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Use of néré seeds, *Parkia biglobosa* (Jacq.) Benth as a partial substitute for roasted soybeans in diet of broiler chickens

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This study was undertaken to contribute to the search for alternative ways to improve poultry feed. The objective was to evaluate the effects of incorporating roasted cowpea seed meal as a protein source in broiler feed. The experiment was conducted for 56 days with 120 Dutch Blue hybrid chicks divided into three batches of 40 chicks. These batches were each subdivided into two sub-batches of 20 chicks corresponding to two replicates. These batches received three feed treatments consisting of a control (R0) containing roasted soybeans and two rations (R1, R2) containing roasted cowpea seeds incorporated at 7 and 14%. The results showed that these three feeds resulted in good weight gain, better feed conversion and low mortality. The chicks showed better growth performance with (R0). Roasted soybeans and roasted cowpea seeds appear to be interesting feedstuffs for broilers since the 7 and 14% rates gave good weight growth performance comparable to that of roasted soybeans. We suggest the use of roasted cowpea at rates between 7 and 14% since they are locally available and significantly cheaper than soybean. The continuation of this study on the blood profile, a very important aspect of feeding, should be considered.

Key words: Parkia biglobosa, chicken, food, growth performance.

INTRODUCTION

Poultry farming is widespread in Burkina Faso and provides livelihoods for around 1.6 million producers and households (FAO, 2018a). Many studies have confirmed that most of the costs of the poultry sector are due to feed (Boggia et al., 2010; Leinonen et al., 2012). This situation indicates the need to explore the use of alternative feed ingredients that are locally available and easily accessible to producers (Ouedraogo et al., 2015). Among these alternative feed resources, we find néré seeds. The néré or *Parkia biglobosa*, of its scientific name, is a plant very popular in Africa thanks to its multiple nutritional virtues. The fruits of *P. biglobosa*, in the form of pods are consumed not only for their floury and sweet pulp but also and above all for their seeds

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Figure 1. Néré plant (*Parkia biglobosa*).
Source: Author's study.

used in the preparation of fermented condiments in West Africa (Coulibaly et al., 2020). Néré is a perennial plant that is part of the vast family of legumes whose nutritional value of the seeds lies in their high protein content. The seeds are a good source of protein, fat and calcium. The raw seed contain of 30 to 35% crude protein (Azokpota et al., 2005), richer than most traditional legumes (Rateau, 1995). But the seeds are added to poultry feed, after processing to neutralize their anti-nutritional properties. According to studies, nere seeds contain anti-nutritional factors, hence the interest in treating them before use. The same authors showed that boiled and fermented seeds contain 28.60 ± 0.15% protein, 35.03 ± 0.07% lipids, 18.50 ± 0.50% carbohydrates and 10.49 ± 0.32% fibre and are therefore good sources of protein and fat (Cissé et al., 2021). The nutritional value of Néré can, in certain respects, be compared to that of soya, a reference food in the plant world. Unlike soybeans, Nere seeds have not benefited from research interest for its application. Indeed, studies on its nutritional value are incomplete, old or not very thorough. Despite the presence and availability of this resource in Burkina Faso, very little work has been devoted to its development in poultry feed, hence the interest of this study. The objective of the study is to evaluate the effects of the gradual incorporation of néré seed flour previously treated by roasting as a food resource in broiler chickens.

MATERIALS AND METHODS

Study site and period

This study was conducted in a poultry farm in the village of LABA in the municipality of Zawara in a chicken coop fitted out for this purpose in a real poultry farming environment. The study took place during the rainy season from May 16, 2020 to July 18, 2020 for 8 weeks. The study site falls within the province of Sanguié in the Center West region of Burkina Faso. The town is located at 11°43'30.9" North and 2°39'53.7" West. The climate is of the Sudano-Sahelian type characterized by a dry and cold season from November to February and a dry and hot period from March to May with maximum temperatures of around 40°C, especially in April.

