

Assessment of the Content of Antibiotic Residues in the Meat of Broilers Sold on the Markets of Daloa (Côte d'Ivoire)

Ehouman Ano Guy Serge^{1,3,*}, Dalogo Kacou Alain Paterne², Koko Anauma Casimir¹, Ehui Edi Jean Frejus¹, Beugre Grah Avit Maxwell¹, Traore Karim Sory³

¹Agroforestry Training and Research Unit, Biochemistry-microbiology Department, Agrovalorisation Laboratory, University Jean Lorougnon GUÉDE, Daloa, Côte d'Ivoire

²National Agricultural Development Support Laboratory, Abidjan, Côte d'Ivoire

³Laboratory of Environmental Sciences, University Nangui Abrogoua, Abidjan, Côte d'Ivoire

Email address:

ehoumanserge@gmail.com (E. A. G. Serge)

*Corresponding author

To cite this article:

Ehouman Ano Guy Serge, Dalogo Kacou Alain Paterne, Koko Anauma Casimir, Ehui Edi Jean Frejus, Beugre Grah Avit Maxwell, Traore Karim Sory. Assessment of the Content of Antibiotic Residues in the Meat of Broilers Sold on the Markets of Daloa (Côte d'Ivoire). *Journal of Food and Nutrition Sciences*. Vol. 9, No. 6, 2021, pp. 139-143. doi: 10.11648/j.jfns.20210906.11

Received: September 28 2021; **Accepted:** October 18 2021; **Published:** November 5, 2021

Abstract: The need in animal proteins has exponentially increased in the ivoirien big cities in these latest years. It is the case of Daloa, where the broiler industry can meet the needs of meat consumers after 35 to 45 days. To respect the required time, the poultry farmers take veterinary medicines notably the antibiotics. The use of these antibiotics in veterinary medicine can lead to bioresistant phenomenon by the consumer, favorising the selection of resistant bacteria to later treatments. To protect the consumer, this study has been made to identify and quantify antibiotic residues in broiler meat. For the purpose, broilers from the farming hours in the urban zones of Daloa and ready for sale, have been sampled at random with some sellers on different markets of Daloa. The samples (15) have been analyzed by chromatography multi residue. Antibiotic analyses were performed on a SHIMADZU chromatographic set consisting of a sample changer, a high-pressure binary HPLC pump, a UV-visible absorption detector. This method permits to analyze simultaneously many families of antibiotic residues. The results of this chromatographic analysis made on this foodstuff have revealed the presence of four (4) families of antibiotics: sulfonamides, Macrolides, Tetracyclines and Fluoroquinolones. The concentration rates of samples are between 30 to 100%. The average concentration of their residues vary from 12.46 ± 21.12 to 90.80 ± 187.18 $\mu\text{g} / \text{Kg}$. These concentrations are generally lower than the safety standards (MRLs) recommended by the Codex Alimentarius. However, face to the phenomenon of bioresistance that the excessive use of the antibiotics brings about, the results of this study must prompt the public powers to set a politic to reduce their use. In fact, the breeders must be sensibilised to a correct use of antibiotics.

Keywords: Broiler Meat, Antibiotic Residues, Bioresistance, Daloa (Côte d'Ivoire)

1. Introduction

Veterinary treatments in general and particularly antibiotics are therapeutic weapon necessary for animal breeding [1, 2]. In fact, their use in both human and veterinary medicine, has for long constituted an efficient weapon against many pathology germs. The antibiotics permit to prevent or treat a great number of infections diseases. They also play a growth promoting role [3]. But, the generalized abusive use and the non respect of using

norms can lead to a bioresistance, to technologic, allergic and toxicologic problems [4, 5].

The presence of these chemical contaminants in the foodstuffs for human consumption represents a public health problem.

Currently, in many European countries, the use of antibiotics like growth stimulator is forbidden [6].

In Côte d'Ivoire, the presence of antibiotic residues in animal foodstuff has rarely drawn attention and less controls are made in the sale circuit. Nowadays, there is no fairly official data available on the antibiotic residues prevalence.

Today, harmlessness and the quality of foodstuff is a real challenge for the consumers so that the systematic use of these chimic substances is in question.

