
COMPARISON OF THE WEIGHT PERFORMANCE OF THE SAME STRAIN OF BROILER CHICKENS SUBJECTED TO THREE RATIIONS

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ABSTRACT

This work aims to improve the weight performance and survival rate of the chicks by incorporating local agricultural by-products into their feed. During this study, one hundred and twenty (120) day-old chicks of Ross (508) meat strain with a live weight of 40 ± 2 g were randomly assigned to three treatments. A comparison of the results obtained after six weeks of weight growth monitoring showed significant variations within and between treatments. Statistical analysis showed a significant difference between Lot 1 and Lot 2 ($p < 0,05$) to the disadvantage of Lot 1 and a highly significant difference between Lot 1 and Lot 3 ($p < 0,001$) to the advantage of Lot 3, as well as between Lot 2 and Lot 3 ($p < 0,001$) to the disadvantage of Lot 2. The values 112.68 g, 113.55 g and 116.38 g correspond to the average daily earnings of the animals of lot 1, lot 2 and lot 3 in order at the end of the trial. Thus, the highest feed conversion rates were observed for the chicks of lot 2 (CI=0.99) which recovered more than those of lot 1 (CI=1.06) and lot 3 (CI=1.49). It appears of this study that the addition of crushed sorrel leaves in the birds' feed had a positive effect on weight performance, chick survival and physical activity.

Keywords: Broiler chickens, Association, Sorrel leaves, Weight performance, Niger.

1. INTRODUCTION

Livestock accounts for 40% of global agricultural production in terms of value, and contributes to the livelihoods and food security of nearly 1.3 billion people [9]. It is also the primary insurance against risks for millions of poor people whose livelihoods rely on rain-fed agriculture. Niger is a breeding country par excellence. An activity practiced by nearly 87% of the working population [21; 24]. The contribution of livestock is on average 15% to household income and 25% to the satisfaction of food needs according to the Rural Development Strategy document [21].

Chicken represented 57.5% of poultry reared in Niger in 2007 with a predominance of local breeds representing 54.7% of the herd [20]. Intensive poultry farming concerns 2.8% of the workforce, broilers representing 1.6% of the poultry flock and laying hens 1.2% [18; 23]. Before the census, the breeding services considered that chicken constituted 70% of the poultry raised in

Niger [20]. Poultry farming is a source of food (meat, eggs) and income for producers and effectively contributes to ensuring sustainable food security and poverty reduction [18]. The development of poultry farming requires a sustained availability of raw materials [8], in this case day-old chicks and food resources in quantity and quality which condition the development of production performance. The poultry sector is characterized by the diversity of species and production methods. Each of the models is positioned on a very specific market, responding to the demand of consumers who are also very diversified in their consumption choices. The present work follows this logic. For this study, the choice is made on the breeding of the species *Galus galus* domesticated in Asia a long time ago. It is about broiler chicken farming. The objective of this work was to improve the weight performance and survival rate of chicks by incorporating local agricultural by-products into their diet.

2. MATERIALS AND METHODS

2.1. Experimental site

This work was carried out in a poultry farm located 3 km from the Urban Commune of Kollo (CUK) whose geographic coordinates are 13 ° 20'25" North, 2 ° 18' 59" East (Figure 1). Kollo is a town in the department of Kollo in the Tillabery region. Located around 30 km from the capital Niamey to the South-East. The CUK covers an area of 10,002 km² [16]. Its population was 443,371. The climate is desert-like according to the Koppen-Geiger classification of 1900. Annual precipitation averages 635.3 mm.

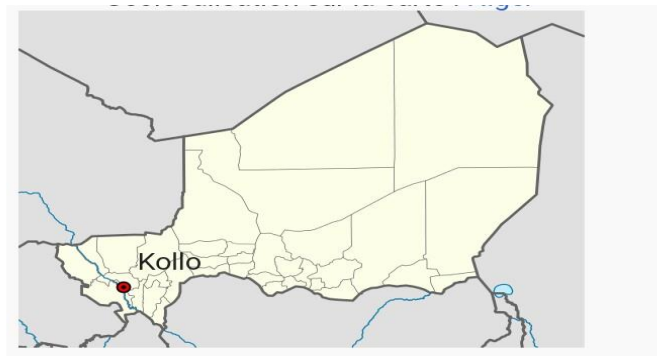


Figure 1: Geographical location of the Urban commune of Kollo [16]

2.2. EQUIPMENT

2.2.1. Biological material

During this study, one hundred and twenty (120) broiler day-old chicks were used. This is precisely the Ross 508 strain (Figure 2).



