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Efficiency of the feed additive ALPHA-BIO+ as an alternative to antibiotics on the eggs production performance of the layer LHOMAN Brown

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ABSTRACT: The growing problem of antibiotic resistance calls into question practices related to the use of antibiotics. Their large-scale use to accelerate the rapid growth of food animals is of increasing concern to researchers. Currently, several studies are being carried out to find biological solutions as an alternative to the use of antibiotics in poultry farm. It is within this framework that the present study falls, the objective of which is to evaluate the effectiveness of an organic product, ALPHA-BIO+, on the production parameters of Lohmann Brown laying hens. Thus, two batches (control and experimental) subdivided into triplicate were formed from a sample of 458 animals. Thus, a classic breeding protocol with the use of antibiotics was applied in the control batches. As for the experimental batches, they received the food additive ALPHA-BIO+. The technical data obtained were subjected to statistical analyzes in order to assess the effectiveness of ALPHA-BIO+ on the animals zootechnical parameters. Indeed, in terms of ingested food, the values obtained varied from 97.7 to 120.87 g for the control batch and from 94.12 to 114.95 g for the experimental batch. Regarding the laying rate, the two batches reached peak laying between the 30th and 32nd weeks of age with 95.24% for the control batch and 98.54% for the experimental batch. However, the conversion indices did not show a significant difference between the two batches. According to the results, the food additive ALPHA-BIO+ could help reduce the use of antibiotics in poultry farms.

KEYWORDS: Feed additive ALPHA-BIO+, Alternative, Antibiotic, Eggs production, layer Lohmann Brown.

1 INTRODUCTION

Poultry products are very important because they contribute to a balanced diet through their supply of animal proteins [1], [2]. The FAO has also shown that protein deficiencies, particularly of animal origin, are among the most widespread nutritional deficiencies in the world [3]. Poultry farming has emerged in recent years as a solution to meet the ever-increasing demand for protein of animal origin for many countries in tropical regions and particularly in Africa [4]. Côte d'Ivoire is no exception. Indeed, national poultry production covers 96% of poultry meat needs and 100% of consumption egg needs [5]. Egg is one of the foodstuffs of animal origin richest in protein and contains all the essential amino acids in balanced proportions [6]. One egg can cover around 10% of our daily protein and mineral needs [7]. However, the booming poultry industry knows difficulties linked to health problems. Several pathologies are observed in the poultry world with a dominance of bacterial diseases [8]. To fight against these bacteria, breeders overuse antibiotics without calling a veterinarian for the most part [9]; [10]. This misuse of antibiotics creates resistances [11]. Furthermore, failure to respect the waiting period after use constitutes a public danger. Indeed, this exposes consumers to antibiotics residues in foods of animal origin. This could cause hypersensitivity or intoxication by favoring the selection of bacteria resistant to subsequent treatments [9]. To overcome this human health problem while reducing production costs, a biological solution could be considered. It is in this context that the ALPHA-BIO+ food additive made from rhamnolipids and trace elements comes into play. This food additive could significantly contribute to reducing the use of synthetic antibiotics in poultry farms. It could therefore, in the long term, be an effective means of improving the profitability and the quality of poultry farms products. The objective of this work is to evaluate the efficiency of the feed additive ALPHA-BIO+ on the production parameters of the layer Lohmann Brown

2 MATERIAL AND METHODS

2.1 MATERIAL

2.1.1 STUDY ZONE

This study was carried out at NANGUI ABROGOUA University (Figure 1) from February 2022 to July 2023. The University is located on the Abobo-Adjamé axis in the Autonomous District of Abidjan, in the South East of the Côte d'Ivoire). The District has coordinates of 5.360° and 5.440° of North latitude and 4.050° and 3.960° of West longitude.