This study is done in order to evaluate the content of antibiotic residues in the broiler meat sold on the markets of Daloa. The objective of this study is to assure the sanitary state of the boiler meat consumed in Côte d'Ivoire in general and in particularly in Daloa by verifying the conformity or non-conformity of antibiotic residues in this foodstuff for human consumption.

2. Material and Methods

2.1. Biologic Material

For the research of antibiotic residues, some meat samples are taken on the thigh of broiler (Hubbard).

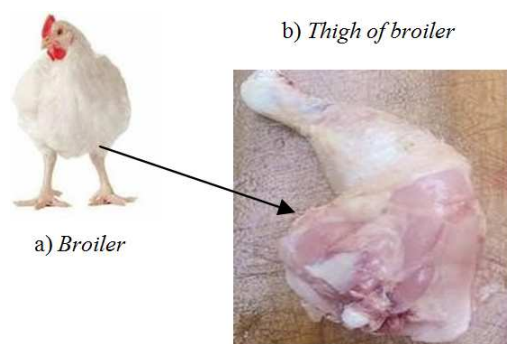


Figure 1. Broiler (Hubbard) and meat of the thigh of broiler.

2.2. Methods

2.2.1. Sampling

Broiler meat ready for sale is sampled on many market of the city of Daloa. In sum (15) fifteen broiler, representing (15) samples are randomly taken on the markets with the sellers. The search for antibiotic residues is done on the flesh of the thigh, part of well appreciated by many consumers. The thigh samples are cut with a knife and chips put in an aluminum foil and a plastic bag in a cool box and then taken to a laboratory on a temperature of -20°C .

2.2.2. Determining the Content of Antibiotic Residues in the Broiler Meat

The analysis of antibiotic residues has been realised by chromatographic multi-residues method. This method permits to analyze simultaneously many antibiotic residues families [7, 8].

2.2.3. Extraction and Purification of Antibiotic Residues

The extraction of antibiotic residues consists in grinding 25 g of broiler in a porcelain mortar with 10 g of anhydre sodium sulfate. After, 25 mL of Acetonitril-methanol mixture is headed to the grinded broiler and made homogeneous during 3 min in a blender. The homogeneous mixture is centrifuged for 5 min at 300 tums/min. The liquid above is taken, treated with sutured Hexane and some Acetonitril, dry evaporated with a rotavapor and retaken with 1,5 mL of

Methanol. The solution obtained is filtered with a disk filter of $0.45\ \mu\text{m}$ porosity. The final extract is put in a vial.

2.2.4. Identification and Quantification of Antibiotic Residues

The identification and the quantification of antibiotic residues in the broiler samples have been made by high performance liquid chromatography (HPLC) and a gaseous chromatography coupled to a mass spectrometry to confirm the results with the HPLC. The quantity of broiler samples used the research eventual antibiotic residues is about $3\ \mu\text{L}$.

2.2.5. Statistic Analysis of Data

For the exploitation of data, statistic analysis have been done with the STATISTICA software 7.1. The descriptive statistic (elementary statistic) has permitted to determine the maximum and minimum concentrations, the average concentrations and the standard deviation of antibiotic residues concentration detected into the samples analysed. The similarity of the concentrations has been possible owing to a comparison from an average to the standard.



Figure 2. Sale of broiler on Lobia market (Daloa).

3. Results and Discussion

3.1. Antibiotic Residues Detected in the Meat of the Thigh of Broiler

The chromatographic analysis undertaken permitted to detect (4) four families of antibiotics in broiler meat: the Sulfonamides (sulfadiazin and sulfadimethoxin), the Macrolides (erythromycin), the Tetracyclins (oxytetracyclin) and the Fluoroquinolones (sarafloxacin and enrofloxacin) (table 1).

The presence of these different antibiotic residues could be explained by the abusive use of antibiotics in the poultry industry or by the respect of insufficient delay [9]. A similar study done in 2005 Abiola and his collaborators have shown the existence of these same antibiotic residues in the meat of broiler after many successive analyses (STAR method, thin layer chromatography) [10]. In a study on the research of antibiotic residues in the muscle of the broiler in the center region of Algeria in 2019, Baazize and his collaborators have detected these same antibiotic residues [11].

