ESI Preprints Not Peer-reviewed

Incorporation of a Non-Conventional Liana *Tetracapidium Conophorum* Seed Oil Cake in Based - Diets of Indigenous *Batéké* Chicks Raised in Close Confinement in Congo

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Doi: 10.19044/esipreprint.5.2024.p462

Approved: 15 May 2024
Posted: 20 May 2024

Cite As:
Adzona P.P., Mopoundza P., Ngouama D.A., Bati J.B., Ntsoumou M.V., Saya Ngouonomba H.J., Akouango P. & Banga-Mboko H. (2024). *Incorporation of a Non-Conventional Liana Tetracapidium Conophorum Seed Oil Cake in Based - Diets of Indigenous Batéké Chicks Raised in Close Confinement in Congo*. ESI Preprints. https://doi.org/10.19044/esipreprint.5.2024.p462

Abstract

The indigenous *Batéké* hen (*Gallus gallus*) has low productivity due to various constraints such as feeding sources. The aim of this study was to improve the productivity of the local hen using a new local protein source: *Tetracarpidium conophorum* meal. Ninety-six chicks 21-day old from the local population were randomized into 3 groups of 32 birds each (TC0, TC4 and TC6), with one replicate. *Tetracarpidium conophorum* meal was incorporated into groupsTC4 (4% *Tcconophorum* oil cake and 11% soya oil cake), TC6 (6% *T.conophorum* oil cake and 9% soya oil cake) whereas TC0 served as a control group (0% *T.conophorum* meal and 15% soya oilcake). The experiment started at 3 weeks and lasted at 20 weeks of age. Chickens were fed *ad libithum* and had free access to drinkers. The treatment decreased mortality rate (3.12 % versus 9.3), On the other hand the treatment improves significantly ($p < 0.05$). feed intake (56.8 vs 60.1g per day), feed conversion (6.5 vs 5.7), and carcass yield (65.8 % vs 71.3 %). The final body weight at 20 weeks of age was low in all groups (1.200g versus 1300g) at 4% of incorporation of *T. conophorum* meal. Meat yield. This study indicated to incorporate *T.conophorum* oil cake at 4% and reducing soya oil cake from 15% to 11%) in a small scale poultry farming in Congo.

Keywords: Indigenous *Gallus gallus*, feeding, growth performance, conophorum nutn, Brazzaville

Introduction

Avian genetic biodiversity (*Gallus gallus*) is constitute by experimental breeds, commercial lines and indigenous breeds. In Africa, the local chicken population is raised in rural and peri-urban areas. This type of farming plays an important role to food security by supplying meat, eggs, and cash to the rural economy (Gondwe *et al.*, 2005 and Dinka *et al.*, 2010).

In Congo, the native chicken is called *Batélé* chicken is present at all socio-cultural events: dowry, family party, Christmas or Easter party, reception of a guest, and healing sacrifice. Unlike to indigenous waterfowls, Batéké chicken meat or egg are not subjected to any taboos (Banga-Mboko *et al.*, 2007).

Morpho-metric studies carried out in Congo have shown that the local *Batéké* is backyard farming characterized by scavenging system with, enormous phenotypic variations, low in -put production namely poor housing and feeding (Akouango *et al.*, 2004, 2010 and Saya Ngouonimba *et al.*, 2019).

The scavenging system as reported by many authors, suffer in dietary imbalance, combined with precarious sanitary conditions and management techniques, accentuates traditional chickens weakens their resistance to parasites and disease, increases flock mortality and consequently reduces the flock size. (Badubi *et al.*, 2006 and Mugumaarhahama *et al.*, 2016). Also, we are witnessing genetic erosion as *Batéké* chicken is uncontrollably crossed with commercial exotic strains.

However, although an increase in imported chickens in carcass form (Thigh. whole carcass wings) local chicken meat is gaining more and more demand. In fact, it is observed a change in mentality, with traditional free-range rearing evolving towards confinement rearing in order to satisfy an ever-growing demand.

Unfortunately, such an option is hampered by a lack of feed from which Congolese poultry farming suffers. The binomial corn. -soybean is difficult to cover because national production of corn is low and soybean meal oil cake is imported because there is no national oil extraction industry. (Badubi *et al.*, 2006).

