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Effects of Incorporating Coconut Cake or Palm Kernel Cake in Piglet Fattening

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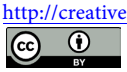

Abstract

In Côte d'Ivoire, coconut and palm cultivation are very developed. Industrial utilization of these crops fruits is generated some under products that can be used in breeding. The aim of this study was to test the potentialities in the breeding of cattle-cake of coconut and cattle-cake of palm kernel when they are incorporated in diets of piglet fattening. 18 piglets teamed up into three homogenous groups (three males castrate and three females) were used. The control group was fed a diet made with 55% of maize + 10% of bran maize + 25% fish powder + 4% of ash + 3% of salt. The test 1 group called diet ESSAI 1 was fed a mixture of 70% of the control diet and 30% of cattle-cake of coconut. The test 2 group called diet ESSAI 2 was fed with a mixture of 70% of the control diet and 30% of cattle-cake of palm kernel. The analysis made showed that the two cattle-cake are nutritiously rich and their incorporation in diets at degree of 30% of the total diet induced growth performance similar to that obtained with the control diet. Animals of each group were in good health and diets EASSAI 1 and ESSAI 2 were cheaper than the control diet. Then, cattle-cake of coconut and cattle-cake of palm kernel can be recommended as part of the diet of piglet (about 30%) in order to enhance profit with the same growth performance.

Keywords

Diet, Cattle-Cake, Coconut, Kernel Palm, Piglet

1. Introduction

In Côte d'Ivoire, breeding contributed approximately 4.5% of the agricultural Gross Domestic Product (GDP) and 2% of Côte d'Ivoire global GDP [1]. It re-

mained an emerging economy. Nevertheless, is agricultural under sector very important which concerned many stockbreeders. It is contributed to reinforcing food security, diversifying the income of persons who are concurrently farmers and stockbreeders, to protect the environment when farming is associated with breeding. The main animals' breeds in Côte d'Ivoire are cattle, sheep, caprinae, poultry and pigs. In all these species, there are races locally adapted such as "Ndama race", "baoulé race" and "lagoon race" concerning cattle, "Djallonké race" concerning sheep, "dwarfish-goat" concerning caprinae, "african-chicken", "flesh-chicken", "good layer" and "cockerel" concerning chicken, "african-guinea-fowl" and "flesh-guinea-fowl" concerning guinea-fowl, "african-running pig" and "Korhogo race" concerning pigs. According to statistics, pig meat (Pork), for a mass of 110 million Tons in 2019, is the second meat that is more consumed in the world [2]. In Côte d'Ivoire, despite religious taboo, pig meat is highly prized by a chunk of the population so its cost continues to increase every time. For example, at Korhogo the biggest town located in the North of Côte d'Ivoire, the cost of one kilogramme of pig meat was 1100 FCFA in the year 2014 and it become 1500 FCFA in the year 2019. This is also due to the insufficiency of production which can not satisfy the need for population consumption. Becoming a pig farmer can give enough financial resources if the cost of pig diet is relatively low. In fact, food is one of the most important parameter which must be mastered to succeed in pig breeding business [3]. In the majority of cases, pig is undemanding because it consumed practically everything. It consumed either vegetable-food or animal-food. However, food intake must be complete. So, the nutritional possibilities of underproducts [4] and especially some cattle-cake as proteins sources and energizing [5] such as cattle-cake of coconut seeds and cattle-cake of palm kermel available in Côte d'Ivoire can be exploited in order to reduce the cost of pig production. Because the literature is not extensive, we found it useful to study the effect of blending two kinds of cattle-cake (cattle-cake of coconut seeds and cattle-cake of palm kermel) in diet on the fattening up of "Korhogo race" pigs.

2. Materials and Methods

2.1. Experimental Site

The study was done at Korhogo precisely in the pigsty located in the botanic garden of the University Peleforo Gon Coulibaly of Korhogo (UPGC), Côte d'Ivoire. The dimensions of this pigsty were: Building: 3.5 × 15 m; Warehouse: 3.5 × 4.8 m; Lodge: 2.2 × 3.4 m.

2.2. Products

The desinfectant products used were the missing washing powder called OMO + bleach + desinfectant called "Grésyl". These products were brought to market. The product used to rid parasites which were OXYLON 10% while the antibiotic

used was Intermectin.

2.3. Food Products

For this study, several kinds of food products were used. It was crushed maize, bran of maize, fish powder, cattle cake of coconut, cattle cake of palm kernel and ash of beef bone.

Maize, bran maize, fish discards, salt, cattle cake of coconut and cattle cake of palm kernel where brought while the beef bones were picked up at the slaughterhouse.