Unlike Algeria, where antibiotics are used extensively in chicken farming, in Madagascar, the works done by

Randrianomenjanahary in 2006 in Antananarivo give a satisfying result with an absence of antibiotic residues in the flesh of chicken [12]. This absence of antibiotic residues in the flesh of chicken could be accounted on one hand by the fact that these antibiotics are not used in breeding in Madagascar and on the other hand by the rational use of antibiotics (respect of measure, the delay before slaughtering).

Table 1. Families of antibiotics detected in the meat of broiler.

Families	Antibiotics
Sulfamides	Sulfadiazin Sulfadimethoxin
Macrolides	Erythromycin
Tetracyclins	Oxyteracyclin
Fluoroquinolones	Sarafloxacin Enrofloxacin

3.2. Contamination Level of Broiler Meat by Antibiotic Residues

The present investigative study on the presence of antibiotic residues in broiler meat marketed in Daloa shows that this broiler meat contains many antibiotic residues. The contaminations rates vary from 33.33% to 73.33% (figure 3). These rates approaching these of Hakem and his collaborators with contamination rates of 75.81% [13]. Some similar studies in other countries in Africa, have also revealed the presence of antibiotic residues in the meat of broiler. This the case the works of Rinatou and his collaborators in Senegal. That have shown a contamination rate of 54% [14]. Also in Algeria, in 2018, Amine and his collaborators have obtained a contamination rate of 56% of broiler meat by the antibiotic residues [15].

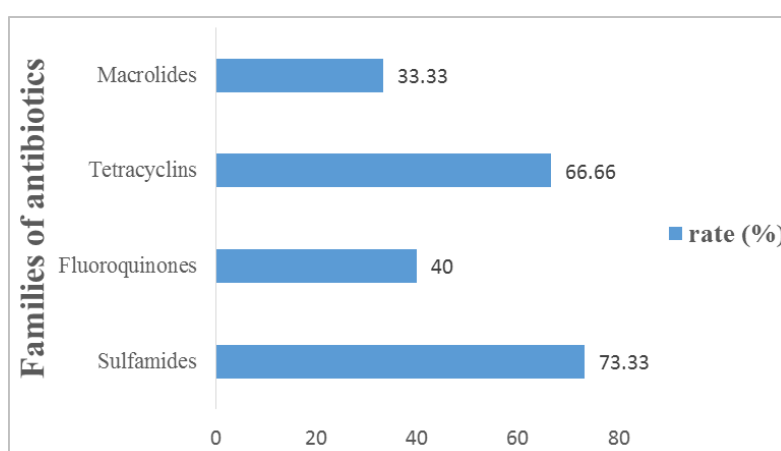


Figure 3. Contamination rate of broiler meat by antibiotic family.

Table 2. Antibiotic residues levels in broiler meat ($\mu\text{g/Kg}$).

Antibiotic residues	Number of samples	Average	Minimum	Maximum	Standard deviation
Sulfadiazin	15	77,20	0,00	490,00	126,41
Sulfadiméthoxin	15	90,80	0,00	752,00	187,18
Erythromycin	15	12,46	0,00	65,00	21,12
Oxytétracyclin	15	63,00	0,00	154,00	52,21
Sarafloxacin	15	15,66	0,00	69,00	22,90
Enrofloxacin	15	15,53	0,00	78,00	25,53

3.3. Comparison of Average Concentrations of Antibiotic Residues in the Meat of Broiler with the Standards (MRLs)

The average levels of the detected antibiotic residues were compared to the current safety standards (MRLs) [16]. The statistical analysis showed a significant difference ($p \leq 0.05$) at the level of residues of erythromycin, enrofloxacin and oxytetracyclin. On the other hand at the level of sulfadiazine, sulfadimethoxin and sarafloxacin, it indicates that the average concentrations are statistically identical to the standards (Table 3).

Today, with the proliferation of emerging microorganisms, the use of antibiotics in the breeding factory is unavoidable. The use of these chemical pollutants has become worldwide.

Unfortunately, all over the world, their use is problematic. That is the case in the Caribbean, precisely in Trinity and Tobago, where in 2015, Adesiyun and Nikechi have obtained some samples of chicken liver, some contamination rates ranging from 14.9 to 52.9% [17]. According to FAO/WHO, these contamination rates are not harmful if the concentrations of these residues are inferior to the Maximum Residue Limits (MRLs).