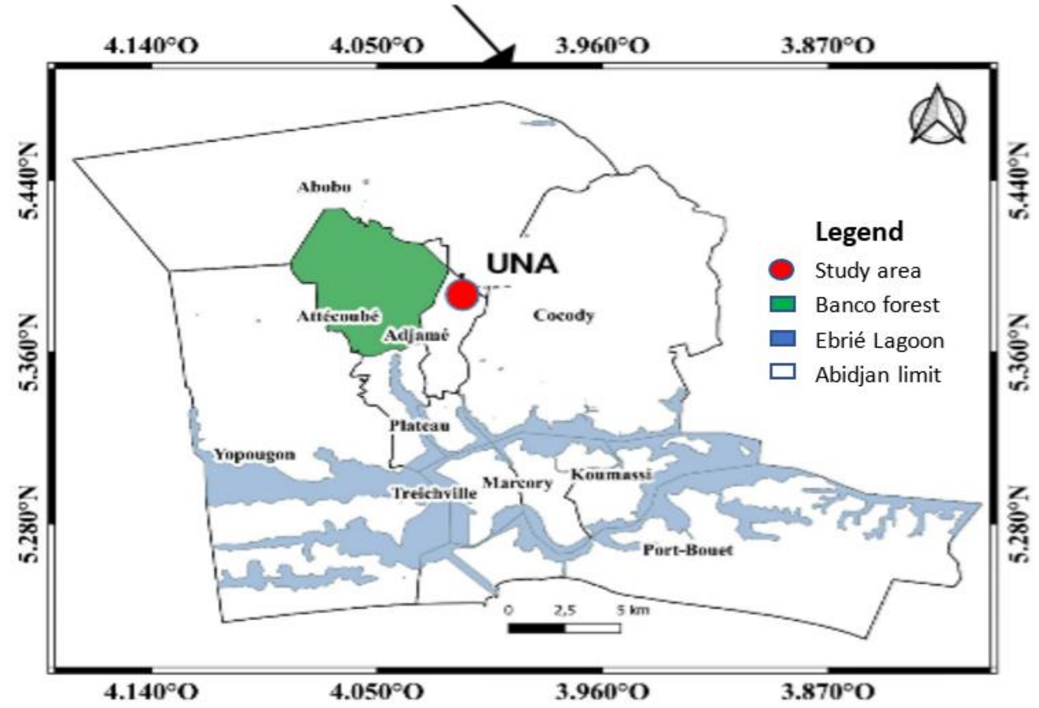

Fig. 1. Location of the study area

2.1.2 WORKING MATERIAL

The experiment took place in a building of NANGUI ABROGOUA University poultry farm.

This building of 105 m2, 15 m long and 7 m wide, was used for breeding animals. The biological material concerned 498 layers Lohmann Brown and the feed additive ALPHA-BIO+. ALPHA-BIO+ is a biological solution rich in Rhamnolipids and trace elements in addition to having very high electrical conductivity (718 µS/cm). In particular, it provides phosphorus, a mineral which gives energy and contributes to good bone health, and iron, useful for preventing anemia. This food additive contains copper and manganese which, combined with iron, contributes to blood regeneration. It also contains phosphorus, sodium and calcium essential for the formation of bones and the proper functioning of cells. ALPHA-BIO+ also contains magnesium which is excellent against fatigue and lack of mobility and zinc which helps to stimulate the immune system. Table I illustrates the chemical composition of ALPHA-BIO+.

Table 1. Chemical composition of the food additive ALPHA-BIO+

Parameters	Values
PH	6.89
pH measurement temperature °C	28.2
Electrical conductivity at 25°C (µS/cm)	718
Total Nitrogen % (mg/100mL)	5.43
Phosphorus Total-P2O5% (mg/100mL)	0.752
Potassium-K2O % (mg/100mL)	0.834
Calcium (mg/L)	11.12
Magnesium (mg/L)	0.95
Sodium (S/T) (mg/L)	4.78
Iron (S/T) (mg/L)	1.92
Cobalt (S/T) (mg/L)	0.079
Mn (mg/L)	0.15
Copper (mg/L)	0.287
Cadmium (S/T) (mg/L)	0.031
Lead (S/T) (mg/L) <	0.001

The food range, *Ponte 20* of the IVOGRAIN® animal feed production unit, an entity of the company SIPRA (Société Ivoirienne de Production Animale) was used during this study to feed the animals. Table II shows the bromatological composition of the food.