2.4. Animals

The animal used in this work was constituted of 18 piglets of "Korhogo race" (nine males and nine females) weighing between eight and twelve kilograms. These piglets were bought with a pig breeder at Korhogo region and brought at the pigsty located in the botanical garden of Universty Peleforo Gon Coulibaly. "Korhogo race" pigs are race of pigs obtained from the crossing with sows of African race and boar of an exotic race called "Large White". It is in Korhogo town, the biggest town located in the North of Côte d'Ivoire, where the first specimen of crossing was obtained. That is why this specimen is called "Korhogo race" pigs. These pigs have the particularity to be more vigorous and more resistant to the environment and disease than parents of race "Large White" and their growth performance is superior to that of the African parent [1]. In fact, the average daily gain after weaning is 350 to 400 grams and their weight after one year of old is between 50 and 100 kg while African race pigs weight after an age between twelve and fifteen months is between 50 and 60 kg [1].

2.5. Methods Used to Obtain Biosecurity on the Site

In breeding, biosecurity is obtained when animals are protected from pathogenic germ. To arrive at biosecurity, we first sweep the different lodges and remove cobwebs and secondly, we desinfected the pigsty with the mixed of water + soap (OMO) + beach + desinfectant (grésyl). It is usefull to notice that we took some precautions consisted by wearing boot, ghent and appropriate chlothes.

2.6. Measure before Experimentation

When piglets were brought to the pigsty of UPGC, they were adapted to the new condition for two weeks before the beginning of the experiment. During this moment of adaptation, they were fed *ad libitum* with the same diet composed by 55% of maize + 10% of bran maize + 25% fish powder + 4% of ash + 3% of salt.

2.7. Methodology of Animals Separation

After two weeks of adaptation, they were divided into three homogeneous groups composed of six piglets with three females and three males castrated. Each group of piglets was put in one of the three lodges (lodge 1, lodge 2 and

lodge 3) beforehand the lodges were desinfected.

2.8. Formulation of the Three Diets

Three kinds of diets (Control diet, Essai 1 and Essai 2) were formulated. The Control diet formulation was made taking into account the protein cotent of maize, 7% - 12% [6], found in the literature. Fish discards sold at market were used as main source of protein. The protein content of these fish discards was determined using the Association Analytical Chemists methods [7]. This value found was 46.32% ± 0.03%. After that, the Control diet was formulated in accordance with the nutritional needs of pigs in-term of crude protein which is between 15% and 20% [8].

Then, the control diet was formulated by mixing 55% of maize + 10% of bran maize + 25% of fish powder + 4% of ash + 3% of salt.

The diet Essai 1 was formulated with the mixture of 70% of the control diet and 30% of cattle-cake of coconut while the diet Essai 2 was formulated with the mixture of 70% of the control diet and 30% of cattle-cake of palm kernel.

2.9. Composition of Cattle-Cake of Coconut, Cattle-Cake of Palm Kernel, Control Diet, Diet Essai 1 and Diet Essai 2

2.9.1. Determination of the Proximate Composition

The recommended methods of Association Analytical Chemists [7] were employed in determining the levels of moisture, ash, crude protein and crude fat. Moisture content was determined by heating 2 g of samples to a constant weight in crucible placed in an oven (MMM Medcenter Gmbh (D-82152, Munich, Germany) maintained at 105˚C for 4 hours. Ash was determined by incineration of 1 g samples placed in a muffle furnace (P Selecta, Espagna) maintained at 550˚C for 6 hours. Crude protein content (% total nitrogen × 6.25) was determined by Khedjahl method, using 1 g samples. Crude fat was obtained by exhaustively extracted 5 g of each sample in a Soxhlet apparatus for 8 hours using hexane as the extractant [9].

Total carbohydrate (%) was estimated by difference as shown in the equation:

Total carbohydrate (%) = 100 − [Protein (%) + Lipids (%) + Asch (%) + Fibre (%)].

2.9.2. Analysis of Minerals in the Different Cattle-Cake and in the Diets

The minerals were extracted from ash by adding 20 ml of 2.5% chloric acid, heated in a steam bath to reduce the volume to about 7 ml, and this was transferred quantitatively to a 50 ml volumetric flask. It was diluted to volume (50 ml) with deionised water, stored in clean polyethylene bottles and mineral contents determined using an atomic absorption spectrophotometer (Perkin-Elmer, Model 2380, USA). Sodium and Potassium were determined using flame photometry [10]. Phosphorus was determined as phosphate ion (PO_4^{3-}) by the vanadium phosphomolybdate (vanadate colorimetry method) in which the phosphorus present as the orthophosphate reacts with a vanadate molybdate reagent to produce a yellow-orange complex, the absorbance of which was measured at 420

nm.