The statistic analyses done in this work have shown some significant differences between the MRLs and the concentrations of erythromycin, enrofloxacin and oxytetracyclin residues with some probabilities of 0.00 ($p \leq 0.05$). Concerning the residues of sulfadiazin, sulfadimethoxin, and sarafloxacin, the probabilities superior to 0.05, show that the average concentrations of these

residues are statistically identic to the standards.

Basing oneself on the standards of the couple FAO/WHO (2016), the consumption of broiler meat could not represent

any danger for the consumers because the antibiotic residues detected in this meat have in general some concentrations inferior or statistically identic to the standards.

Table 3. Comparison of average concentrations of antibiotic residues in the meat of broiler with the standards (MRLs).

	Average Concentrations (µg/Kg)	Standard deviation	N	MRLs (µg/Kg)	df	p
Sulfadiazin	77,20	126,41	15	100,00	14	0,49
Sulfadiméthoxin	90,80	187,18	15	100,00	14	0,85
Erythromycin	12,46	21,12	15	100,00	14	0,00
Enrofloxacin	15,53	25,53	15	100,00	14	0,00
Oxytétracyclin	63,00	52,21	15	200,00	14	0,00
Sarafloxacin	15,66	22,90	15	10,00	14	0,35

($P \leq 0,05$): importance difference between average concentrations and MRLs

N: Number of samples; df: degree of freedom; p: probability.

4. Conclusion

The aim of this study is to evaluate the content of antibiotic residues that can be present in broiler meat, a foodstuff well appreciated by the population of Daloa. The chromatographic analysis done has showed that the meat of this poultry contains many antibiotic residues. Fortunately, the concentrations of these different residues are in general inferior to the standards recommended by the Codex Alimentarius. However, the presence of antibiotic residues and some concentrations going sometimes above the Maximum Residual Limits (MRLs), must draw the attention of each octor of poultry factor. Some preventing strategies must be set in order to reduce the fullness and the contamination of broiler by antibiotic residues in Côte d'Ivoire. The data obtained will be submitted to the FAO/WHO coordination committee for Africa for a sanitary evaluation of population exposition to antibiotics.

References

- [1] Okombe E., Luboya L., Nzuzi M. and Pongombo S. (2016). Détection des résidus d'antibiotiques dans les denrées alimentaires d'origine animale commercialisées à Lubumbashi en République Démocratique du Congo. [Detection of antibiotic residues in animal foodstuffs commercialised in Lubumbashi in Democratic Republic of Congo] *Agronomie Africaine*, 29 (3): 207 - 216.
- [2] Brou G., Diaby M., Silué N. and Soro Y. (2018). État des lieux des mesures de prophylaxie sanitaire dans les élevages de poulets de chairs, souche COBB 500, dans le département de Korhogo (Côte d'Ivoire). [Inventory of sanitary prophylaxis measures in broiler farms, COBB 500 strain, in the Korhogo department, Côte d'Ivoire] *Journal of Applied Biosciences*, 126: 12717- 12723.
- [3] Martel J. L. and Chaslus-Dancla E. (2000). Practical aspects of antibiotic resistance in veterinary medicine. *Médecine et Maladies Infectieuses*, 30 (3): 173-177.
- [4] Sanders P., Bousquet-Mélou A., Chauvin C. and Toutain P-L. (2011). Utilisation des antibiotiques en élevage et enjeux de santé publique. [Use of antibiotics in breeding and public health challenge] *INRA Productions Animales* (Paris), 24 (2): 199-204.
- [5] Mensah S., Koudande O. D., Sanders P., Laurentie M., Mensah G. and Abiola F. (2014). Résidus d'antibiotiques et denrées d'origine animale en Afrique: risques de santé publique. [Antibiotic residues and animal foodstuffs in Africa: public health risks.] *Revue scientifique et technique - Office international des épizooties*, 33 (3): 975-986.
- [6] Delanoue E., Dockes A., Chouteau A., Roguet C. and Philibert A. (2018). Regards croisés entre éleveurs et citoyens français: vision des citoyens sur l'élevage et point de vue des éleveurs sur leur perception par la société. [Cross vue between breeders and French citizens: the vue point of citizens on breeding and breeders' vue on their perception by the society]: 51-68.
- [7] Jia X., Shao B., Wu Y., Yang Y. and Zhang J. (2008). Simultaneous determination of tetracyclines and quinolones antibiotics in Egg by Ultra-Performance Liquid Chromatography-electrospray Tandem Mass Spectrometry. *Journal of AOAC International*, 91 (2): 461-468.
- [8] Gaugain-Juhel M., Delepine B., Gautier S., Fourmond M., Gaudin V., Hurtaud-Pessel D. and Verdon E. (2009). Validation of a liquid chromatography-tandem mass antibiotics in milk: a qualitative approach. *Food additives & contaminants- Part A: Chemistry, Analysis, Exposure and Risk Assessment*, (26): 1459-1471.
- [9] Guetiya R. E., Zambou N. F., Anyangwe F. F., Njimou J. R., Coman M. M., Verdenelli M. C., Cecchini C., Silvi S., Orpianesi C., Cresci A. and Colizzi V. (2016). Abusive use of antibiotics in poultry farming in Cameroon and the public health implications. *British Poultry Science*, 57 (4): 483-493.
- [10] Abiola F., Diop M. M., Teko-Agbo A., Delepine B., Biaou F. C., Roudou T. B., Gaudin V. and Sanders P. (2005). Résidus d'antibiotiques dans le foie et le gésier du poulet de chair dans les régions du Dakar et de Thiès (Sénégal) [Antibiotic residues in the liver and gizzard of broiler in the regions of Dakar and Thiès (Senegal)], *Revue Médecine vétérinaire*, 156 (5): 264-268.
- [11] Baazize-Ammi D., Dechicha A., Tassist A., Gharbit I., Hezil N., Kebbal S., Morsli W., Beldjoudi S., Saadaoui M. and Guetarni D. (2019). Recherche et quantification des résidus d'antibiotiques dans le muscle du poulet de chair et dans le lait dans la région centre d'Algérie. [Research and quantification of antibiotic residues in broiler muscle and milk in the central region of Algeria.]. *Revue scientifique et technique, international office of Epizootics*, 38 (3): 663-680.

