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Nutraceutical Products to Replace Synthetic Antibiotics in Broiler Farms in the Tonkpi Region, West of Cote d'ivoire

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Abstract

A study was conducted in the Tonkpi Region in western Côte d'Ivoire with the overall objective of gaining a better understanding of the effects of nutraceuticals as a replacement for antibiotics on the health status of broiler chickens. The method used was convenience sampling, which consisted of collecting data from 40 responding and available farmers. The results showed that 85% of farmers were unaware of the concept of antibiotic residues in broiler meat. Unfortunately, these antibiotic residues are thought to be at the root of public health problems among consumers. None of the farmers complied with the waiting periods for veterinary medicines after administering them to the poultry. Thus, the mortality rate on farms using antibiotics (3.4±0.5%) was high compared to those using nutraceuticals (2.2±0.3%) over 49 days of rearing. The average daily gain and feed conversion ratio of broiler chickens using nutraceuticals were better than those using antibiotics. In addition, the average live weight of broiler chickens produced using nutraceuticals (2116 ± 2.95 g) was higher than that of antibiotics (1920 ± 3.5 g). However, comparison of the results revealed no significant difference ($p > 0.05$).

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Keywords

Nutraceuticals, antibiotics, broilers, farmers, Tonkpi.

Introduction

In Côte d'Ivoire, the modern poultry industry provides 100% of the country's eggs for consumption and a very large proportion of its poultry meat requirements (MIRAH, 2022). However, its development is hampered by a number of problems, including the quality and cost of feed, poor farm performance linked to the quality of poultry products, and pathological problems (M'Bari, 2000). Although synthetic antibiotics have therapeutic effects and are economically useful, they are sometimes misused (Stolz, 2008). In addition, their withdrawal period is not respected and could leave residues in food of animal origin that are dangerous for human consumption (Dosso, 2014). For this reason, farmers have been encouraged by supervisory bodies to adopt alternative medicines by using nutraceuticals to replace antibiotics in modern broiler farming. Nutraceuticals are medicines that prevent disease and have proven physiological benefits (PADE-CI, 2019). According to the Strategic Development Plan for Livestock, Fisheries and Aquaculture in Côte d'Ivoire, structuring the animal and fish sectors, health monitoring and protecting livestock against epizootics and zoonoses are all part of the development strategy (MIRAH, 2014). This raises the question of whether the use of nutraceuticals to replace antibiotics in livestock farming could prevent public health problems for consumers. To answer this

research question, the general objective is to contribute to knowledge of the effects of nutraceutical products replacing antibiotics on the health status of broilers.

Materials and Methods

Study area

The Tonkpi Region is located in the Mountain District in the extreme west of Côte d'Ivoire, with Man as the District capital (Figure 1). It comprises five (05) Departments (Man, Biankouma, Danané, Zouan-Hounien and Sipilou) with an estimated population of 1,387,909, the majority of whom live in rural and agricultural areas (INS, 2021). The transitional tropical climate is characterised by both drought and humidity. This is reflected in high temperatures (25 to 30°) and heavy rainfall, sometimes reaching 2,500mm. The relief is relatively monotonous, with scattered hills, numerous low-lying areas with ferralitic soils and hydromorphic soils (Aboly, 2022).

Sampling

For the sampling, the poultry strains available and accessible to the farmers were COBB 500. This is an important selection criterion for the study, enabling nutraceuticals to be assessed in relation to antibiotics. The method used was convenience sampling, which involved collecting the study data from a group of farmers who agreed to take part in the study. The experimental set-up consisted of 40 farmers divided into 2 groups of 20 farmers, with group 1 dealing with antibiotics and group 2 with nutraceuticals for flocks of 1,000 broilers.

Rearing operations

Within 24 to 48 hours of the chicks' arrival, the brooding room was heated and the drinkers and feeders were filled. The same prophylaxis plan was applied to minimise variation factors that could influence the growth performance of the chickens. The animals were fed a combination of functional feed and commercial feed sold by regular feed suppliers. Day-old broiler chicks for both types of poultry farm were of the same strain and came from the same supply hatchery.

The technical and economic monitoring of the farms was carried out over one year and each farmer had set up five (5) flocks of 1,000 broilers. The chicks were weighed on the first day of the flock and then weekly throughout the rearing period using an electric scale. Technical and economic data sheets were drawn up with the support of the technical department of the Projet d'Appui au Développement de l'Elevage en Côte d'Ivoire (PADE-CI) to collect technical data such as the average weight of broilers, the average daily gain, the consumption index, the mortality rate of chickens and the production cost of broilers.

Data processing and analysis

Statistical analysis of the data was carried out using Excel version 2013 and SPSS Statistics 26. Comparisons of the zootechnical parameters of chicken growth, on the one hand, and knowledge of the concepts relating to antibiotic residues in meat and the withdrawal period for veterinary medicines, on the other, were carried out using Student's t-test for independent samples at a significance level of 5% ($p < 0.05$).

