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RESEARCH ARTICLE

LEVEL OF CONTAMINATION OF CHICKEN MEAT AND EGGS COLLECTED FROM POULTRY FARMS IN IVORY COAST BY ANTIBIOTICS (SULFADIAZINE, SULFADIMETHOXINE, SARAFLOXACIN AND OXYTETRACYCLINE).

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Abstract

The objective of this study was to determine the level of contamination of chicken meat and eggs collected from poultry farms in Ivory Coast by antibiotics (sulfadiazine, sulfadimethoxine, sarafloxacin and oxytetracycline). To carry out this work, thirty (30) samples of chicken flesh and thirty-six (36) samples of eggs were collected on the two sites (Abidjan point kilometer 17 and Agnibilékrou). These samples were processed and then assayed on a SHIMADZU chromatographic system consisting of a sample changer, a high pressure binary HPLC pump and a UV-Visible absorption detector. The results of the analyses showed the presence of antibiotics in the chicken meat collected in Abidjan and Agnibilékrou with variable levels. In Abidjan, apart from sarafloxacin, the levels of the other antibiotics detected in the chicken meat were above the European Union standards. In Agnibilékrou, they are all outside the standards except for oxytetracycline. Regarding egg samples, the results showed the presence of only one antibiotic molecule (sulfadiazine) in egg samples taken in Abidjan and Agnibilékrou with levels below the standard set by the European Union.

Introduction:

Chicken meat is a popular food in many cultures. It is full of vitamins, essential aminoacids and quality proteins [1]. In Ivory Coast, the majority of the population, especially in the cities, favors this protein. Unfortunately, the environment in which battery hens are kept does not always meet health safety standards [2]. This type of farming is often criticized for the many abuses it entails, such as short rearing periods, injection of growth hormones, steroids and antibiotics [3]. Indeed, after injecting antibiotics into the hens, these treatments result in the presence of residues in the hen meat and in the eggs from these hens. The presence of antibiotic residues in the flesh and eggs from these hens due to non-compliance with the conditions of use (dosage and with drawal time) or errors in the conduct of the farm can have serious consequences on the health of consumers [4,5]. The objective of this study is to determine the level of contamination of chicken flesh and eggs by antibiotics (sulfadiazine, sulfadimethoxine, sarafloxacin and oxytetracycline).

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Materials And Methods:

Presentation of the study areas

The studies were carried out in the district of Abidjan, precisely at kilometer point 17 and in the department of Agnibilékrou, two towns in Ivory Coast where most poultry farms are concentrated. The district of Abidjan is located in the south of Ivory Coast between latitudes 5°00 and 5°30 North and longitudes 3°50 and 4°10 West. As for the department of Agnibilékrou, it is located in the central east of Ivory Coastand is situated between latitude 7°7'49.012" North and longitude 3°12'11.074 West. Figure 1 below presents the study areas.

