidrug-resistant uropathogenic Escherichia coli. *Clin. Infect. Dis*., 40: 251-257

Teuber, M. 2001. Veterinary use and antibiotic resistance. *Curr. Op. Microbiol*., 4: 493–499

Witte, W. 2001. Selective pressure by antibiotic use in livestock. *Int. J. Antimicrob*. Agent 16: 19-24

World Health Organization. 2000. WHO global principles for the containment of antimicrobial resistance in animals intended for food: report of a WHO consultation with the participation of the FAO of the UN and the OIE, 5-7 June 2000, Geneva

****