Figure 2: Day-old chick of Ross Strain 508

2.2.2. Technical material

The technical equipment used during our work consists of:

At the level, it is placed: (i) Three feeders / starter trays; (ii) Six second age feeders; (iii) Three early drinking troughs; (iv) Three second age drinkers.

To weigh the amount of feed to give the animals and even take their weight weekly, we used a scale and a bucket. A sprayer was used for the disinfection of the habitats. Added to these are light bulbs, brooms, a metal basin used for mixing and many more.

2.2.3. Food

The rations formulated for the animals in the sample consisted of crushed corn seeds, wheat bran and 30% broiler concentrate which constitute the staple diet and crushed sorrel leaves (Figure 3b). But given the inaccessibility of the 30% broiler concentrate, a ready feed manufactured by the Nuseb company (Figure 3a) was used after two weeks of start-up.



Figure 3: Ready-made food from the company Nuseb (a) and crushed sorrel leaves (b)

2.3. METHODS

2.3.2. Preparation of chickens

2.3.2.1. Establishment of guard perimeters

For successful production in broiler breeding, sanitary prophylaxis is necessary. The installation of the guard perimeters was preceded by the sweeping of the surface to be exploited and the elimination of cobwebs as well as all kinds of objects which could impact the production. Made with broken cement within a building, three guard perimeters were created. Each of these guard perimeters has an area of 2 m². Here, the idea is 20 chicks / m². This preparation of guard perimeters was done one week before the arrival of the chicks. They were disinfected with sleet, a high efficiency disinfectant. This practice consists of reducing or neutralizing pathogens.

2.3.2.2. Litter placement

Raising broilers on the ground requires the installation of litter to ensure the proper growth of these birds, in other words to combine the comfort and health of the poultry. In order to meet the requirements of this breeding, a good dry and slightly flexible litter was put at the perimeters. It is the rice rooster, 15 cm thick. This litter prevents contact between birds' feet and cement or soil. In such a production system, litter plays an essential role, because this contact produces necrosis, the bird uses all its energy to fight against this plague and this slows down its growth. Pododermatitis (or contact dermatitis) is an inflammation of the skin affecting the plantar region of chickens feet which can lead to mild to severe lesions. When there is a lesion, the latter can serve as an entrance for certain microorganisms including *Staphylococcus aureus* and create secondary infections. It (the litter) was subsequently disinfected in order to neutralize viruses and bacteria if it contained.

2.3.2.3. The footbath

A device called the footbath is placed at the front door of a chicken coop. The latter must be regularly maintained. For large poultry farms, the footbath is used to disinfect the wheels of the trucks that bring the food. The footbath used in this study was always cleaned and filled with water containing the upper sleet. It is a disinfectant among many others, it has a significant efficiency in the dosage. It is used one cc for one liter of water. It was used here to disinfect the feet whenever we would enter the chicken coop. This can reduce the spread of disease between different buildings.

2.3.2.4. Heating system

The good start of broiler chicks can be conditioned by an ideal temperature of 30 ° C. To maintain this temperature, the installation of a heating system is essential within the broiler. During this study, three heating systems were used namely:

System 1: The use of waste-based coal.

It is the most efficient system used when starting chicks. The first week of this job coincided with the cold season. The month of January is a very critical time for the chicks, the temperature is too low ranging from 5 ° C to 18 ° C. Chicks need a temperature close to that of their fetal life 37 ° C to 38 ° C. This charcoal heater allowed us to maintain the ideal temperature by using the signs observed in chicks as a guide to adjustment. Thanks to this, we were able to ensure a good start.

