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

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Authors' contributions

This work was carried out in collaboration among all authors. Author BN did the methodology, writing original draft, data curation, conceptualization and funding acquisition. Author MHO did the writing review and editing, data curation and formal analysis. Author IS did the supervision. All authors read and approved the final manuscript.

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ABSTRACT

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.

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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.

Keywords: Local chicken; feed; performance; family poultry farming; Niger.

1. INTRODUCTION

In Africa, the development of poultry farming is limited by the availability and quality of feed. 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 feed 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 source of energy and more important in volume in feed), 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 [3-6].

Under these conditions, the research and development of alternative and locally available feed 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 [7].

The chemical composition and metabolizable energy vary depending on several factors including the origin of the ingredient [8]. But also, the feed “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 feed [9].

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.

2.2 Feed, 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 feeds (Table 1).

The quantity of feed 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 (feed and water) in order to eliminate individual variations due to feed 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. Feed formulas used

Ingrédients (%)	Feed 1	Feed 2	Feed 3	Feed 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

2.3 Statistical 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 DISCUSSION

3.1 Evolution of Feed Ingestion

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

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 Feed 4 to 68.21g/day for Feed 3. Local chickens consumed less Feed 4 containing more millet bran. They consumed more feed 3 which contains more sorrel and locust grain. It therefore seems that local chickens have an appetite for sorrel grain and locust. This feed intake obtained is higher than that obtained by Guédou et al. [10] and by Guédou et al. [11] in local chickens fed on different varieties of corn in Benin.Also, this resultdoes not corroborate those found by Muftau and Olorede [12] and Brah et al. [13] who recorded in broiler chickens, a lower consumption of feed containing locust meal as a replacement for fish meal. Furthermore, Salim and Ahmed [14] in Nigeria noted a negative effect on feed consumption when the locust incorporation rate was 100%. On the other hand, Adeyemo et al. [15] 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 [16] 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	Feed 1	Feed 2	Feed 3	Feed 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*

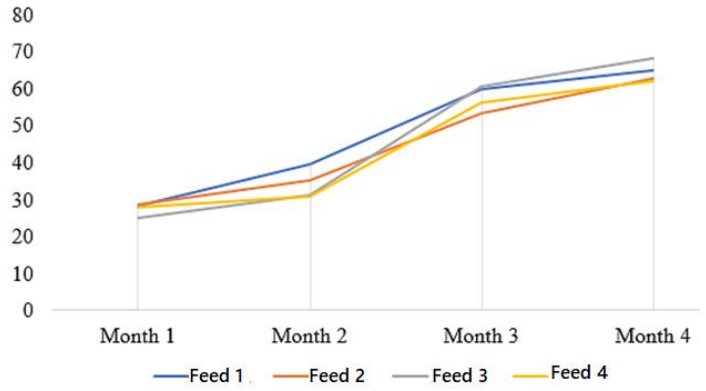

Fig. 1. Feed intake according to month

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

Month	Feed 1	Feed 2	Feed 3	Feed 4	p-value
Weight 6 weeks	350.20±3.83	349.60±7.50	352.80±6.80	350.20±5.85	0.790
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. Variation in weight according to sex and feeds during the 4th month

Treatment	Female	Male	p-value
Feed 1	1093.48±235.87	1218.66±273.86	0.074
Feed 2	1044.27±289.49^{b}	1260.53±294.53^{a}	0.009**
Feed 3	781.61±258.22^{b}	931.88±276.91^{a}	0.037*
Feed 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*

Table 5. Average daily gain of local chickens

Month	Feed 1	Feed 2	Feed 3	Feed 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*

Table 6. Consumption index of local chickens

Month	Feed 1	Feed 2	Feed 3	Feed 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*

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. Feed1 containing a high proportion of fish has a high weight. Indeed, even if bromatological analyzes of locust and fish [17] have shown that locust meal has a protein level equivalent to that of fish meal, according to Dayon and Arbelot [18] 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 Feed 1 which contains, in addition to fish, lysine and methionine.

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 feeds. This dimorphism was non-significant for feed 1, highly significant for feed 2, significant for feed 3 and very highly significant for feed 4.

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 Feed 1 containing fish can be replaced by locust. And Feed 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 [12]and Brah et al. [13] 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.

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 feed did not statistically influence the average consumption index during the entire period of the experiment. These results corroborate hose of Laway [17] 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 [17] noted a slight deterioration in the consumption index with the increase in the inclusion rate of locust flour beyond 50%.

4. CONCLUSION

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, Feed 2, 3, and 4 utilized locally available and accessible ingredients, contrasting with Feed 1, which incorporated industrial products. Consequently, Feed 1 may pose accessibility challenges for rural producers. Specifically, feed 2, enriched with fish, proves advantageous for producers situated in regions abundant in fishing resources like the Niger River area. On the other hand, Feed 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.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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ETHICAL APPROVAL

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

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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