Faced with this difficulty, the use of local sources to meet nutritional needs in indigenous chicken is becoming a challenge (Adzona, 2019) since unconventional *Tetracarpidium* oil cake meal, rich in crude protein (43%), is produced in locally by cosmetic industry and which have the same content in crude proteins with oil cake soya (Mezanjoug Kenfack, 2010 and Sianard, 2010).

T.conophorum oil cake has been successfully tested in commercial line broiler lines and improved growth performance in broiler (Londé Malanda, 2016 and Soki Kimpala, 2024) in the rates varying from 4 to 6 % of *T. conophorum* oil cake.

Despite the century presence of Batéké chicken in Congo, all studies are carried on morphometric characteristics in the scavenging system with poor housing (Akouango *et al.*, 2004, 2010 and Saya Ngouonimba *et al.*, 2019).

Therefore, the study aimed to evaluate the effect of *Tetracarpidium conophorum* meal based –diet on the growth performance of *Batéké* chickens in close confinement.

Material and methods

Study area

The study was carried out in Brazzaville, the Republic of Congo in the experimental farm of the Institute national de Recherche Agronomique (IRA). The Climate of Brazzaville is tropical humid of Bas-Congolese type (Samba, 2014). Average annual temperatures are around 25ºC, with slight temperature variations of no more than 5ºC.

The maximum temperature does not exceed 35ºC and the minimum remains above 20ºC (Samba 2014). It is characterized by two seasons: a rainy season from October to May, with a deep in January, and a dry season from June to September. Brazzaville is situated at an altitude of almost 301 m, with a latitude of 4º 15 '58" to the south and a longitude of 15º 16' 59 " to the east of the Republic.

Material
Plant material
Tetracarpidium conophorum oil cake has been produced according to the procedure previously described by Mejazoug Kenfack (2010); Londé Malanda (2016). (Ntsoumou *et al.*, 2021, 2023). Briefly, the oilcake production process is illustrated in the figure 1.

Figure 1: Production of *T. conophorum* oil cake

Pre-experimental phase
This phase was marked by the management of the breeding flock which produced the experimental chicks. The chicks were then raised for 2 weeks following the experiment, in order to get them used to the food.

Methods
Composition of the breeding flock
A core breeding flock was created by acquiring 30 chickens (5 males and 25 females) from local *Batéké* populations.

These breeders were raised on the ground on wood shavings (Figure 2). in a semi-open henhouse. Eggs were collected daily, then artificially incubated from the 10th day of collection.

Figure 2: Breeder nucleus of *Batéké* hens

Production of experimental chicks

One hundred and ten (110) fertile eggs from the *Batéké* flock were incubated in a French "Covatutto 120" electric incubator (figure 3a). A total of 66 *Batéké* chicks (various phenotypes) hatched, representing a 60% hatching rate. Incubation lasted 21 days.

The 66 day-old chicks from the local population. Unisexed. of different phenotypes. resulting from artificial incubation of the eggs produced. at the IRA experimental farm. were identified and weighed. During a two-week acclimatization period. These chicks were kept in a brooder and fed with a starter feed sold in feed mills.

Chick rearing

The chicks were reared together on the floor, covered with sawdust litter, in the same 13m² hard-built building at a rate of 6kg of litter per m². The density was 5 chicks per m². They are heated under 100-watt bulbs. The room temperature was manually adjusted according to the chicks' behavior under the bulbs.

These chicks were vaccinated against Newcastle disease and Infectious Bronchitis on day 7, with a booster on day 23, and against Gumboro disease on day 10. An anticoccidial (Amprolium) was administered in the drinking water on three consecutive days, and an internal dewormer (Levalape) was administered every three weeks (12 to 19 weeks), according to a well-defined prophylaxis program. Stocking density was 8 birds/m². Feed was distributed ad libitum twice a day (at 9 am and 4 pm). Tap water was distributed ad libitum. A starter feed containing 2762.75kcal of energy and 17% PB was fed to the chicks prior to experimentation.

Experimental phase
Experimental setup

From the 3rd week. The chicks were placed in the 13 m2 experimental room, divided into 3 compartments, each measuring approximately 4m².

