Original Research Article

Effect of Locally Available Feed on The Zootechnical Performance of Local Chickens in Niger

ABSTRACT

This study was conducted with the main objective of knowing the effect of incorporating local products into the food ration on growth performance in young local chickens in Niger. The study is carried out on 200 local chickens aged 6 weeks and divided according to a completely randomized design into 4 groups of 10 subjects each on peanut shell bedding. Millet, wheat bran, millet bran, peanut cake, sorrel seeds, fish meal, locust meal, moringa leaves, bone meal were the main materials. raw materials used to formulate the four (4) different foods. Water was distributed freely to all individuals. The food was distributed over a period of 4 months. The results show that food 3 is the most consumed by local chickens. The feed had a very highly significant effect (P=0.000) on the live weight of the chickens in the second month of the experiment and a significant effect (P=0.020) during the third month. There is sexual dimorphism between the hens and the roosters for foods 2, 3 and 4. It appears from the statistical analysis that there is only a significant effect on the Average Daily Gain of local chickens between the different treatments. during the first month. Likewise, the food only had a significant effect (P = 0.055) on the consumption index of local chickens during the first month of experimentation. For feeding local chickens, feed 2 containing fish can be used wherever there is availability and accessibility to fish. For localities that are more susceptible to locusts, the formulation of food 3 and 4 are more recommended. To enable the adoption of these formulas, it would be important to repeat the experiments in rural areas.

Key words: Local chicken, food, performance, family poultry farming, Niger.

1. INTRODUCTION

In Africa, the development of poultry farming is limited by the availability and quality of food. At the farm level, feed is the first item affecting the cost price and constitutes the most effective means of controlling production costs and product quality [1]. The problem of supplying food inputs is all the more crucial these days as we are witnessing an increase in the cost of ordinary materials on the international market, in particular corn (the main

Comment [U1]: This study aimed to investigate the impact of incorporating locally available ingredients into the diet of young indigenous chickens in Niger on their growth performance. Two hundred chickens, aged 6 weeks, were utilized in the study and randomly assigned to four groups of ten birds each, housed on peanut shell bedding. The diets were formulated using a variety of local ingredients including millet, wheat bran, millet bran, peanut cake, sorrel seeds, fish meal, locust meal, moringa leaves, and bone meal. Water was provided ad libitum to all birds, and the feeding trial lasted for 4 months.

Results revealed that the third diet was the most preferred by the local chickens. The diet significantly influenced the live weight of the chickens in the second month (P=0.000) and showed a significant effect during the third month (P=0.020) of the experiment. Sexual dimorphism was observed between hens and roosters for diets 2, 3, and 4. Statistical analysis indicated a significant difference in the Average Daily Gain of local chickens among the different treatments during the first month. Additionally, the diet significantly influenced the consumption index of local chickens during the first month of the experiment (P=0.055).

Based on the findings, it is suggested that Diet 2, containing fish meal, can be utilized in areas where fish availability and accessibility are high. Conversely, Diets 3 and 4 may be more suitable for regions prone to locust infestations. To facilitate the adoption of these dietary formulations, it is recommended to replicate the experiments in rural settings.

Please replace it

source of energy and more important in volume in food), but also other protein raw materials (soy, peanut, fish meal) which, due to human-animal competition and their diversion towards biofuels, poses availability problems [2].

In Niger, the supply of protein sources (cake, fish meal) constitutes a major constraint for poultry farmers. Additionally, it is difficult to have a regular supply of good quality fish meal. Furthermore, although available on the market, imported corn is increasingly difficult to access for poultry farmers. Indeed, competition with humans means that prices are very high and very fluctuating [3].

Under these conditions, the research and development of alternative and locally available food resources in chicken feed should make it possible to improve their productivity while maintaining input and production costs below the level of inflation in this system. poultry production [4].

The chemical composition and metabolizable energy vary depending on several factors including the origin of the ingredient [5]. But also, the food "formulator" must deal with the nutritional constraints of the available raw materials and compensate for the deficits of some with the advantages of others without penalizing the cost of the food [6].

This study contributes to improving the diet of local chickens in Niger by promoting local products in their diet.

2. MATERIALS AND METHODS

2.1 Experimental device

The experiment was carried out in a henhouse at the Regional Agricultural Research Center of Maradi, Niger. A total of 200 6-week-old local chickens were used. These chickens are purchased from farmers. They were distributed randomly into 20 groups of 2.5 m x 1.5 m with an initial number of 10 chicks per group on peanut shell litter. The experiment lasted 4 months.