- [12] Randrianomenjanahary R. 2006. Investigation sur la présence de résidus d'antibiotiques dans les denrées alimentaires d'origine aviaire commercialisées à Antananarivo (Madagascar): Cas du muscle et du foie. Thèse en faculté de Médecine, de Pharmacie et d'Odonto-Stomatologie de Dakar, Université Cheikh Anta Diop de Dakar (Sénégal). [Investigation of the presence of antibiotic residues in avian foodstuffs commercialised in Antananarivo (Madagascar): Case of muscle and liver. Thesis in the Faculty of Medicine, Pharmacy and Odonto-stomatology of Dakar, Cheikh Anta Diop University of Dakar (Senegal)], 82 P.
- [13] Hakem A., Titouche Y., Houali K., Yabrir B., Malki O., Chenouf N., Yahiaoui S., Labiad M., Ghenim H., Kechih-Bounar S., Chirilă F., Lapusan A. and Fiț N. I. (2013). Screening of Antibiotics Residues in Poultry Meat by Microbiological Methods. *Bulletin of the University of Agricultural Sciences & Veterinary Medicine Cluj-Napoca*, 70 (1): 77-82.
- [14] Rianatou B-A., Eric C., Chantal B. and Ayayi J. (2004). Identification of antibacterial substance residues in chicken meat consumed in and around Dakar (Senegal). *Bulletin de l'Académie Vétérinaire de France*, 157 (2): 67-70.
- [15] Amine B., Tarek K. and Ibtissem L. (2018). Antibiotics resistance in broiler chicken from the farm to the table in Eastern Algeria. *Journal of World's Poultry Research*, 8 (4): 95-99.
- [16] FAO/OMS. 2016. Programme mixte FAO/OMS sur les normes alimentaires. Trente- neuvième session de la commission du Codex Alimentarius, [Mixte program FAO/ OMS on the Codex Alimentarius commission], Rome (Italie) 27 juin - 1^{er} Juillet 2016. Available on «www.codexalimentarius.org».
- [17] Adesiyun N. V. and Nikechi V. O. (2015). Detection of antimicrobial residues in Chicken Muscle and liver sold at Retail Outlets in Trinidad. *International Journal of Poultry Science*, 15 (8): 456-462.