The chicks were reared continuously from the 3rd to the 20th week of the experiment (17 weeks). Subjects were randomly divided into 3 batches of approximately identical weight, each comprising 22 subjects.
These batches corresponded to the three feed treatments (TC0, TC4 and TC6), each of which was subdivided into 2 sub-batches of 11 chicks. In accordance with the experimental set-up shown in Table 1.

Table 1 : Expérimental design

Age in week	Treatment	Number of subjects	
3-20	**TTC0 (0%)**	**TC 0**	**32**
	TTC4 (4%)	**TC 4**	**32**
	TTC6 (6%)	**TC 6**	**32**

TTC: Tetracarpidium conophorum cake at 0%. 4% and 6%.
Lot TC0 (control): made up of sublots TC01. TC02; made up of subjects fed the feed without TTC;
Group TC4: sublots TC41. TC42; subjects fed with feed containing 4% TTC;
Lot TC6: sub-lots TC61. TC62; made up of subjects fed the diet containing 6% of the TTC.

Diets

Feed rations were designed according to the recommendations formulated for Dessi (Anjum. Khan, 2008) and Venda (Mbajiorgu, 2011) indigenous hens.)

Table 2: Diet formulations

Ingredients	**Controls**	***Tetracarpidium*-based feed *Conophorum***	
	TC0 %	TC4 %	TC6 %
Corn	45	40	43
Wheat bran	7	3	4
Cassava bran	10.5	7	10
Brewer's grains	8	11	8
Palm oil	5	5	1.5
Soybean meal	**15**	**11**	**9**
TTC	**0**	**4**	**6**

Fish meal	5	5	5
Cowpea flour	3	8.5	9
lime	1	5	4
Na cl	0.5	0.5	0.5
Total	100	100	100
Calculated bromatological values			
Metabolisable energy/Kg de MS)	2762.75	2864.35	2747.20
Crude protein	17.90	17.96	17.89
Lysine	1.72	2.46	2.04
Methionine	0.24	0.35	0.37
Calcium	0.55	0.58	0.59
Phosphoruus	0.43	0.49	0.53
EM /PB (Kcal/g)	159.45	159.48	156. 3

The *T. conophorum* meal used in the present feed formula has a nutritional value of 2800kcal (Mezajoug Kenfack 2010); 43.75% PB. 3. 17%Ca. 0.85%P (Ntsoumou *et al.*, 2023).

Parameters measured

Mortality

Mortality was monitored daily by regular visual observation of the animals.

Subject weight: this was recorded by weekly weighing of the subjects on an electronic scale, and recorded in a follow-up sheet.

Voluntary I feed intake (VFI)

Individual food consumption is the quantity of food consumed per subject over a given period of time. It is expressed in grams (g) and was calculated according to the following formula:

$$VIFC = \frac{QAD\ (g)/periode - QAR\ (g)/periode}{\text{Duration of period (d)}}$$

QAD: Quantity of feed distributed. QAR: Quantity of feed refused

Average daily gain (ADG)

Weekly measurements of animal weights were used to calculate the Average Daily Gain (ADG) by dividing the average weight gain during a period by the duration (in days) of the period. It was determined using the following formula :

$$ADG = \frac{\text{Weight gain(g)during a period}}{\text{Length of period}}$$

Feed conversion ratio (FCR)

The feed conversion ratio (FCR) was determined as follows:

$$FRC = \frac{\text{Amount of feed consumed during a period(g)}}{\text{Weight gain during the same period(g)}}$$

Mortality rate (MR)

The mortality formula rate expressed as follows:

$$MR = \frac{\text{Number of animals that died during a period}}{\text{Number of animals at start of period}} \text{ x } 100$$

Carcass yield (CY)

Carcass and: at 20 weeks of age, 12 male and female chickens (4 chickens/treatment) were randomly selected. They were subjected to a 24-hour diet. then weighed. bled. scalded. plucked and eviscerated as described by Onu *et al.*, (2010).

This is the ratio, expressed as a percentage (%), of carcass weight to live weight at slaughter. Chicken carcass yield was determined using the following formula:

$$CY = \frac{\text{Carcass weight (g)}}{\text{Live weight at slaughter(g)}} \times 100$$

Statistical analysis

Data were recorded Microsoft Excel 2013 and then transferred in R software (R Core Team, 2022). The effect of the treatment on parameters was assessed by using analysis of variance (one way) followed by comparison of means using t student Nieman Keul. Two means were different when p value was lower than 0.05.