2.2Feed, rationing and evaluation of chicken performance

Millet, wheat bran, millet bran, peanut cake, sorrel seeds, fish meal, locust meal, moringa leaves, bone meal were the main materials. raw materials used to formulate the four (4) different foods (Table 1).

Comment [U2]: In Africa, the progress of poultry farming is hindered by the accessibility and quality of feed. At the farm level, feed stands as the foremost cost factor and is pivotal in managing production expenses and ensuring product quality[1]. The challenge of procuring feed ingredients becomes increasingly critical with the escalating costs of staple commodities like maize, a primary energy source and a significant component in feed formulations. Moreover, the competition between human and animal consumption, along with the diversion of feed ingredients towards biofuel production, exacerbates availability issues for other essential protein sources such as soy, peanuts, and fish meal [2].

In Niger particularly, the scarcity of protein sources like cake and fish meal poses a significant hurdle for poultry farmers. Additionally, the irregular supply of high-quality fish meal compounds the problem. Despite being available in the market, imported maize faces accessibility issues for poultry farmers due to steep and fluctuating prices, attributed to stiff competition with human consumption [3].

In such a context, the exploration and utilization of alternative, locally sourced feed ingredients for poultry could enhance productivity while ensuring that input and production costs remain manageable, staying below the inflation threshold in poultry production systems [4]. The chemical composition and metabolizable energy of feed ingredients vary based on factors such as their origin [5]. Thus, formulating feeds entails addressing the nutritional limitations of available raw materials and compensating for deficiencies with the strengths of other ingredients, all while ensuring cost-effectiveness [6].

This study endeavors to enhance the dietary regimen of local chickens in Niger by advocating for the integration of locally available products into their feed, thereby striving to strike a balance between nutritional adequacy and economic viability.

Please replace it

The quantity of food distributed and refusals are collected every day. Weight measurements are carried out at the start of the experiment and every month. Before each weighing, the subjects were subjected to a total fast (food and water) in order to eliminate individual variations due to food intake.

From these collected data, the following variables were obtained: feed intake per chicken, live weight at typical age, consumption index and average daily gain.

Table 1. Food formulas used

Ingrédients (%)	Food 1	Food 2	Food 3	Food 4
Millet	67	65	63	60
Bran of wheat	10	0	0	0
Bran of millet	0	12	12	15
Peanutmeal	8	4	0	0
Sorrel grain	0	4	7	7
Fishmeal	10	5	0	0
Locustmeal	0	5	10	10
Moringa leaf	0	0.5	3.5	3.5
Bone powder	4	4	4	4
Premix	0.30	0	0	0
Lysine	0.10	0	0	0
Methionine	0.10	0	0	0
TOTAL	100	100	100	100

2.3Statistical analyzes

The data collected were entered into Excel 2016. The R software was used to carry out the analysis of variance of biological performances followed by the comparison of the arithmetic means using the Student-Newman-Keuls (SNK) test to detect the effects. treatments. The means are compared to the 5% threshold, i.e. for P values lower than 0.05, the difference is considered significant.

3. RESULTS AND DISCUSION

3.1 Evolution of food ingestion

The figure below shows the evolution of food intake depending on the month. There appears a progressive increase in the ingestion of the 4 types of food over the 4 months. Food 1 was better consumed by local chickens from the start of the experiment until the third month. It was overtaken by food 3 at the end of the experiment.