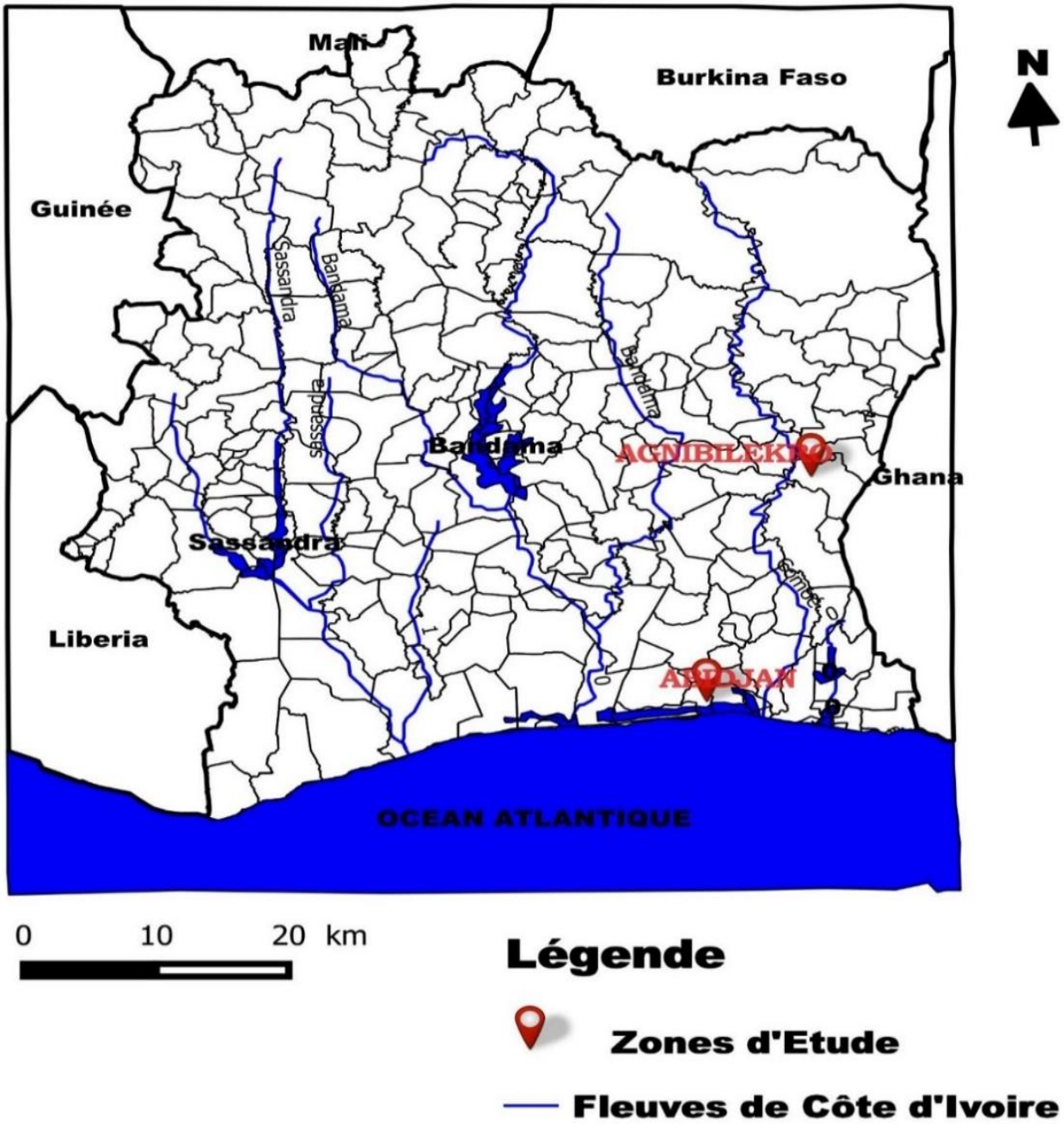

Figure 1: Location of the two study areas.

Study material and products used

The study medium is chicken meat (Gallus gallus) and eggs from these hens. All the reagents used for the various analyses are of recognized analytical quality (Merck Supra pure or equivalent). Figures 2 and 3 show the study matrices.

Figure 2: Goosebumps.

Figure 3: Chicken eggs.

Sampling method

Sampling of chicken meat

Chicken meat samples were collected randomly from three (3) farms in Agnibilékrou and two (2) farms in Abidjan. In the Agnibilékrou region, the sampling consisted of thirty (30) hens per farm divided into batches of five (5) hens, i.e. six batches per farm. A composite sample of chicken meat was taken from each batch of slaughtered hens, which corresponds to six (6) composite samples per farm. Thus, eighteen (18) composite samples of chicken meat were collected for all three (3) farms. In Abidjan, the same sampling was conducted. In total, twelve (12) composite samples of chicken meat were collected for all two (2) farms in the commune of Yopougon (point kilometer 17).

Egg sampling

In Agnibilékrou, the sampling consisted of taking three (3) trays of eggs, i.e. one tray per farm and two trays of eggs in Abidjan. The egg samples were constituted by randomly taking eggs from each tray. Thus, eighteen (18) eggs were collected in the Agnibilékrou region at a rate of six (6) eggs per tray and also eighteen (18) eggs in Abidjan at a rate of nine (9) per tray. In total, thirty-six (36) eggs were obtained and were distributed for antibiotic analysis (Sulfadiazine, Sulfadimethoxine, Sarafloxacin and Oxytetracycline) in the laboratory.

Extraction and purification of antibiotics from chicken meat

Twenty-five (25 g) of fresh meat was ground in a porcelain mortar with ten (10 g) of anhydrous sodium sulfate. Twenty-five (25 mL) of an acetonitrile-methanol mixture (95/5, v/v) was added to the resulting grind and then the whole was homogenized for 3 min in a blender. The homogenate was centrifuged for 5 min at 3500 rpm. The

supernatant was collected, treated with hexane saturated with acetonitrile (50/50; v/v), and then evaporated to dryness using a rotavapor. The sample was taken up with 1.5 mL of methanol and then stored at -18 °C until analysis.