The system 2: The use of heating bulbs

Three heat bulbs were used during the last weeks of the start-up phase. The heating bulbs were used in the second phase from the end of the first week until the 21st day which constitutes the end of the start-up phase. One bulb for each compartment of the broiler housing a set of 40 subjects. They were placed 0.5 m high above the ground to provide maximum heat to the animals.

System 3: The use of gas

This method was used as a reinforcement to the three blisters. The bottle was placed out of the way, it was used through a radiant placed within the dust and a pipe. The use of gas lasted 5 days. When there is a good temperature or bad temperature, the signs below will be noticed:

The chicks are distributed over the entire available space: temperature and ventilation are well regulated;

The chicks clump together in certain places (under the heaters), are not very active, do not start to move around here and there and appear listless: the temperature is too low;

Chicks avoid certain places: there may be drafts there;

The chicks are spread out on the ground, wings extended, seem to pant and start to chirp: it is too hot or there is too much carbon dioxide in the ambient air

2.3.2.5. Health

Avian diseases are the leading cause of death in poultry farming. To fight against these pathologies, we have implemented a prophylaxis plan (Table 1).

Table 1: Prophylaxis plan

Day	Disease/Stress	Product /Vaccine	Administration Voice
1 st to 3 rd	Stress	Antibiotic ± vitamin and sugar water (5 to 10g/L) or vitamin	Drink water
4 th	Stress	Amin total	Drink water
5 th	New Castle et	HB1 et H120 ou cevac BIL ou	Drink water

	bronchite	sota	
6 th to 7 th	Stress Vaccinal	Amin total	Drink water
8 th	Simple water		
9 th	Stress Vaccinal	Amin total	Drink water
10 th	Gumboro	Cevac et gumboro	Drink water
11 th to 12 th	Stress Vaccinal	Amin total	Drink water
19 th to 20 th	Coccidiose	Amproluim	Drink water
19 th to 20 th	Stress Vaccinal	Amin total	Drink water
21 st	New Castle et bronchite	HB1 et H120 ou cevac BIL ou sota	Drink water
22 nd to 23 rd	Stress Vaccinal	Amin total	Drink water
24 th to 25 th	Déparasitage	Diurétiques	Drink water
26 th	Simple water		
27 th	Stress Vaccinal	Amin total	Drink water
28 th	Gumboro	Cevac gumboro	Drink water
29 th to 30 th	Stress Vaccinal	Amin total	Drink water
31 st to 39 th	Simple water		
40 th to 42 nd	Coccidiosis (abates latef)	Amproluim	Drink water
43 th to 45 th	Simple water		

a) Health prophylaxis

This term refers to a whole set of measures that the aviculturist will take to prevent the appearance of diseases in his farm. These measures do not call for drugs but rather for observing good practices within the unit. The subject being very broad, the elements which we evoke in these lines are far from being exhaustive.

Choice of the appropriate site, adequate infrastructure and materials;

Permanent hygiene of shelters, water, food and actors

Cineration of corpses, quarantine of newly acquired poultry;

Absence of noise around the facilities;

Fight against predators

b) Medical prophylaxis

Vaccination is made against the most frequent diseases such as: smallpox, Gomboro disease, Newcastle disease, infectious bronchitis, etc ...

Periodic disinfection and disinsection of shelters and equipment;

Periodic deworming of poultry;

Distribution of anti-stress products before and after handling in the event of worsening atmospheric conditions (high heat, violent storms, heavy rains).

2.3.2.6. The conduct of the test

A total of one hundred and twenty (120) day old chicks of the Ross strain with an average weight of 40 ± 2 g were selected and distributed at random in three different batches (treatments). Table 2 shows the experimental setup and explains how the rations and the different proportions of these foods are formulated.

Table 2: Experimental setup

Lots	Number of subjects at start-up	Rations
Lot 1	40	Staple food (but 55%, wheat bran 15%, concentrate broiler 30%)
Lot 2	40	Staple food (but 55%, wheat bran 15%, concentrate broiler 30%) + 10% scrambled sorrel leaves
Lot 3	40	Staple food (but 55%, wheat bran 15%, concentrate broiler 30%) + 15% scrambled sorrel leaves

2.3.2.7. The observed parameters

The parameters observed during this study are: (1) Weight change, (2). The Average Daily Gain (ADG), (3) The consumption index; (4) The death rate. Weight change (live weight) and mean

daily GQM gain were followed by weekly weighings from the first week until the end of the trial.