Results and discussion

No data are available in the literature on the use of *T. conophorum* meal in diets of indigenous hens (*Gallus gallus*). So, after presenting the results, the discussion will focus in comparison with other strains experimented with local agro-resources.

Effect of *tetracarpidium conophorum* oil cake meal on final body live weight of *batéké* chicken

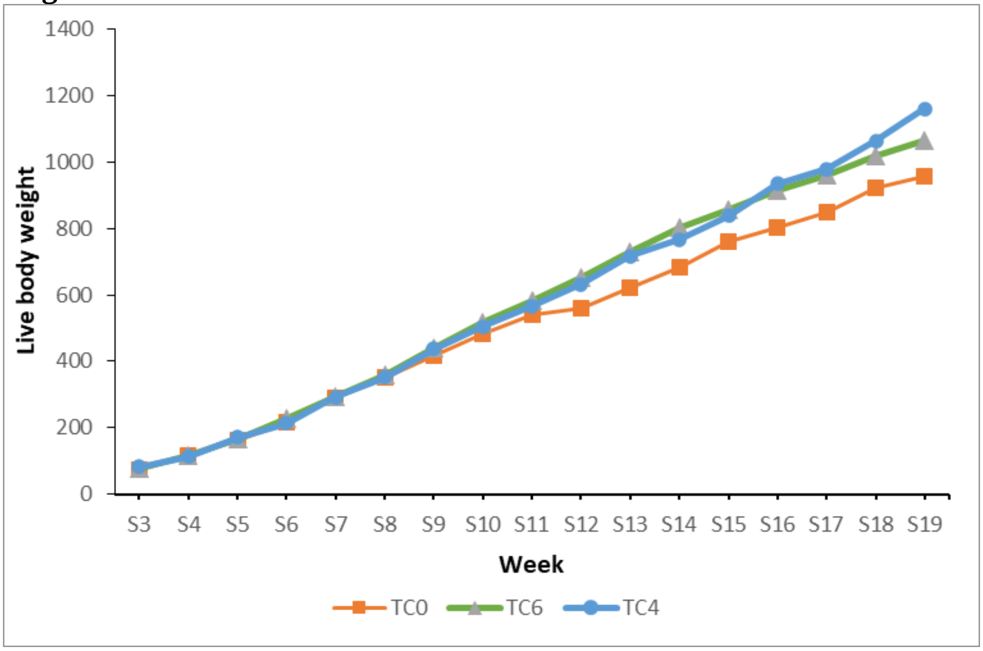

Figure 3: Illustrates the effect of *Tetracarpidium conophorum* on weight development

It can be seen that from week12 at ill the end of the experiment there was a significant difference between treatment groups and the control (P-value=0.002). These results are higher to those of Akouango *et al.*, (2010), who recorded live weights of 993,43 ± 99g in colored fawn-Hermine phenotype Batéké chickens reared in Brazzaville. These results are lower than those found by Moula *et al.*, (2009) respectively after 17 weeks of age in the Fayoumi breed from Egypt and the Kabylie hen from Algeria chicken (1531 g)., Badubi *et al.,.,* (2006) recorded 1.9kg in males and 1.5kg in females) , whereas Gondwe *et al.*, (2005,) reported 1.5kg .In another way ,by using crossbred (Isa brown x indigenous);) Ouedraogo *et al.,.,* (2015) were aware of 1,689g at 4 month of age.

Tested to commercial broiler lines, Londé Malanda 2016 recorded 880g at 4 weeks of age and Soki Kimpala (2024) 1.8kg at 8 weeks

Results on the effect of *T. conophorum* meal on growth performance are given in Table 3.