Extraction and purification of antibiotics from eggs

The extraction of antibiotics from eggs consisted of taking 5 mL of well homogenized egg white and yolk sample. Then, 25 mL of a dichloromethane solution, 5 g of sodium chloride and a pinch of anhydrous sodium sulfate were added. The whole was homogenized with a mixer-disperser for 30 s at 11 rpm and then centrifuged at 4 °C at a speed of 3000 rpm for 15 min. The supernatant was transferred to a glass test tube and then evaporated to dryness in a water bath at 50 °C. The residue was taken up with 1 mL of methanol. The purified extract was transferred to conical tubes and stored at -18 °C until analysis.

Determination of antibiotics extracted from chicken meat and eggs

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. The analytical conditions of the different molecules are recorded in **table 1**

Table 1: Analytical conditions of the different molecules.

Molecules	Eluent	Detection wavelengths
Sulfadiazine	25 % MeOH + 75 % Double-distilled water	220 nm
Sulfadiméthoxine	25% MeOH + 75% Double-distilled water	201 nm
Oxytétracycline	45 % MeOH + 55% Double-distilled water	220 nm
Sarafloxacin	22 % MeOH + 78 % Double-distilled water	250 nm

Results And Discussion:

Proportions of contaminated chicken meat samples in Abidjan and Agnibilékrou

The proportions of contaminated chicken meat samples in Abidjan and Agnibilékrou are presented in **Figures 4** and **5**.

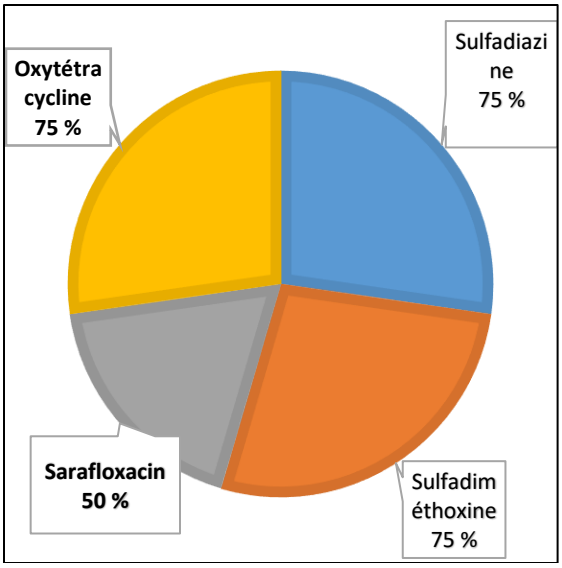

Figure 4: Proportion of contaminated chicken meat samples in Abidjan (P K 17)