Table 2. II: Bromatological composition of laying food 20

Compositions	Values
Metabolizable energy (Kcal/Kg)	2768.09
Crude protein (%)	17
Crude fat (%)	5
Raw ash (%)	13
Crude fiber (%)	4.7
Calcium (g/Kg)	34.9
Total phosphorus (g/Kg)	5.8
Sodium (%)	0.17
Vitamin A (IU/Kg)	9000
Vitamin D3 (IU/Kg)	2250
Vitamin E (IU/Kg)	18.5

For this study, 2nd age feeders and drinkers used respectively to feed and water pullets. Egg-laying nest and alveolus were used for laying and collecting eggs respectively. An SH-125 brand electronic scale with a capacity of 5000 ± 1g was used for weighing the eggs. A UNIQUE® brand electronic scale with a capacity of 40,000 ± 2g was used to weigh the pullets and the food distributed.

2.2 METHODS

2.2.1 EXPERIMENTAL PROTOCOL

This study required the use of two batches of 249 pullets each due to five (05) animals per m^2. Among the two batches, one served as a control and the second as an experimental batch subjected to the food additive ALPHA-BIO+. Each batch was subdivided into three (3) sub-batches of 83 pullets. The experimental batch and the control batch were conducted in the same building and the same conditions. Water and food were served to both batches in the same proportions while, however, evaluating the quantities of food actually consumed in each batch. Indeed, from a pre-laying food at the start of the experiment (at the age of 18 weeks), a transition was made to move to a laying food (*Ponte 20*) from 2% laying until the end of the experiment. The food distribution was carried out during the cold hours of the day, particularly morning and night. Water was available during the experimental period. In the experimental batch, the food additive was added to drinking water over a period of three (3) to five (5) days every three weeks. However, if disease is suspected, the additive is used to prevent the problem. For each treatment, ALPHA-BIO+ is used at a rate of 2 ml/l of water. As for the control batch, its health monitoring was carried out in accordance with the medical prophylaxis program of the hatchery supplying the chicks. Indeed, for this batch, vaccines and antiparasitics were used to prevent and/or treat viral and/or parasitic diseases. Also, in this batch, antibiotics were used each time a health problem of bacterial origin occurred. A light program has been put in place. From 12 hours of natural light, the hens were stimulated by going to 14 hours of light from the 18th week and then to 15 hours of light at the end of the 19th week. The launch of light stimulation took into account the live weight of the pullets. Indeed, the light stimulation was carried out when the pullets recorded an average weight of 1400 g. At the time of laying, egg collection was done five times a day. Each evening after service, the number of eggs laid and the average egg weight are determined for each batch.

2.2.2 Zootechnical Parameters

2.2.2.1 Ingested Daily Food

The individual food ingested was determined by the difference between the quantity of food served and the refusals according to the following formula:

$$Food\ ingested\ (g) = quantity\ of\ food\ served\ (g) - quantity\ of\ food\ refused\ (g)$$

2.2.2.2 Eggs Weight

Each day, 10% of the eggs laid were weighed to determine the average weight. Double-yolked eggs, small eggs, and abnormal eggs were not considered in the weighing. The average egg weight is determined by the following formula:

$$PMO\ (g) = P10\%\frac{g}{N}$$

PMO = Average egg weight
$P_{10\%}$ = Weight of 10% of eggs laid
N = Number of eggs weighed

2.2.2.3 Conversion Index

It provides information on food quality. This is the quantity of feed consumed to produce one kilogram of egg. It is obtained by the quantity of food consumed compared to the weight of all eggs laid over a given period.

$$IC = \frac{Quantity\ of\ food\ consumed\ over\ a\ period}{Weight\ of\ all\ eggs\ produced\ over\ this\ period}$$

2.2.2.4 Laying Rate

It makes it possible to evaluate the quality of the egg laying. It is determined by the number of eggs laid per day in relation to the number of hens present at the start of the day.

$$Laying\ rate\ (\%) = \frac{Number\ of\ eggs\ laid\ during\ the\ day}{Number\ of\ hens\ at\ the\ start\ of\ the\ day} X\ 100$$

2.2.2.5 Mortality Rate

It is determined by the number of dead animals out of the total number of animals.

$$Mortality\ rate\ (\%) = \frac{Number\ of\ dead\ animals}{Total\ number\ of\ animals} X\ 100$$

2.2.2.6 STATISTICAL ANALYZES

The data collected was processed with Microsoft Office 2016 Excel software which was also used to construct the tables and figures. R-STUDIO software version 4.3.1. was used for statistical comparisons of the zootechnical parameter values of the two batches. Thus, average values of intake, conversion index and live weight were subject to a Fisher test while the proportions linked to laying intensity were subjected to a Khi-2 test. The significance level for these comparisons was 0.05.