Experimental animals

The experimental animals consisted of 120 Dutch Blue hybrid chicks15-day-old purchased from a commercial hatchery in Ouagadougou, the capital. During the start-up phase the chicks were fed commercial chick feed. After this period which lasted 14 days the animals were weighed, identified on the wing, then distributed according to body weight to form 6 homogeneous batches of 20 chicks and assigned to the experimental diets.

Source and processing of test ingredient

The stands of Parkia in the commune and the region are scattered in the fields and in fallow land, they are very often associated with Shea. It is a tree well adapted to areas frequently affected by low rainfall and continuous water runoff (Figure 1).

The seeds are separated from the floury pulp by beating and constitute the main resource of néré. The néré seeds used for the experiment were purchased at the price of 125 CFA francs per kilogram on the local market where the plant is widespread (Figure 2). The seeds have been (1) cleaned to remove any form of dirt, (2) Then they are roasted. The traditional roasting process consists of cooking the seed with its envelope, at the bottom of a pot, for about ten minutes. The envelope becomes crumbly, it is gently pounded then winnowed, (3) washed with water, (4) Drained then dried in the sun for 24 h, (5) After drying the seeds were finely ground and sieved through a 1 mm sieve to form a powder which was

Figure 2. Raw (B) and roasted (A) seeds of *Parkia biglobosa.*
Source: Author's study.

Table 1. Percentage composition (%) of growth regimes – finishing.

Ingredients	Rations		
	T0 (0%)	T1 (7%)	T2 (14%)
Maize	52	52	52
Bran	18	18	18
Roasted soy flour	16	9	2
Roasted Nere seed flour	0	7	14
Peanut meal	6	6	6
Fish meal	5	5	5
CMV	2.5	2,5	2,5
NaCl	0.5	0.5	0.5
Total	100	100	100

Source: Author's study.

Table 2. Experimental device.

	Repetition 1			Repetition 2		
Treatments	T0	T1	T2	T0	T1	T2
Chicks	20	20	20	20	20	20

Source: Author's study.

incorporated into the experimental diets. Roasted seed flour tastes and smells like roasted peanuts.

Experimental diets

For the grow-finish period, three experimental diets (T0, T1, T2) with strictly the same grow-finish nutritional values were used. A T0 control ration without néré seed powder was produced and 2 other rations formulated by incorporating into this basic ration respectively 7 and 14% of the roasted néré seed powder (Table 1).

Experimental apparatus

The chicks were distributed at 15 days of age. The experimental design included three feeding treatments (T0, T1 and T2) with two (2) replicates per treatment. Each feeding treatment was assigned to a batch of 40 chicks divided into two sub-batches of 20 chicks each. Batching was done in such a way that there was no significant difference between the mean weights of the subjects in the different batches. The birds in each batch were identified by plastic rings placed on the wing. The interior of the building was divided into six compartments (Table 2).

The chickens were raised on a concrete floor covered with sawdust bedding. After batching, the chicks were subjected to a feed transition of five days during which the commercial feed was gradually replaced by the experimental feed. Tap water was given to them ad libitum. Sanitary prophylaxis measures such as hygiene, crawl space, and medical prophylaxis in force in the area, have been respected to avoid and prevent the appearance of possible pathologies.

Data gathering

The weight of the birds is recorded weekly and the quantities of food consumed (served and refused) are recorded by daily

Table 3. Composition of the different types of provided food (%).

Parameter	WitnessT0 (0%)	T1 (7%)	T2 (14%)
Dry nutriments (%)	90.28	90.69	90.98
Crude protein (%)	20.58	20.69	20.87
Fats (%)	6.87	7.22	7.70
Crude fiber (%)	4.37	4.38	4.55
Ashes (%)	3.51	4.45	4.78
E. M (kcal/kg))	3102	3112	3170

Source: Author's study.

Table 4. Chickens food consumption(g).