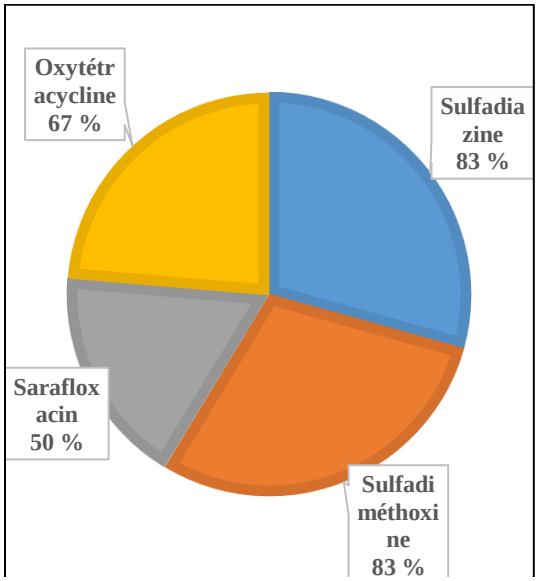

Figure 5: Proportion of contaminated chicken meat samples in Agnibilékrou

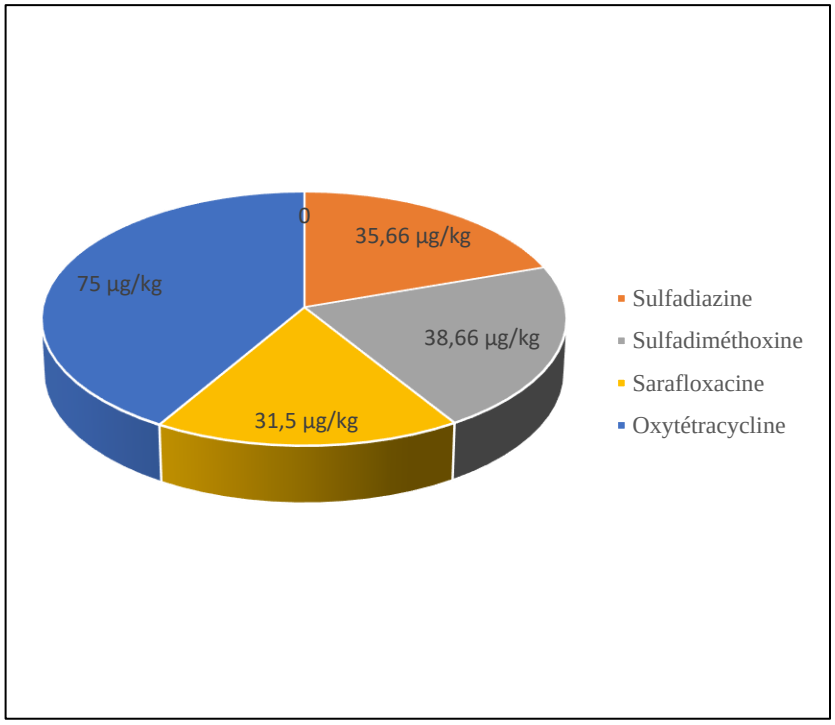

Figure 6: Antibiotic levels in chicken meat samples collected in Abidjan.

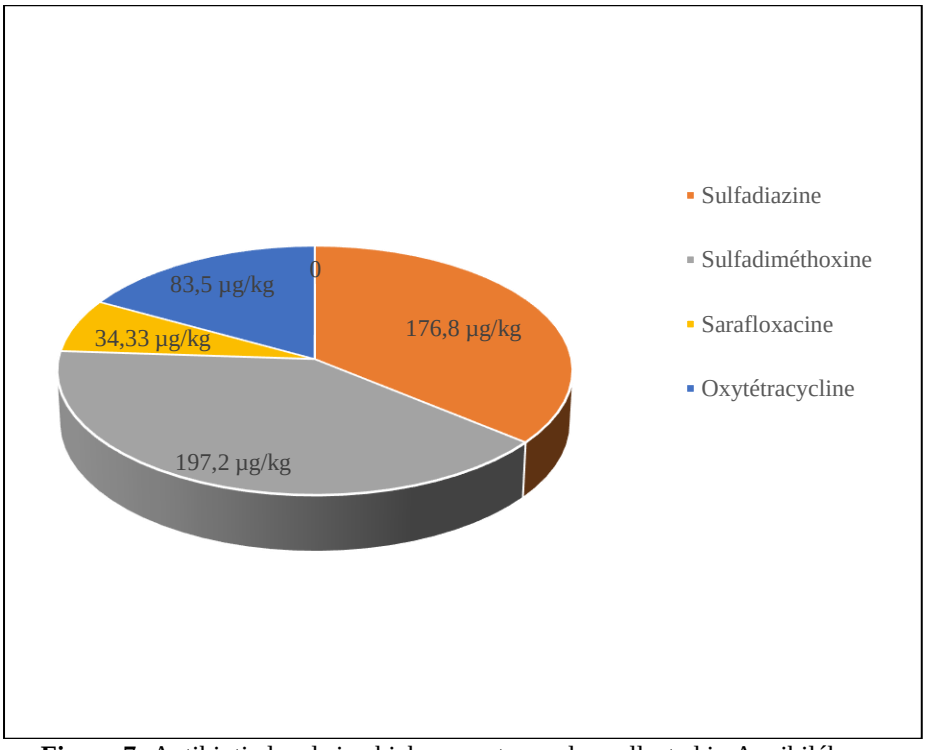

Figure 7: Antibiotic levels in chicken meat samples collected in Agnibilékrou.