2.10. Methodology of Alimentation during the Experimentation

The three groups of piglets formed were fed *ad libtum* for four months with the three kinds of diets (Control diet, diet Essai 1 and diet Essai 2). Then, the control group was nourished with the control diet while the second and the third group were nourihed with diet Essai 1 and diet Essai 2 respectively.

Animals of each group received every day the diet at 9 o'clock after the different lodges were swept out. Water was put *ad libtum* in the watering place of each lodge and renewed every day after the lodges have been swept out.

2.11. Treatment Made during the Duration of the Experimentation

Animals were inspected every day in order to know if they are subjected to pathologies or not. Animals received every two weeks of the four months of experiment injection of oxylon 10% in order to care pulmonary infections and also injection of intermectin which is an anthelminthique in order to rid animals of parasites. While oxylon 10% was injected intramuscularly, intermectin was injected under cutaneous in the jugular vein.

2.12. Anthropometric Parameters Measured

Body weight of animals was taken and snout height, the tower of hock, thoracic tower, body height and garrot height were measured at the beginning of the experimentation and every two weeks during the duration of the study which was four months. These different measurements were made before the distribution of the different diets.

2.13. Blood Sample

Blood samples were collected on the vena cava of the ears of pigs at the middle of the experimentation (two months after the beginning of the experimentation) and at the end of the experimentation (four months after the beginning of the experimentation). When collected, the blood sample of each pig was put in individual vacum tube. After that, all the blood samples collected were centrifuged at 8000 r.p.m for 15 min to harvest serums. Serums harvest were utilized to determine some biochemical parameters such as glyceamia, tryglycerides, Total- cholesterol, LDL-cholesterol, atherogenicity index, urea, creatinine, transaminases (TGP and TGO), plasmatic bilirubin (total bilirubin, free bilirubin and conjugated bilirubin) and to measure some minerals such as sodium, calcium, phosphorus and chlorine.

Biochemical parameters and serum minerals analysis in the serum were performed using an automatic chemistry analyzer (Hitachi model 902, Roche).

2.14. Statistical Analysis

The data were subjected to statistical analysis for calculation of mean and stan-

dard error (mean ± standard error). The proximate composition of values obtained was compared to some values found in the literature using G-test "Log likelihood ratio" (logiciel R. version 2.0.1 windows).

The experimental results obtained on animals were assessed by the method of analysis of ANOVA followed by Dunnett test [11] [12]. All differences were considered statistically significant at $p < 0.05$.

3. Results

3.1. Evaluation of the Production Cost of Each Diet

For the formulation of 100 Kg of each diet, total expenses were 27600 FCFA, 22990 FCA, and 22240 FCFA respectively for the control diet, diet Essai 1 and diet Essai 2. When we compared the different costs, we can notice that Profit was 4700 FCA, 5360 FCFA respectively for diet Essai 1 and diet Essai 2 in comparison with the control diet cost. The cost of the different ingredients used is shown in Table 1.

3.2. Proximate Composition of the Different Cattle-Cake (C-c)

According to the statistical analyzes, cattle-cake of palm kernel protein content, lipids content and carboxydrates content are higher than that of cattle-cake of coconut. On the other hand, cattle-cake of coconut contain a high quantity of

Table 1. Cost of the formulation of 100 kg of the differents diets.

Ingredients	Control diet		Diet Essai 1		Diet Essai 2	
	Quantity (Kg)	Cost (CFA)	Quantity (Kg)	Cost (CFA)	Quantity (Kg)	Cost (CFA)
Maize	55	11,000	38.5	8400	38.5	8400
Bran corn	10		7		7	
Fish powder	26	15,000	18.2	10,920	18.2	10,920
Bone powder	4	0	2.8	0	2.8	0
Salt	3	600	2.1	420	2.1	420
Cattle-cake of coconut	0	0	30	2250	0	0
cattle-cake of palm kernel	0	0	0	0	30	1500
Transport	1000		1000		1000	
Total expenses	27,600		22,990		22,240	
Profit compare to control diet			4610		5360	

The prize of 1 kg of maize was 200 FCA; The prize of 1 kg of bran corn was 100 FCA; The prize of 1 kg of fish discards was 600 FCA; The prize of 1 kg of salt was 200 FCA; The prize of 1 kg of Cattle-cake of coconut was 75 FCA; The prize of 1 kg of cattle-cake of palm kernel was 50 FCA; The beef bones were picked up at the slaughterhouse.

ash and moisture than cattle-cake of palm kermel. Nevertheless, statistical analyze do not show significant difference ($p > 0.05$) between the components of the two cattle-cake. These results are shown in Table 2.