Period	Food consumption depending on age				
	T0 (0%)	T1 (7%)	T2 (14%)	P	Meaning
S1-S2	30.94±2.11	29.84±2.11	28.75±2.08	0.762	NS
S3-S4	46.89±1.09	45.97±0.84	45.10±0.79	0.390	NS
S5-S6	83.97±1.40	82.10±1.59	81.20±1.54	0.423	NS
S7-S8	104.47±3.09	96.41±2.84	101.54±3.19	0.172	NS
S1-S8	66.57±2.94	63.58±2.72	64.15±2.91	0.736	NS

N' The values of the same line, subscripted by different letters are significantly different at the 5% level ($p< 0.05$).
Source: Author's study.

weighing. The various parameters calculated were (1) individual food consumption, (2) average daily gain (ADG), (3) consumption index (IC), mortality rates.

Statistical analysis of data

Data was entered using Microsoft Office Excel spreadsheet 2010. Statistical analyses were performed using R 3.5.1 software. The effects of food on food consumption, weight gain, feed conversion and carcass yield were tested by analysis of variance (ANOVA) using the Tukey HSD model at a threshold of 0.05.

RESULTS

Food bromatological analyses

The bromatological values obtained for the different experimental foods after analysis were reported in Table 3. It emerges from the table that the experimental rations are iso-protein and iso-energy. The nutritional analyses carried out in the laboratory of the research center concerned the determination of dry matter (DM), crude protein, crude cellulose (CB), ash, mineral, fat (MG) (Table 3).

Effect of incorporating roasted néré seed powder on food consumption.

Over the entire duration of the experiment (1st to 8th week of age), the incorporation of néré seed powder did not lead to significant variations in food consumption from one treatment to another compared to the control. Thus, food consumption T0 (66.57 ± 2.94 g/d), T1 (63.58 ± 2.72 g/d) as well as T2 (64.15 ± 2.91 g/d) were not significantly ($p > 0.05$) different. Throughout the period of trial (S1-S8), the average food consumption T0 was higher followed by the T2 group (14%) (Table 4). The group fed the T1 ration (7%) recorded low food consumption (63.58±2.72g/d on average). The control diet with roasted soybeans and the 14% diet containing néré seed powder were the most ingested compared to the diet containing (7%) néré seed powder, although the difference remained non-significant.

Effect of incorporating roasted néré grains on live weight

The weight evolution of the chicks according to the incorporation rates presents significant variations until the 8th week. From the 1st to the 8th week the difference between batches is significant ($p <0.05$). At the end of the 8^{th} week feeding trial, taking into account the different rations, there is a significant difference at the 5% threshold between the treatments. The control batch T0 has the highest average weight 1,392.62 g followed by the batch T1 (7%) which has 1,271.95 g, then the treatment at T2 (14%) which has 1,169.00g, The effect of the incorporation of néré seed powder in the rations on

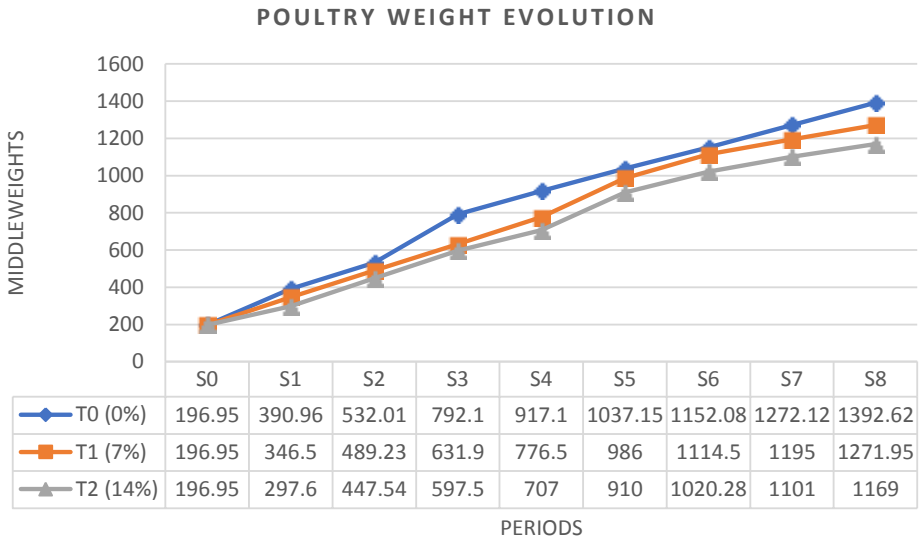

Figure 3. Evolution of live weights of chickens from different batches according to age.
Source: Author's study.