The consumption index (CI) is the ratio of the amount of food ingested (QAI) and the ADG. The IAQ is determined by taking into account the quantities of feed distributed to the animals each week removed from the weekly refusal and thereafter the daily consumption. Thanks to these, it was possible for us to assess the zootechnical performance indicator, which is the CI, in a real time of six weeks.

The mortality rate (MT) was calculated by taking the ratio between the number of deaths recorded within a batch and the total number at the start of the batch in question, the whole multiplied by one hundred.

2.3.2.8. Statistical analysis of data

The data recorded on the individual cards were reported in an Excel file before being subjected to an analysis of variance (ANOVA1) using the software Minitab version 14. The Tukey test was used to identify the means which differed. significantly at the 5% level.

3. RESULTS

3.1. Results

3.1.1 Effect of adding crushed sorrel leaves

3.1.1.1. Live weight

At the start of the test (at one day old), the birds weighed 40 ± 2 g. Table 3 represents the average weights of these different treatments (batches). For the weight growth of the birds, a significant variation was observed within the same lot and between the different lots at the end of the test. Statistical analysis of the data revealed an important distinction between Lot 1 and Lot 2 ($p < 0.05$) to the disadvantage of Lot 1 and a more significant difference between Lot 1 and Lot 3 ($p < 0.001$) to the advantage of Lot 3, as well as between lot 2 and lot 3 ($p < 0.001$) to the detriment of lot 1.

Table 3: The average live weights of the animals at the start and at the end of the test

Lots	Average starting weights (g)	Average weights at the end of the test (g)	Average change (g)
Lot 1	40.25 ± 1.03^{ab}	1581.40 ± 9.65^{ac}	1541.15 ± 4.26
Lot 2	39.50 ± 1.27^{ab}	1623.46 ± 19.94^{ac}	1583.96 ± 31.96
Lot 3	40.00 ± 1.58^{ab}	1615.88 ± 15.67^{ac}	1575.88 ± 22.57

A: for the same row, the difference observed between the values assigned to this letter is statically significant ($p < 0.001$).

Ab: for the same column, there is not a significant difference between the values affected by the letters ab.

Ac: for the same column, a significant difference ($p < 0.01$) is observed between the values affected by the letters ac.

Representative growth curves of animals from three treatments (lots) in this case Lot 1, Lot 2 and Lot 3 are not types of a first degree function (Figure 4). Indeed, they prove a continuous evolution of weight gain of the animals during six weeks of follow-up. In addition, it was found that there was no significant advancement in growth between the three treatment levels during the first week. For Lot 2 and Lot 3, their representative curves differ from that of Lot 1 towards the end of the last two weeks of the test.