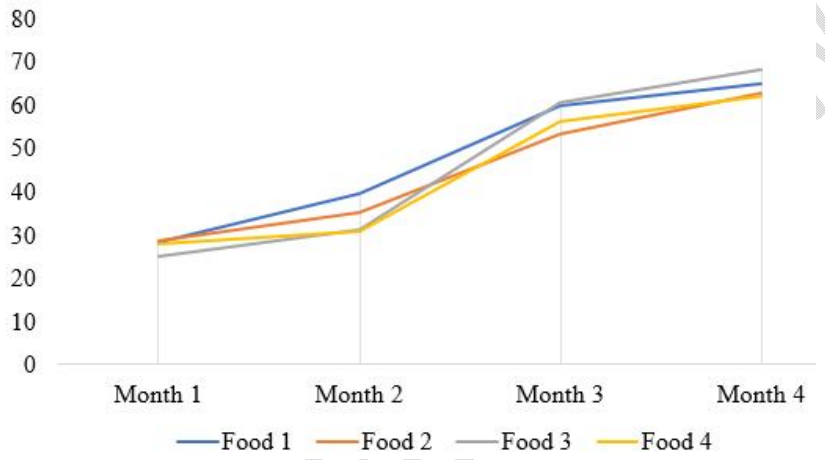

Figure.1 Food intake according to month

During the four (4) months of experimentation, the feed had a very highly significant effect ($P < 0.000$) on the intake of local chickens. The average intake of local chickens considering the 4 months varies from 62.03g/day for Food 4 to 68.21g/day for Food 3. Local chickens consumed less Food 4 containing more millet bran. They consumed more food 3 which contains more sorrel and locust grain. It therefore seems that local chickens have an appetite for sorrel grain and locust.This food intake obtained is higher than that obtained by Guédou et al. [7] and by Guédou et al. [8] in local chickens fed on different varieties of corn in Benin.Also, this resultdoes not corroborate those found by Muftau and Olorede[9] and Brah et al. [10] who recorded in broiler chickens, a lower consumption of foods containing locust meal as a replacement for fish meal. Furthermore, Salim and Ahmed [11] in Nigeria noted a negative effect on food consumption when the locust incorporation rate was 100%. On the other hand, Adeyemo et al. [12] found better feed consumption of broiler chickens when locust meal was incorporated at 50% into the fish meal replacement ration. The higher intake of the ration containing 100% locust flour could be explained by its slightly higher crude fiber content. This hypothesis supports the findings of

Ranjhan [13] that birds tend to consume more of a fiber-rich diet to meet their growth and development requirements.

Table 2. Feed intake (g/day) of local chickens

Month	Food 1	Food 2	Food 3	Food 4	p-value
1	28.26±6.00[a]	28.47±5.81[a]	25.00±4.90[b]	27.73±5.47[a]	0.000***
2	39.52±7.13[a]	35.06±8.92[b]	31.17±10.17[c]	30.82±8.80[c]	0.000***
3	59.95±12.42[a]	53.41±11.15[b]	60.53±13.28[a]	56.14±10.99[b]	0.000***
4	64.77±12.36[b]	62.75±10.35[b]	68.21±12.25[a]	62.03±8.00[b]	0.000***
Mean	64.77±12.36[b]	62.75±10.35[b]	68.21±12.25[a]	62.03±8.00[b]	0.000***

*a,b,c: means followed by the same letter on the same line are not statistically different (P>0.050); *=significant; **= highly significant; ***= very highly significant*

3.2 Evolution of live weight

At the start of the experiment (at 6 weeks of age of the chickens), the live weight of the local chickens did not show a significant difference (P = 0.790) (Table 3). The feed had a very highly significant effect (P=0.000) on the live weight of the chickens in the second month of the experiment and a significant effect (P=0.020) during the third month. Food1 containing a high proportion of fish has a high weight. Indeed, even if bromatological analyzes of locust and fish [14] have shown that locust meal has a protein level equivalent to that of fish meal, according to Dayon and Arbelot [15]for a optimal growth of broilers, the recommended intakes for amino acids vary from 1.15 to 1.3g/100g and 0.65 to 0.75g/100g of feed respectively for lysine and methionine. Our result can therefore be explained by the better amino acid balance of Food 1 which contains, in addition to fish, lysine and methionine.

Table 3. Average live weight (g) of local chickens

Month	Food 1	Food 2	Food 3	Food 4	p-value
Weight 6	350.20±3.83	349.60±7.50	352.80±6.80	350.20±5.85	0.790

weeks					
1	495.68±190.83	458.52±179.83	428.35±164.82	481.92±197.31	0.065
2	709.39±234.28[a]	591.41±228.61[b]	539.53±186.72[b]	570.44±233.98[b]	0.000***
3	1003.33±251.02[a]	937.28±318.08[ab]	854.33±293.28[b]	865.66±276.96[b]	0.020*
4	1163.75±263.23	1175.57±308.88	1138.27±331.54	1066.87±269.53	0.209

*a,b: means followed by the same letter on the same line are not statistically different (P>0.050); *=significant; **= highly significant; ***= very highly significant*

Table 4 presents the variation in weight according to sex and treatments during the 4th month. There is sexual dimorphism between hens and roosters for all foods. This dimorphism was non-significant for food 1, highly significant for food 2, significant for food 3 and very highly significant for food 4.