Table 5. Evolution of the subjects' average daily gains(g).

Period	Average daily earnings (e/d)				
	T0 (0%)	T1 (7%)	T2 (15%)	P	Meaning
S1-S2	14.74±2.70[a]	17.67±1.57[a]	17.90±2.03[a]	0.535	NS
S3-S4	27.51±5.58[a]	20.5±2.29[a]	18.53±1.67[a]	0.197	NS
S5-S6	16.78±2.36[a]	24.14±3.36[a]	22.38±3.88[a]	0.241	NS
S7-S8	17.18±0.02[a]	11.24±0.27[b]	10.62±0.55[b]	0.000	S
S1-S8	19.05±1.89[a]	18.4±1.47[a]	17.36±1.52[a]	0.764	NS

The values of the same line, indexed by different letters are significantly different at the 5% level ($p < 0.05$).
Source: Author's study.

the evolution of the live weight of the animals as a function of time is presented in Figure 3.

Effect of incorporation on average daily gains (ADG)

The evolution of the ADG during our study reveals that over the entire trial period (1st to 8th day), ADGs presented non-significant differences with T0 (19.05±1.89 g/d), T1 (18.4±1.47 g/d), then T2 (17.36±1.52a g/d) (Table 5). In general, the ADGs remain non-significant (P=0.764) for all treatments throughout the trial

Effect on the consumption index (CI)

It was found that the incorporation of néré seeds in the ration did not cause any significant adverse effect (Table 6) on the food consumption indices (FI) in the subjects of the different treatments compared to the control throughout the duration of the treatment. Overall, there was a slight decrease in feed conversion quality with rations containing cowpea seeds compared to the control.

Effect on chicken mortality

The average mortality rate is 4.00% for all batches. It should be noted, however, that the mortalities recorded concerned the first two weeks (Table 7).

DISCUSSION

Food consumption

The incorporation at different rates of partial substitution of roasted soybeans with roasted néré seed powder induced non-significant effects on the individual food consumption of the animals throughout the experimental period. The study showed that the more the food contains

Table 6. Evolution of consumption indices.

Period	Consumption Indices according to the age				
	T0 (0%)	T1 (7%)	T2 (14%)	P	Meaning
S1-S2	2.52±1.34	1.66±0.19	1.58±0.11	0.679	NS
S3-S4	2.00±0.83	2.24±0.14	2.52±0.55	0.827	NS
S5-S6	5.01±0.26	3.64±1.00	4.02±1.32	0.633	NS
S7-S8	6.40±0.41	8.60±0.80	9.22±1.55	0.269	NS
S1-S8	3.97±2.11	4.03±3.00	4.33±3.35	0.964	NS

The values of the same line, indexed by different letters are significantly different at the 5% level ($p < 0.05$).
Source: Author's study.

Table 7. Effect of incorporating sorrel seeds on chicken mortality.

Settings (weeks)	T0	T1	T2	Average
1 to 2	1.00	2.00	3.00	2.00
3 to 5	2.00	1.00	1.00	1.33
6 to 8	1.00	1.00	0.00	0.66
1 to 8	4.00	4.00	4.00	4.00

The autopsy did not reveal a lesion, a sign of illness.
Source: Author's study.

néré seed powder, the better it is consumed. This result is contrary to that of Palo et al. (1991) who showed with 15 and 25% of néré powder content that the more the content increases, the less the food is consumed. Following the same logic, Mangesh et al. (2018) reported a decrease in broiler feed consumption with 2.5 and 5% inclusion of *A. pinnata* compared to the control (0%) in the diet of broiler chicks.