Results and Discussion

Notion of antibiotic residues and waiting times for veterinary medicines

The survey highlighted four key themes on which the 40 broiler farmers were assessed. With regard to the concept of antibiotic residues in broiler meat, 15% of farmers were informed and 85% were unaware. The latter appeared to be unaware of the public health risks associated with the use of antibiotics. With regard to the withdrawal period for veterinary medicines after they have been used on the farm, 55% of farmers were informed and 45% were unaware of this. Unfortunately, none of the farmers complied with the recommendations on the package leaflets for curative or preventive treatments (Figure 2).

A comparison of frequencies revealed a significant difference ($p < 0.05$) between farms.

Zootechnical production parameters of flocks of 1000 broilers

The average weights and average daily gain of broilers fed nutraceuticals were better than those fed antibiotics (Table I). The same was true for the feed conversion ratio, which was 1.6 ± 0.17 for broilers fed nutraceuticals and 1.74 ± 0.22 for those fed antibiotics. Overall, the feed conversion ratio of broilers from one farm to another was less than 2 in 49 days of rearing. In terms of feed consumption, the average broiler feed intake was

557.28 ± 274 g for nutraceuticals and 568.71 ± 295 g for antibiotics (Table II). For the replicates, the first week was excluded because the chicks had to be placed in the experimental set-up. This gave 6 replicates per group and comparison of the results between these 2 groups revealed no significant difference (p >0.05).

Mortality rate of broilers

Farms using antibiotics recorded a higher average mortality rate (3.4 ± 0.5%) than those using nutraceuticals (2.2 ± 0.3%). However, the mortality rates of the different farms were lower than the norm (5%) in 49 days (Table III).

Antibiotics are sometimes misused despite their necessity in therapeutic actions and their economic usefulness (Stolz, 2008). It has been reported that antibiotic residues in broiler meat are capable of causing hypersensitivity accidents and food poisoning (Dosso, 2014). To combat these public health problems, the Projet d'Appui au Développement de l'Elevage en Côte d'Ivoire (Support Project for Livestock Development in Côte d'Ivoire) has proposed that farmers use nutraceutical products to replace synthetic antibiotics (PADE-CI, 2019). A survey was conducted among these farmers to assess their level of knowledge about broiler meat quality. It turned out that 85% of poultry farmers were unaware of the concept of antibiotic residues in broiler meat.

This was justified by the farmers' lack of knowledge of veterinary medicines and the importance of nutraceuticals in farm management. On farms where antibiotics were used, none of the farmers complied with the withdrawal periods for veterinary products after they had been used. Failure to comply with the waiting period was said to be due to ignorance on the part of farmers and for economic reasons. These observations have been reported by authors such as Bitty (2013) in Côte d'Ivoire and Pare (2012) in Senegal. In terms of health, a mortality rate of 3.4±0.5% was recorded for farms using antibiotics, compared with 2.2±0.3% for those using nutraceuticals. These mortalities were due to problems of paralysis and torticollis in broilers on the different farms.

Our results are similar to those of Andela (2015) who found that feed pelleting caused ascites syndrome in broilers. According to Chafai (2006), the efficacy of probiotics such as nutraceuticals reduces chick mortality.

Table.1 Average weight and GMQ of broilers by rearing category

Age (days)	Average live weight (g)		Average daily gain (g)	
	Nutraceuticals	Antibiotics	Nutraceuticals	Antibiotics
1	37	37	0	0
7	158	123	22,57	17,57
14	310	280	22,14	20
21	563	495	26,8	23,57
28	880	810	31,42	28,92
35	1304	1230	37,25	35,14
42	1730	1580	41,19	37,61
49	2116 ± 2,95	1920 ± 3,5	43,18± 2,2	39,79± 3,7
Average	**824,16± 605**a	**753± 566**a	**711,71± 627**b	**650,71± 583**b
Level of p-value	**0,8376**		**0,8337**	
Significance	**NS***		**NS***	

*Means followed by the same letters are not significantly different at the threshold
*α = 0.05; NS = Not Significant.

Table.2 Broiler consumption index by rearing category

Age (days)	Consumption index	
	Nutraceuticals	Antibiotics
7	1,24	1,47
14	1,47	1,5
21	1,55	1,6
28	1,64	1,77
35	1,68	1,8
42	1,74	1,94
49	1,84	2,07
Average	**1,6±0,17**a	**1,74± 0,22**a
Level of p-value	**0,2354**	
Significance	**NS***	

*Means followed by the same letters are not significantly different at the threshold α = 0.05; NS = Not Significant.