The results in **Figures 4, 5, 6** and **7** show that sulfadiazine, sulfadimethoxine and oxytetracycline were detected in 75 % of the samples collected in Abidjan with mean concentrations of 35.66 µg/kg, 38.66 µg/kg and 75 µg/kg respectively. Sarafloxacin was detected in 50 % of the samples collected with an average concentration of 31.5 µg/kg. In the Agnibilékrou region, sulfadiazine and sulfadiméthoxine were detected in 83 % of the chicken meat

samples collected, with average levels of 176.8 µg/kg and 197.2 µg/kg, respectively. Sarafloxacin and oxytetracycline were detected in 50 % and 67 % of the chicken meat samples respectively with levels of 34.33 µg/kg and 83.5 µg/kg. Finally, three (3) families of antibiotics (sulfonamide, fluoroquinolone and tetracycline) were detected in the chicken meat samples collected in Abidjan and Agnibilékrou. These results could be explained by the fact that these families of antibiotics are frequently used in poultry farming because of their broad spectrum of activity and their low cost. This same observation was made by [7] during the implementation of a poultry observatory of antibiotic consumption in the Brittany region. These authors showed that these antibiotic families (sulfonamide, fluoroquinolone and tetracyclines) are used in diseases attributed to Escherichia coli and the most detected in meat products.

Comparison of average antibiotic levels (µg/kg) in meat with standards

The average levels of antibiotics found in chicken meat in Abidjan and Agnibilékrou and compared with European Union standards are shown in **Figure 8**.

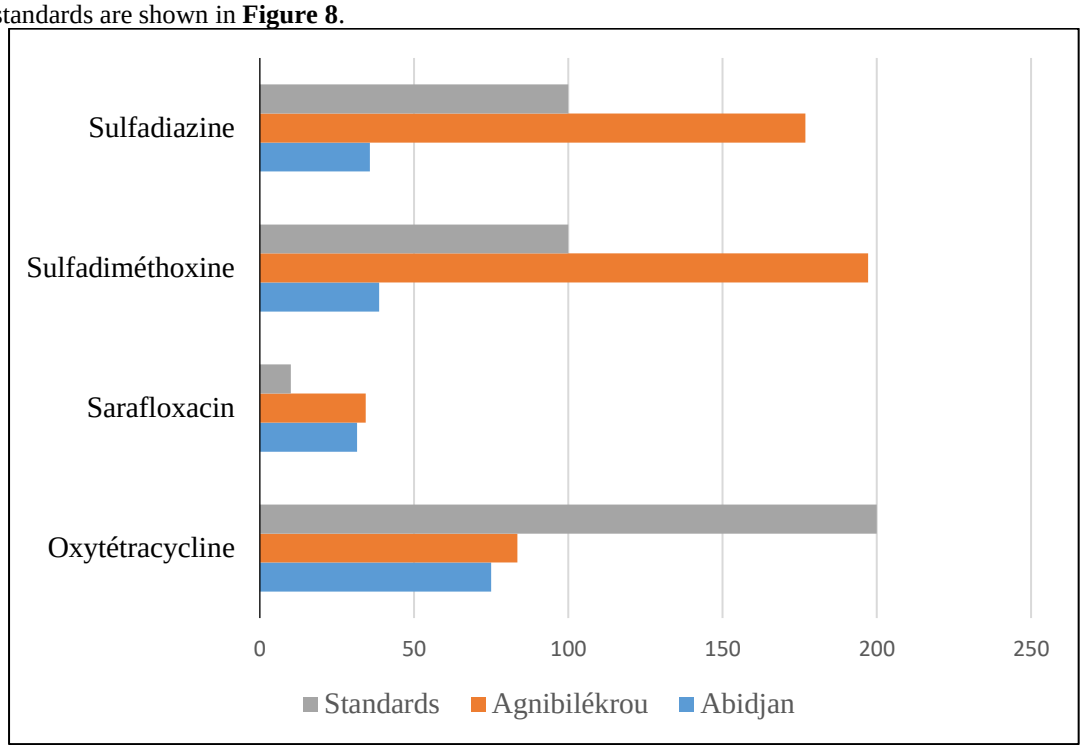

Figure 8: Comparison of average antibiotic levels in chicken meat with EU standards.

The results in **Figure 8** show that in Abidjan, apart from sarafloxacin, the levels of the other antibiotics detected in the goose flesh are below the norm. In Agnibilékrou, they are all outside the norms except for oxytetracycline.

Antibiotic levels in egg samples from Abidjan and Agnibilékrou

Table 2 presents the levels of antibiotics detected in egg samples collected in Abidjan and Agnibilékrou.

Table 2: Antibiotic levels in eggs in Abidjan and Agnibilékrou.