Table 4. Variation in weight according to sex and foods during the 4th month

Treatment	Female	Male	p-value
Food 1	1093.48±235.87	1218.66±273.86	0.074
Food 2	1044.27±289.49[b]	1260.53±294.53[a]	0.009**
Food 3	781.61±258.22[b]	931.88±276.91[a]	0.037*
Food 4	935.1±169.08[b]	1225.0±284.87[a]	0.000***

*a,b: means followed by the same letter on the same line are not statistically different (P>0.050); *=significant; **= highly significant; ***= very highly significant*

3.3 Evolution of Average Daily Gain

It appears from the statistical analysis that there is no significant effect on the average Average Daily Gain of local chickens between the different treatments (Table 5). This assumes that all the different treatments give similar results. Thus Food 1 containing fish can be replaced by locust. And Food 3 is then recommended for producers who do not have the capacity to obtain fish for their local chickens. Our results do not corroborate those of Muftau and Olorede[9]and Brah et al.[10]who obtained significant weight gains in broilers with the incorporation of locust meal into the ration at rates of 50%. and 100% as a substitute for fish meal.

Table 5. Average daily gain of local chickens

Month	Food 1	Food 2	Food 3	Food 4	p-value
1	8.83±2.96[a]	5.98±1.34[ab]	3.93±2.45[b]	5.88±0.79[ab]	0.015*
2	5.71±2.22	3.99±1.59	3.64±2.21	3.94±1.67	0.355
3	10.08±3.20	14.28±2.47	13.40±2.73	11.22±4.75	0.227
4	5.16±2.59	6.37±3.01	7.91±3.85	5.68±2.33	0.516
Mean	7.44±3.31	7.65±4.51	7.22±4.83	6.68±3.80	0.894

*a,b: means followed by the same letter on the same line are not statistically different (P>0.050); *=significant; **= highly significant; ***= very highly significant*

3.4 Consumption index

The feed had a statistically significant effect (P = 0.055) on the consumption index of local chickens in the first month of experimentation (Table 6). The food did not statistically influence the average consumption index during the entire period of the experiment. These results corroborate those of Laway[14] who showed similar effectiveness between a control containing only fish and the batch which had 25% incorporation of locust meal. It should be noted that Laway[14]noted a slight deterioration in the consumption index with the increase in the inclusion rate of locust flour beyond 50%.

Table 6. Consumption index of local chickens

Month	Food 1	Food 2	Food 3	Food 4	p-value
1	5.19±2.08[b]	7.09±1.25[ab]	11.93±6.92[a]	6.64±1.02[ab]	0.055*
2	8.82±5.60	10.89±6.85	14.05±11.43	9.37±3.60	0.690
3	6.64±1.70	4.01±0.51	4.90±0.78	6.40±3.41	0.151
4	14.14±9.46	10.32±5.67	8.65±3.34	10.56±4.04	0.558
Mean	8.69±6.25	8.08±5.01	9.88±7.26	8.24±3.49	0.745

*a,b,c: means followed by the same letter on the same line are not statistically different (P>0.050); *=significant; **= highly significant; ***= very highly significant*

4. CONCLUSION

Feed intake of local chickens varied and was statistically influenced by feed. The live weights of the chickens were only influenced by the feed in the first month. This situation turned out to be the same in the case of the consumption index. Foods 2, 3 and 4 present more products locally available and more accessible for local producers compared to food 1. In fact, Food 1 presents industrial products, which makes it less accessible for producers in rural areas. Food 2 containing fish is more suitable for producers located in a fishing environment such as the Niger River region. Food 3 and 4 are recommended for producers who are accessible to locusts. Station experimentation made it possible to develop food formulas for local chickens adapted to the context of family poultry farming. To enable the adoption of these formulas, it would be important to repeat the experiments in rural areas.

CONSENT

Experimental protocols were reviewed and approved by the national ethics committee of Niger.