Average daily gain (ADG)

The evolution of the ADG during our study reveals that over the entire trial period (1st to 8th day), ADGs presented non-significant differences with T0 (19.05±1.89 g/d), T1 (18.4±1.47 g/d), then T2 (17.36±1.52a g/d). In general, the ADGs remain non-significant (P=0.764) for all the treatments over the entire trial. This is in agreement with the results of Palo et al. (1991) according to which the heat treatment proposed in our trial did not induce any negative effects on the foods used. This result is contrary to that of Ayssiwede et al. (2010) who had found an overal Average Daily Gain (ADG)l recorded in the control subjects over the entire experimental period a significant difference at the 5% threshold between the Average Daily Gain (ADG)of the subjects for the different rations based on *Cassia tora.*

Effect of incorporating roasted néré grains on live weight

The weight evolution of the chicks according to the incorporation rates presents significant ($P < 0.05$) variations until the 8th week. At the end of the 8^{th} week feeding trial, taking into account the different rations, there is a significant difference at the 5% threshold between the treatments. The control group T0 has the highest average weight 1,392.62 g followed by the group T1 (7%) which has 1,271.95 g, then the treatment at T2 (14%) which has 1,169.00 g. base of roasted néré seeds obtained the lowest weight gains while those who received the foods that contained the roasted soybean gained better weight gain. This difference could be attributed to the action of the treatment on anti-nutritional substances still existing in the seeds after roasting. Our results are in agreement with those of Palo et al. (1991) with autoclaved néré seeds.

Consumption index

It was found that the incorporation of néré seeds in the ration did not cause any significant adverse effect on the food consumption indices (FCI) in the subjects of the different treatments compared to the control for the entire duration of the experiment in the feed conversion ratio with rations. Overall, there is a slight decrease in the quality of the consumer index containing néré seeds compared to the control with T0 (.3. 97±2.11), T1 (4.03±3.00), T2 (4.33±3.35). Our results are in agreement with those of Palo et al. (1991) with autoclaved néré seeds. According to these authors, the heat treatment applied to the seed of néré did not significantly improve its nutritional value, The heat treatment applied to the

seed of néré did not significantly improve its nutritional value measured by weight gain as well as the consumption index. Over the whole of the test period, the feed conversion ratio was slightly higher in the control group than in the group fed the feed containing different levels of cowpea seeds. But these differences in feed conversion ratios were not statistically significant. The consumption indices of the batches fed with rations incorporating néré seeds as a partial substitution for roasted soybeans were not significantly different from that of the control batch. This shows a good ability of broilers to enhance rations incorporating néré seeds.

Effect of nere seed powder on mortality

Throughout the duration of the trial, an average mortality rate of around 4% was observed. This rate is lower than that indicated in the Mémento de l'agronome (2002), in hot countries (5-8%). In all cases, food rations had no impact on mortality. In other words, the incorporation of roasted néré seeds in broiler chickens feed did not affect animal survival and our results corroborate those of Palo et al. (1991). These jumpers have shown that mortality rates are low for all diets incorporating heat-treated néré seeds.

CONCLUSION AND PERSPECTIVES

The composition of néré seeds suggests that they could be a valuable feed for broiler chickens. However, our preliminary results suggest the existence of an antinutritional factor, partially heat-resistant under the conditions of the experiment and not yet reported in human nutrition despite a long tradition. However, there are opportunities for use in poultry feed. Our work confirms the existence of enormous possibilities for local feed ingredients that can improve poultry zootechnical parameters. Roasted soybeans and heat-treated néré seeds remain, by their composition and protein concentration, foods likely to lead to good growth performance in chickens. These two ingredients appear to be interesting raw materials for chicken feed even if soy remains a raw material not within the reach of any producer in the country.

In view of the results of our study, we recommend roasting as a detoxification treatment for an optimal reduction of antinutritional factors for better weight performance of poultry. It seems necessary to determine the factors present in the néré seed that could be responsible for the drop in performance observed when the rate of incorporation of the seeds exceeds 14%. To support the large-scale use of these ingredients, our work suggests the need to better characterize them by testing the digestibility of these ingredients in order to verify the effects of antinutritional factors, determine their tolerance thresholds with a view to improve broiler productivity, We also suggest the continuation of this study on the blood profile which is a very important aspect of nutrition.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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