3 RESULTS AND DISCUSSION

3.1 RESULTS

3.1.1 INGESTED FOOD

Figure 2 illustrates the food intake of the control and experimental batch. From the 18th to the 38th week of age, the food ingested by the control group was higher than that of the experimental group. The values obtained varied from 97.7 ± 13.95g to 120.87 ± 17.26g for the control batch and from 94.12 ± 13.44g to 114.95 ± 16.42g for the experimental batch. However, no significant difference was observed between the foods ingested from the two batches. ($p > 0.05$).

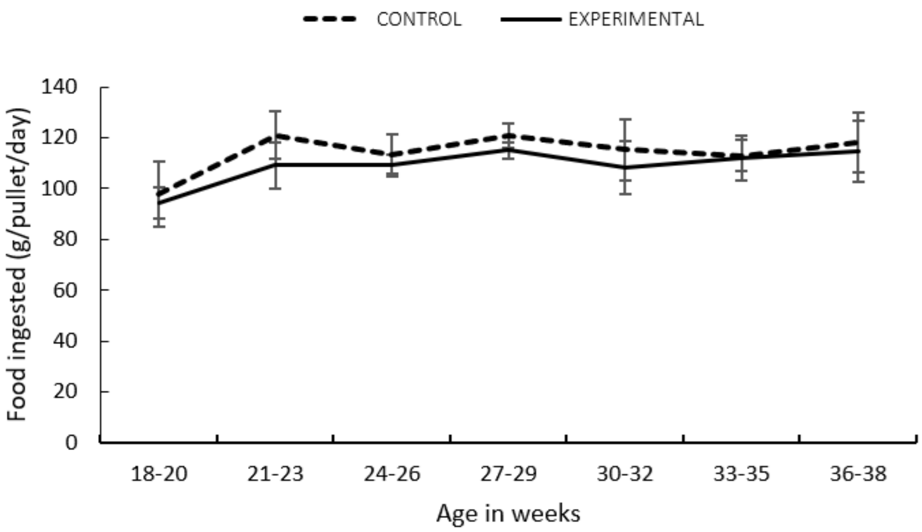

Fig. 2. Pullets food ingested evolution in the control and experimental batches from week 18 to week 38

3.1.2 CONVERSION INDEX

Overall, the comparison of the conversion index values of the control batch and the experimental batch showed no significant difference ($p > 0.05$). During this study, the highest values of the conversion index were recorded in the first two age intervals in each batch, in particular, the age interval 18-20 weeks and 21-23 weeks. For these two age groups, the values of the conversion index for the two batches varied between 2.19 and 2.34. For the other age groups, the conversion indices of the two batches varied between 1.92 and 2.08 (**Figure 3**).