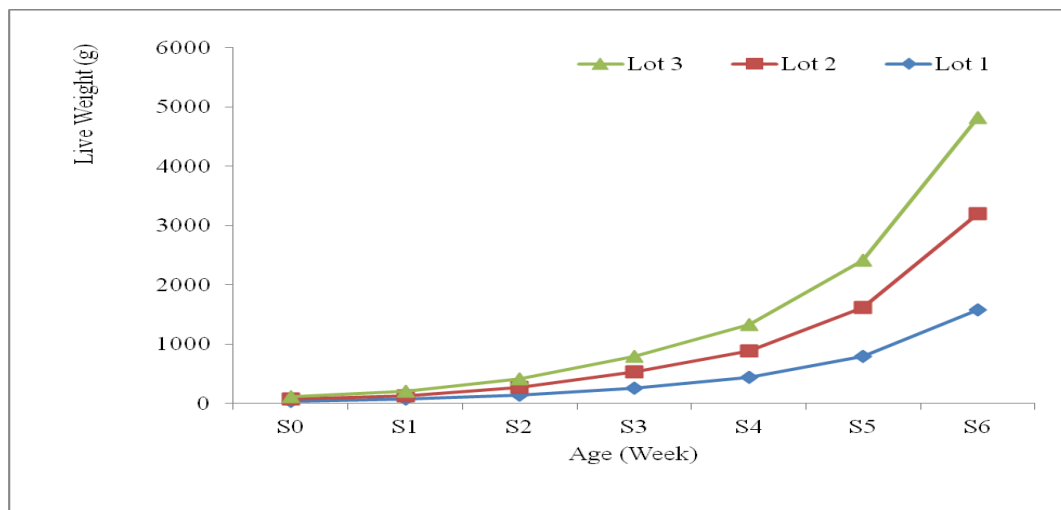


Figure 4: Weight growth curves for the different treatments

3.1.1.2 Average daily gain (ADG).

It was performed at the same time as the monitoring of the weight development of the chicks. The values 112.68 g, 113.55 g and 116.38 g correspond to the ADGs of the animals of Lot 1, Lot 2 and Lot 3 in the order at the end of the test. These ADGs were recorded in Table IV. From the start of the test (S1) until the end (S6), the animals show a weight gain of slightly less than double their previously obtained weight. It is noted that at the end of the second week Lot 1 or the control receiving only the basic feed experienced a significant gain than the test lots. On the other hand, the latter, whose ration is supplemented with sorrel leaves, generated a greater gain at the end of the last two weeks of the trial.

Table 4: Average daily earnings

Lots	Beginning of the test Week	ADG (g)	
		Week 1	Week 6
Lot 1	0	3.32	112.68
Lot 2	0	3.13	113.55
Lot 3	0	4.28	116.38

Figure 5 shows the evolution of the ADGs of the different treatments (batches). A considerable change in this GMQ parameter is observed and presented by a strip graph comprising a succession of cycles. At the end of the first weighing, the chickens have an ADG of 3.32 g (batch 1), 3.13 g (batch 2) and 4.28 g (batch 3). The latter (batch 3) recorded the best score before experiencing a drastic drop in Week 2. From Week 3 to Week 4, we observe an alternation of weight gain between the different treatments (batches). Finally, from S5 to S6, the two test batches all show an increase in weight gain. Taking into account all the weighings made during the six weeks of the test, the ADG of chickens from three batches was more or less considerable for both test batches.

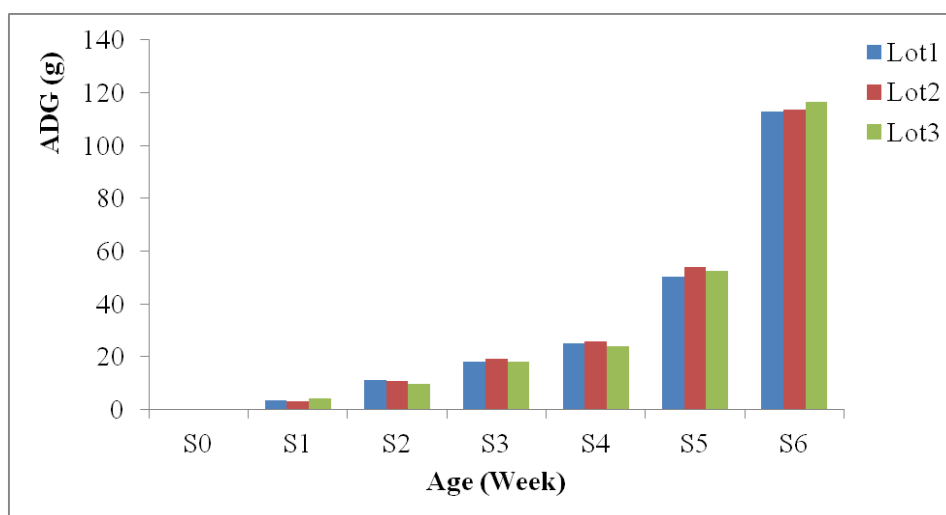


Figure 5: Evolution of the Average Daily Gain

3.1.1.3. Consumption index

They were determined by considering the value of the quantity supplied to the animals and the refusal obtained as well as the ADG. The highest CIs were observed at the 5th week and 6th week levels where the birds from Lot 2 (CI = 0.99) valued more than those from Lot 1 (CI = 1.06) and Lot 3 (CI = 1.49) at the 5th week. This state changes at the 6th week when the best CIs were recorded at the levels of batch 1 (CI = 0.46) and of batch 2 (0.47) next to CI = 0.47 obtained in batch 3. The intra-treatment comparative degree noted differences in a clear and