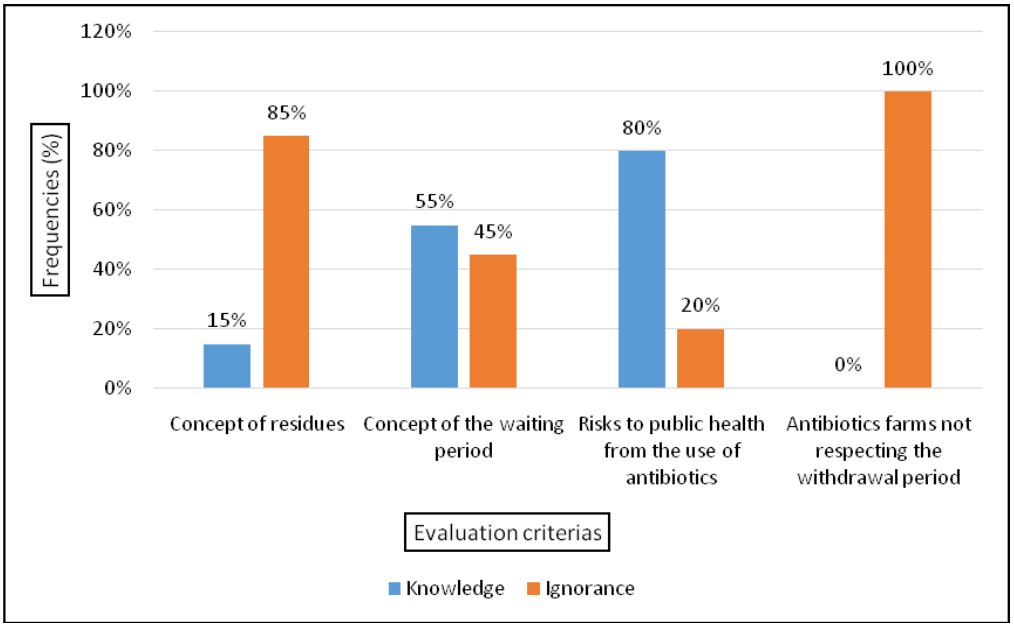
Figure.1 Map of the Tonkpi Region

Table.3 Average mortality rate for broilers by rearing category

Age (days)	Nutraceuticals	Antibiotics
	N=1000	N=1000
	Chicken mortality	
7	12	17
14	2	1
21	0	4
28	3	8
35	0	0
42	4	1
49	1	3
Total mortalities	**22**	**34**
Average mortality rate (%)	**2,2 ± 0,3**	**3,4± 0,5**
Number of chickens remaining	**978 ± 3**	**966 ± 4**

N= Number of head of broilers per flock

Figure.2 Assessment of farmers' level of knowledge



In addition, the use of nutraceuticals and the consumption of functional feed have improved the zootechnical performance of broiler chickens. It should be noted that the mortality rates per flock recorded on the various broiler farms were lower than the norm (5%) per production cycle. According to Chafai (2006), the positive effect of probiotics on the average daily gain (ADG) of broilers is well established. At 49 days of age, broilers fed nutraceuticals weighed 2116 ± 2.95 g compared with 1920 ± 3.5 g for those fed antibiotics. Finally, the feed conversion ratio of broiler chickens from farms using antibiotics (1.74 ±0.22) was higher than that from nutraceuticals (1.6 ±0.17). This could be linked to the improved quality of the feed distributed to the poultry by the incorporation of nutraceuticals. Nevertheless, a comparison of all the results between the two farming categories revealed no significant difference ($p > 0.05$).

Conclusion

Broiler production in the Tonkpi Region was carried out by two categories of farmers using nutraceuticals and antibiotics. At the end of the study, 85% of farmers were

unaware of the concept of antibiotic residues in broiler meat. None of the farmers complied with the withdrawal periods for veterinary products after their use on the farm. In addition, the mortality rate of farms using antibiotics (3.4±0.5%) was high compared with those using nutraceuticals (2.2±0.3%). Nevertheless, the mortality rates of the different farms were lower than the norm (5%) in 49 days. It turns out that The average daily gain and feed conversion ratio of broilers fed antibiotics were higher than those fed nutraceuticals. The average live weight of broilers fed nutraceuticals (2116 ± 2.95 g) was higher than those fed antibiotics (1920 ± 3.5 g). Comparison of results between rearing categories revealed no significant difference ($p > 0.05$). However, the zootechnical parameters of broilers from farms using nutraceuticals were better than those using antibiotics.

Further studies could be carried out to raise farmers' awareness of the use of nutraceuticals to obtain animals likely to give the best performance and sanitary quality meat for human consumption.

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Competing interests

The study was carried out without any conflicts of interest.

Authors' Contributions

The study and the writing of the manuscript were carried out in a collegial manner. Nevertheless, according to the following steps, ABN, MM and BKGG participated in the conception and planning of the study. ABN, MB and AYN collected the data and drafted the first version of the manuscript. BKGG, MB and ABN performed the statistical analyses and interpretation of the data. AYN and MM critically revised the manuscript.

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