Locality	Abidjan PK 17	Agnibilékrou
Levels detected (µg/kg)	15.74 ± 7.23	5.59 ± 3.52
Percentage of contaminated samples (%)	100	100

The results in **Table 2** show that sulfadiazine alone was detected in all egg samples collected in Abidjan (PK 17) and Agnibilékrou with levels of 15.74 µg/kg and 5.59 µg/kg, respectively. However, it is noted that the average in the Abidjan PK 17 area is three times that obtained in the Agnibilékrou area. The ingestion of contaminated feed or environmental matrices such as soil by the hens can be suggested as the main explanatory factor for egg contamination [8].

Comparison of average antibiotic levels (µg/kg) in eggs with the standard

The average levels of antibiotics found in eggs in Abidjan (PK 17) and Agnibilékrou are compared with the standard set by the European Union **(Figure 9)**

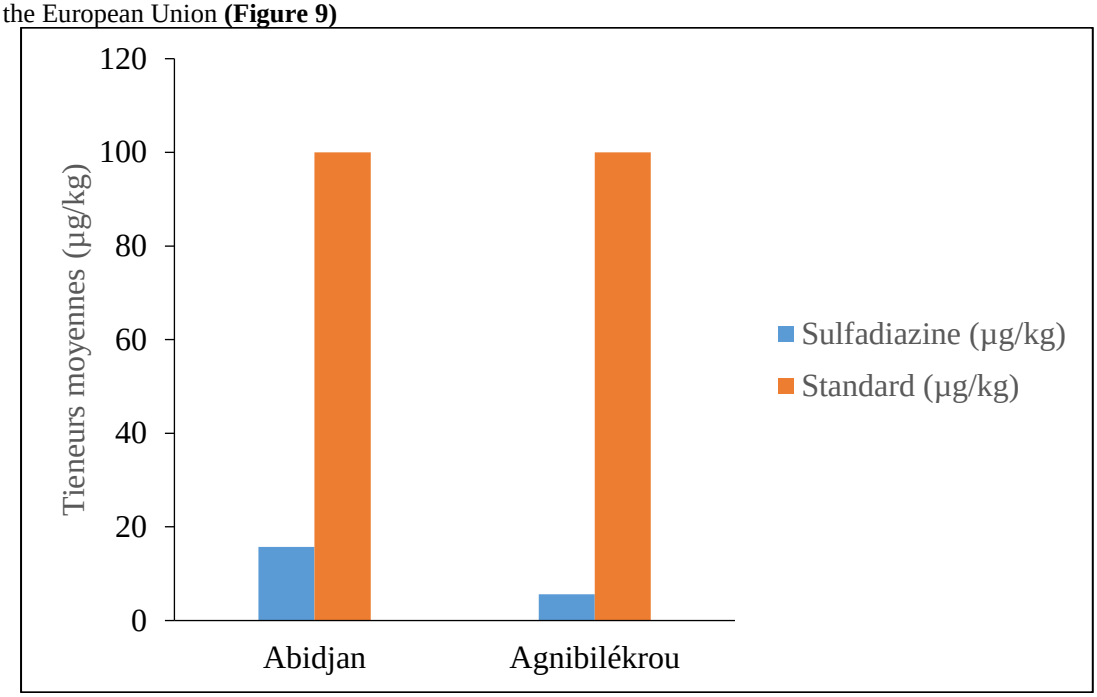

Figure 9: Comparison of average antibiotic levels in eggs with the EU standard

The results in **Figure 9** show that the sulfadiazine levels found in the egg samples collected in Abidjan and Agnibilékrou are below the standard set by the European Union (100 µg/kg).

Conclusion:

This study determined the level of contamination of chicken meat and eggs collected from poultry farms in Ivory Coast by pharmaceuticals (sulfadiazine, sulfadimethoxine, sarafloxacin and oxytetracycline). The results of the different analyses showed the presence of sulfadiazine, sulfadimethoxine, sarafloxacin and oxytetracycline in chicken meat samples taken in Abidjan (PK 17) and Agnibilékrou with variable levels. In Abidjan, apart from sarafloxacin, the levels of the other antibiotics detected in the chicken meat were above the European Union standards. In Agnibilékrou, they are all outside the standards except for oxytetracycline. Concerning the analysis of eggs, the results showed that sulfadiazine alone was detected in egg samples taken in Abidjan (PK 17) and Agnibilékrou with levels below the standard set by the European Union. The abusive use of antibiotics in livestock would contribute to the appearance of forms of resistance that could cause threats to humans and the environment.

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