frank manner ($p < 0.001$). For all the stages, the variations observed between the three batches are also significant ($p < 0.05$) except for the last week of the test during which batches 2 and 1 recorded 0.46 and 0.47 respectively (Table 5).

Table 5: Average Change in ADG of Birds Over Six (6) Weeks

Lots	Beginning of the test	Week5	Week 6
Lot 1	0	1.06	0.47
Lot 2	0	0.99	0.46
Lot 3	0	1.49	0.73

Figure 6 shows the change in the consumption index of different treatments during the experiment, in other words during the 6 weeks. Overall, this growth indicator underwent a continuous gradual change during this trial.

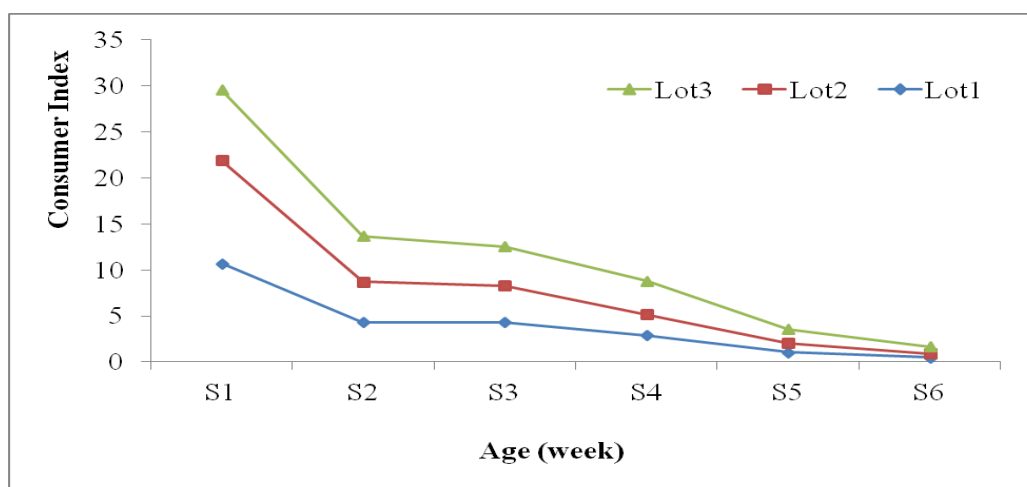


Figure 6: Evolution of feed efficiency

3.1.1.4. Mortality rate

During this work, cases of mortality were recorded at the level of each batch. Of course, this work was done at a critical juncture. However, supplementation with sorrel leaves had a positive effect on the survival of the animals in Lot 3. Table 6 shows the mortality rate.