REFERENCES

1. Dahouda M., 2009. Contribution to the study of the diet of local guineafowl in Benin, and prospects for improvementsusing non-conventionalresources, thesis, University of Liège, faculty of veterinarymedicine animal production departmentdomestic animal nutrition service, 191p

2. Doumbia F., 2002. The supply of inputs for the modern poultryindustry in Senegal. Thesis: Med. Vet: Dakar; 27

3. FAO, Animal Production and Health Division. (2009, April 30). Niger poultrysectorreview (version of June 25, 2010). 69.

4. Sonaiya B. E., EL H. F., Gueye.1998. Bulletin of the International Network for the Development of Family Poultry (RIDAF). (3).

5. Brah N, Houndonougbo MF, Issa S. 2015. Steps and Methods for formulatingpoultryfeed:abibliographicalsynthesis: Int. J. Biol. Chem. Sci., 9(6): 2924-2931. DOI: http://dx.doi.org/10.4314/ijbcs.v9i6.31

Comment [U3]: The feed intake of local chickens exhibited variations, predominantly influenced by the type of feed provided. Notably, the live weights of the chickens were solely impacted by the feed during the initial month of the study. This pattern was consistent with the consumption index, where the influence of feed was primarily observed in the first month.

Among the four feed formulations, Foods 2, 3, and 4 utilized locally available and accessible ingredients, contrasting with Food 1, which incorporated industrial products. Consequently, Food 1 may pose accessibility challenges for rural producers. Specifically, Food 2, enriched with fish, proves advantageous for producers situated in regions abundant in fishing resources like the Niger River area. On the other hand, Foods 3 and 4 are tailored for producers susceptible to locust invasions.

The experimental trials conducted at research stations facilitated the development of feed formulas tailored to the needs of local chicken farming within family-based operations. To foster the widespread adoption of these formulations, it is imperative to replicate the experiments in rural settings, ensuring their compatibility and efficacy within the context of local poultry production.

Replace it

Comment [U4]: References styles are not as per the authors guidelines, please rearrange

6. Bouvarel I, Nys Y, Panheleux M, Lescoat P. 2010. How doeschickenfeed influence eggquality? INRA Prod. Anim., 23(2): 167-182. https://productionsanimales.org/article/view/3298

7. Guédou, M. S. E., M. F. Houndonougbo, G. S. T. Atchadé, I. Gbégo Tossa, G. A. Mensah, 2015. Zootechnical and economic performances of local chickensfedwith α-basedfood rations of four varieties of corn grains in Benin. Bulletin of AgronomicResearch of Benin (BRAB), Number78:46-56.

8. Mr. S. E. GUÉDOU, Mr. F. HOUNDONOUGBO, G. S. T. ATCHADE, I. GBÉGO TOSSA and G. A. MENSAH. 2016. Zootechnical and economic performance of local chickensfedwithfeedbased on different proportions of corn bran in Benin. Bulletin of AgronomicResearch of Benin (BRAB) - Number 80. Pages (pp.) 24-33.

9. Muftau M.A and Olorede B.R., 2009. CaracassCharacteristics and Economics of BroilerChickens Fed DifferentLevel of GrasshopperMeal in Place of Fish Meal. Nigeria: Animal Production Res 5(4):248-251.

10. Brah N., Houndonougbo M. F. and Issa S., 2018:GrasshopperMeal (Ornithacriscavroisi) In BroilerDiets In Niger: Bioeconomic Performance. International Journal of Poultry Science, 17(3): 126-133 DOI: 10.3923/ijps.2018.126.133

11. Salim G. and Ahmed, 2015. Nutritional Evaluation of LocustMeal as aProtein Source in BroilerDiets. Faculty of Animal Production.

12. Adeyemo G.O., Longe O.G. and Lawal, H.A., 2008. Effect of feedingdesertlocustmeal (Schistocercagregaria) on performance and haematology of broiler. Department of Animal Science, University of Ibadan, Ibadan, Nigeria.4p.

13. Ranjhan S.K, 2001. Animal Nutrition in the Tropics. New Delhi, India:Revised Edition. Vikas PublishingHouse: 576p.

14. LawayTulgeatAlhouZakara, 2016. Effect of replacingfishmealwithlocustmeal on the growth performance of broilerchickens in Niger. Doctoral thesis in veterinarymedicine. Cheickh Anta Diop University of Dakar. 91p

15. Dayon F.J and Arbelot B., 1997. Poultrybreeding guide in Senegal. Montpellier: CIRAD-EMVT. 113p.