Table 3: Effect of *T. conophorum* meal on growth performance

Parameters	Treatment groups		
	TC0	TC4	TC6
Mortality (%)	9.37	3.12	3.12
Feed intake (g/day)	56.72±7.90^{b}	60.08±8.11^{a}	63.80±8.21^{c}
Daily Gain weight (g/day)	11.79±7.29^{a}	11.83±4.553^{a}	10.56±4.64^{a}
Feed conversion	6.53±2.9434^{b}	5.7217±3.005^{a}	7.3992±4.3037^{c}
Carcass weight (g)	818.75±51.40^{a}	912.5±21.118^{b}	861.25±63.15^{a}
Carcass yield (%)	65.80±4.5^{a}	71.23±5.908^{b}	66.10±1.51^{a}

Values on the same line with the same superscript letter are not significantly different (P > 0.05).

Effect of T*etracarpidium conophorum* meal on local chicken mortality

Table 3 shows that *T. conophorum* decresed significantly mortality. The incorporation of *Tetracarpidium conophorum* meal into the ration of local chickens had no adverse effects on.

Our results are lower than those, reported by Ouedraogo *et al.*, (2015**)** who recorded 8% in the crossed bred Isa brown x indigenous chick in Burkinafaso.

On the other hand, they are not better than those of Londé Malanda (2016) and Ntsoumou. (2023) who recorded no mortality among broilers and layers fed with *T. conophorum*. This difference can be attributed to experimental conditions, which vary from one experimental setting to another.

Effect of T*etracarpidium conophorum* meal on voluntary feed consumption

T. conophorum meal incorporated at 4% and 6% in diets of local *Batéké* chickens improves feed consumption voluntary feed consumption (p < 0.05). Similar results have been found Londé Malanda (2016) and Soki kimpala (2024) at 5% simple incorporation in broilers of the Cobb 500 strain, feed consumption This could be explained by the presence of alkaloids and amino acids in *T. conophorum*. Recent studies have shown that alkaloids can increase food consumption (Onu *et al.*, 2010). By contrast, the improvement in consumption at 4% incorporation in local chickens disagree with those of Ntsoumou *et al.*, (2021) who observed a slight decrease in consumption in laying hens fed *T. conophorum* at the fourth week. This decrease is thought to be due to the presence of certain anti-nutritional factors that escaped cooking and roasting despite the heat treatment applied, and to the fact that the latter used high rates of TTC as a substitute for soybean meal (12%).

Effect of T*etracarpidium conophorum* meal on average daily gain (dgw)

With regard to DGW, the incorporation of *T. conophorum* meal did not induce any significant effect.

These results are lower to those of Ouedraogo *et al.* (2015) cross local chicken x Isabrown bred in confined condition (27**g/d),** Londé Malanda (2016), who found 12.65 g/d and Soki kimpala (2024) who recorded 42g/day in commercially broiler line fed with *T.conoplhorum* oil cake. This discrepancy can be explained by the fact that this parameter was assessed at different strains and ages.

Effect of T*etracarpidium conophorum* meal on feed conversion

The use of 4% *T. conophorum* in the diets of local *Batéké* hens showed the positive impact on reducing the feed conversion rate. Compared, data in the present study is higher with those reported by Ouedraogo *et al.*, (2015) Londé Malanda and Soki kimpala (2024) who found 2.3, 3.2 and 2.1 respectively in commercial broiler strains

Effect of *tetracarpidium conophorum* meal on carcass yield.

Treatment at 4% improved carcass weight and carcass yield ($p < 0.05$). Data obtained in the present data are similar to the work of many studies in broiler where carcass yield represents more than 65 % (Akouango *et al.*, 2010, Onu *et al.*, 2010, Soki Kimpala (2024).

Conclusion

The aim of this study was to evaluate the effect of *T.conophorum* oil cake on the growth performance of the indigenous *Batéké* chicken.

Tetracarpidium conophorum meal did not cause any adverse effects on the chickens' health status;

- the final body live weight is slow, it reaches 1,300g at 20 weeks of age
- the feed conversion is too high while feed intake was improved at 4%.
- *T. conophorum* meal incorporated at 4% improved slowly the growth performance.

Genetic selection trials are needed to perform *Batéké* chickens, as a tool for a small scale poultry farming.in Congo.

Acknowledgements

The authors are grateful to the National Institute for Agriculture Research for agreeing to carry out this study on its experimental farm.and to Mrs Diane Mavoungou and *Bitsili B. T. a young researcher at the* National College of Agronomy and Forestry. University Marien Ngouabi -for the technical assistance.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

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