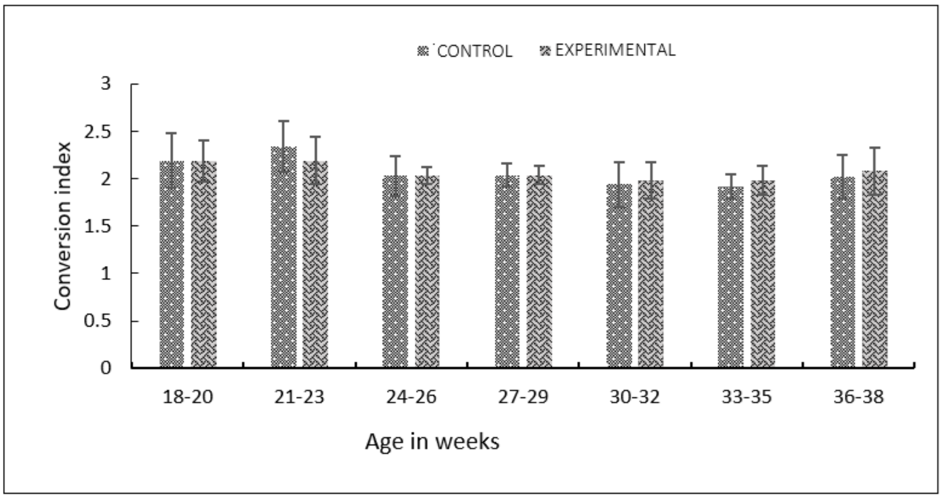

Fig. 3. Evolution of the conversion index of the control batch and the experimental batch from week 18 to week 38

3.1.3 LAYING RATE

Figure 4 illustrates egg production from the start of laying to 38 weeks of age. The laying rate of the two batches increases rapidly from the start of laying and reaches the peak of 95.24% for the control batch and 98.54% for the experimental batch during weeks 30 to 32. Statistical tests established no significant difference between the laying rates of the two batches from week 18 to 38 ($p > 0.05$).

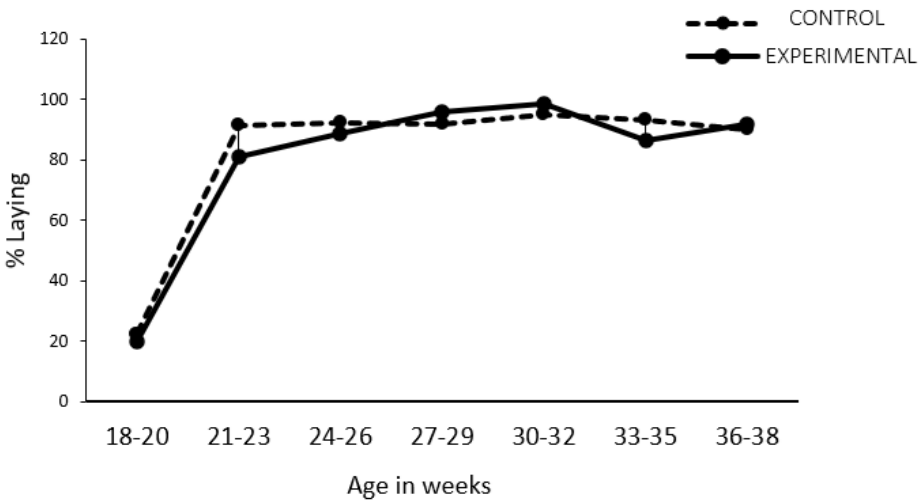

Fig. 4. Laying rate evolution of the control and experimental batches

3.1.4 AVERAGE EGG WEIGHT

The average egg weights of the two batches evolved increasingly over the entire period of the study. However, the average egg weight of the control batch was greater than that of the experimental batch over the entire study period although statistical analyzes showed no significant difference ($p > 0.05$).

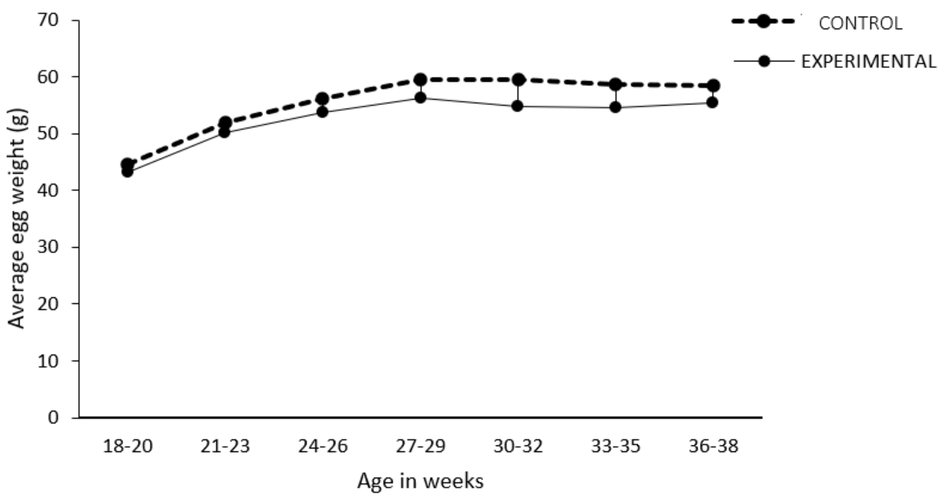

Fig. 5. Average egg weight evolution of the control and experimental batches on the study period