Table 6: Mortality rate

Lots	Number at the start of the trial	Mortality rate

Lot 1	40	35.5%
Lot 2	40	35%
Lot 3	40	15%

4. DISCUSSION

4.1. Effect of supplementation on the growth of chickens

Considered the most important and costly factor in any kind of breeding, feed is provided in three types: (i) starter feed; (ii) growth; (iii) and the finishing feed, the transition of which is gradual depending on the stage of development of the chickens. Complex diets of whole grains mixed or not with other raw materials have allowed poultry for years to experience significant weight gain [10; 14]. Maize is an ideal feed for broilers and it often forms the basis of their diet in developing countries [13; 17]. However, in countries where white broilers are preferred, white corn or other non-coloring cereals should be used, as the broilers currently in use have the genetic property of accumulating fat [17]. The main parts of the corn kernel show significant differences in chemical composition. The seed coat is characterized by a high crude fiber content of around 87%, composed mainly of hemicellulose (67%), cellulose (23%) and lignin (0.1%) [6]. In modern poultry farming, the feed is always a combination of two or more products of the same origin or not in order to correct the lack of nutrients in such and such products. As a reminder, this work aims to highlight three types of food, two of which have a complementation of crushed sorrel leaves in the following proportions: 10% and 15%. The test was carried out on the fast-growing flesh strain of Ross 508. With regard to the zootechnical parameters, the rations formulated during this test allowed a growth of 79 to 81% from the start of the test until in the sixth week. Figure 20 shows a remarkable development and demonstrates the existence of a positive effect of the association of sorrel leaves in the ration. From a nutritional point of view, the leaves are rich in Ca, K, Mg, N, and P [2]. In Niger, the young leaves are also used as ingredients in sauces and serve as a nutritional supplement to cereals such as rice, sorghum and millet [4; 5]. Few data on the topic are available in the literature to compare with those obtained during the present study. However, the average weights recorded during this experiment remain lower than the results obtained during previous studies. For example, the standard, fast growing Ross and Cobb chickens were slaughtered at an age of about 42 days, weighing 1.8 to 1.9 kg [11]. The differences observed with the results by Guerin [11] could be related to the ready food of Nuseb used by default during the test which seems to be less advantageous than the daily mixture resulting from the combination of corn, wheat bran and 30% broiler concentrate for the strain in question.

4.2. Consumption index

While the Nuseb Company's ready feed has an effect on animal growth, the results obtained are below the threshold in the sixth week of previous chicken production on the farm. Indeed, if certain nutrients are lacking, appetite decreases at the same time as growth performance [17].

Omnivorous, and even mainly granivorous, chickens eat more when 70% of their ration is composed of products crushed or crushed into coarse particles [7].

In poultry, digestible energy is not used to characterize the fraction of gross ingested energy that can be used by the animal since faeces and urine are excreted simultaneously at the level of the cloaca. Conversely, metabolizable energy (ME) is relatively easy to measure and therefore is the most widely used energy system [22]. Despite the more or less negative effect of the ready food, which is the default staple, this energy is appreciable at the levels of the last two weeks of the trial.

This is the most remarkable part of the work, figure 22 shows the effect of the association of crushed sorrel leaves where the animals of the second test batch were able to withstand bad weather more than chickens from the other batches, with an 85% survival rate. In addition, physical activity has been observed at the same lodge as the birds from other lodges crowd together for cover. This could be related to the macronutrients and micronutrients contained in sorrel leaves; especially iron which is supposed to correct fatigue and even anemia in the body. According to a study by Abraham [1], hibiscus sabdariffa leaves contain essential nutrients. This plant from the Malvaceae family is also possibly used as an antibiotic and anti-inflammatory, given the amount of methyl esters it contains.

5. CONCLUSION

At the end of this work, it was noticed that the addition of crushed sorrel leaves in the staple diet of birds had a positive effect especially for the survival and physical activity of the birds. It was also noticed that the test batches, in other words batch 2 and batch 3 fed with a combination of the basic food plus sorrel leaves in respective proportions 10% and 15%, achieved very encouraging performances than the batch 1 said witness. In addition, these results confirm the assumptions made at the start of this experiment. In short, the trial yielded appreciable results despite the multiple obstacles encountered. In the course of this work, some difficulties have been recorded which are blocking the development of the poultry sector. Indeed, poultry producers face technical problems in controlling the entire water and feed supply circuit. Access to finance is limited. It is not easy for poultry farmers to find quality concentrates. This constitutes a brake on the conduct of this activity. The exotic strains require care from a sanitary point of view and this will increase the cost of the expense or even generate a loss for the producers.

Author Contributions

Harouna ABDOU designed and planned the study; Harouna ABDOU and Mahamadou ABDOULAYE BOUKAR collected the data. Harouna ABDOU wrote the first version of the manuscript; Harouna ABDOU carried out the statistical analyzes; Harouna ABDOU and Ibrahim ADAMOU KARIMOU, Boureima KARIMOU, Ibrahim ADAMOU KARIMOU and Mahamadou ABDOULAYE BOUKAR revised all versions of the manuscript; Harouna ABDOU coordinated the work from conception to revision of the latest version of the manuscript.

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