3.1.5 Mortality

No mortality was recorded during this study. In fact, the two batches in particular, the control batch and the experimental batch, did not record any cases of mortality during the study.

3.2 Discussion

In this trial, the addition of the food additive ALPHA-BIO+ to the drinking water of the experimental batch did not reduce food intake, egg production and viability of the animals in this batch. En effet, pour l'ensemble des paramètres évalués, les valeurs obtenues chez les deux lots sont statistiquement similaires. This similarity in the zootechnical parameter values of the two batches could lead us to say that the feed additive does not have a negative effect on feed intake, conversion index, egg laying and animal viability. The food additive did not reduce the absorption capacity of nutrients at the intestinal mucosa and would also have allowed the subjects to better value the food. Indeed, containing in particular minerals and trace elements, phosphorus, potassium, calcium, magnesium, sodium, iron, cobalt etc., ALPHA-BIO+ seems to be an ideal food additive to optimize the productivity of poultry and particularly of laying hens. This is supported by the work of [12]. The work of these authors, on the effect of the source of zinc and manganese in the feed for laying hens on the quality of eggshell and bone, gave satisfactory results. Indeed, these trace elements did not degrade egg production, egg weight, feed consumption and feed efficiency. Furthermore, an improvement in the resistance to breakage of egg shells, particularly in the late phase of the laying cycle, from 62 to 70 weeks, was recorded. The beneficial effect of copper in poultry feed has been proven by the work of [13], [14]. According to these authors, a copper intake higher than nutritional requirements would improve the growth performance of broilers. In addition, work carried out by [15] showed that a diet enriched with 100 mg/kg of copper increased the response to primary antibodies against *Salmonella pullorum*. Zn is a trace element essential for the immune system and resistance to disease. A zinc deficiency would lead, according to [16], to involution of the thymus. Still according to them, this deficiency would be associated with an increase in the frequency of bacterial and viral infections. At the dietary level, zinc is a structural component of several enzymes and its availability seems necessary for the activation of these enzymesIt is also involved in the regulation of amino acid and protein metabolism. In addition, it contributes to the stabilization of the intestinal mucosa, the inhibition of the growth of certain pathogenic bacteria and also the improvement of the immune response against infections [17]. According to [17], copper and zinc are involved in the maintenance of cellular integrity, the expression of proteins associated with glutathione metabolism and oxidative stress in the intestinal tract. Still according to them, these compounds would have a beneficial effect on the digestibility of nutrients. In fact, they reduce diarrhea problems and coliform populations in the digestive tract. They also promote better growth performance by stabilizing the intestinal microflora and increasing the surface area of the intestinal villi compared to that of the crypts. The work carried out by [18] showed the beneficial effect of feed additives on the productivity of poultry and particularly laying hens. Indeed, the results of their study showed a significant improvement not only in production parameters, notably the laying rate, the weight of the egg, the rate of downgraded eggs but also in the quality of the egg. Additionally, other work has achieved similar results. These are the works of [19]. Indeed, these authors used feed additives in the feed of layers and all observed an improvement in production parameters. Furthermore, in addition to improving production parameters, [20] recorded a reduction in cholesterol levels in subjects who received a feed additive.

4 CONCLUSION

The use of the food additive ALPHA-BIO+ in drinking water on the productivity of laying hens Lohmann Brown gave satisfactory results. In fact, it did not reduce the viability of the animals. It also improved productivity, including laying rate, conversion ratio and egg weight. ALPHA-BIO+ would therefore be partly an alternative to antibiotics and a solution to improve the productivity of laying hens and reduce production costs.

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