3.3. Proximate Composition of the Different Diets Used to Feed Piglets

Lipids, protein, ash and carbohydrates content of the three diets are almost in equal quantity ($p > 0.05$). Nevertheless, we notice some differences concerning the control diet. In fact, it ash content is higher (18.58%) than that of diet ESSAI 1 (11.98%) and that of diet ESSAI 2 (11.47%). But, it carbohydrates content is worse than that of diet ESSAI 1 and that of diet ESSAI 2 which values are 60.36% and 60.56% respectively. The protein content of control diet is higher than that of diet ESSAI 1 and diet ESSAI 2. However, there is no significant difference ($p > 0.05$) between the components of the three diets. These results are shown in Table 3.

3.4. Evaluation of Anthropometric Paramters of Piglet According to the Diet Consumed

3.4.1. Variation of Piglets Weight during the Duration of the Experimentation

This study is shown that there was no difference ($p > 0.05$) in weight between the three groups of piglets during all the duration of the experimentation. At the beginning of the experimentation, groups of piglets constituted were homogeneous with mean weights which were 8.13 ± 1.79 Kg; 8.40 ± 3.25 Kg and 8.80 ± 2.79 Kg for control group, ESSAI 1 group and ESSAI 2 group respectively. At the end

Table 2. Proximate composition of the different Cattle-cake and fish powder.

	Moisture (%)	Lipids (%)	Protein (%)	Ash (%)	Carboxydrates (%)
C-c Coconut	6.72 ± 0.12	4.45 ± 0.08	8.54 ± 0.09	9.95 ± 0.08	63.56 ± 0.44
C-c Palm	5.81 ± 0.18	7.44 ± 0.08	11.98 ± 0.12	4.41 ± 0.36	70.35 ± 0.49
Fish powder	7.87 ± 0.11	10.33 ± 0.11	46.32 ± 0.03	25.95 ± 2.85	9.53 ± 0.18

Values are means ± SE for three determinations. C-c Coconut: Cattle-cake of coconut; C-c Palm: Cattle-cake of palm kernel.

Table 3. Proximate composition of the different diets used to feed piglets.

	Moisture (%)	Lipids (%)	Protein (%)	Ash (%)	Carboxydrates (%)
C. diet	8.2 ± 0.12	4.85 ± 0.08	16.17 ± 0.19	18.58 ± 0.37	52.20 ± 0.44
Diet E1	7.22 ± 0.09	5.65 ± 0.06	14.79 ± 0.07	11.98 ± 0.30	60.36 ± 0.14
Diet E2	6.92 ± 0.28	5.88 ± 0.09	15.17 ± 0.03	11.47 ± 0.09	60.56 ± 0.28

Values are means ± SE for three determinations. Control diet: C. diet; Diet ESSAI 1: Diet E1; Diet ESSAI 2: Diet E2.

of the experimentation, the mean weight of control group of piglets was 31.95 ± 1.60 Kg, that of ESSAI 1 group was 32.50 ± 5.88 Kg and that of ESSAI 2 group was 33.05 ± 9.61 Kg (Figure 1).

Daily gain weights of piglets were 29.55 ± 2.13 g/day, 30.91 ± 22 g/day and 31.11 ± 2.54 g/day respectively for control goup, ESSAI 1 group and ESSAI 2 group. These gain weight were not significantly difference ($p > 0.05$) to each other.

3.4.2. Study of the Piglets Length

Any difference ($p > 0.05$) was observed throughout the experimentation between the mean piglets length of each homegeneous group formed. In fact, at the beginning of the experimentation mean piglets length were 42 ± 5.94 cm, 45.75 ± 7.85 cm and 44 ± 12.78 cm respectively for control goup, ESSAI 1 group and ESSAI 2 group. In the middle of the experimentation (day 56) mean piglets length were 48.075 ± 5.45 cm for the control group 54.25 ± 8.18 cm for ESSAI 1 group and 51.3 ± 11.79 cm for ESSAI 2 group. At the end of the experimentation (day 98), these values become 54.75 ± 5.56 cm, 59.2 ± 7.53 cm and 55.5 ± 11.15 cm respectively for control goup, ESSAI 1 group and ESSAI 2 group. Neither at the middle nor at the end of the experimentation, was no significant difference ($p > 0.05$) observed between the mean lengths whatever the group of piglets. These values are shown in Figure 2.

3.4.3. Study of the Piglets Garrot Height

This study is shown that there was no difference ($p > 0.05$) of mean piglets garrot height between the three groups of piglets during all the duration of the experimentation. At the beginning of the experimentation, the difference heights were 32 ± 2.58 cm, 35 ± 6.78 cm and 33.6 ± 3.9 cm for control group, ESSAI 1

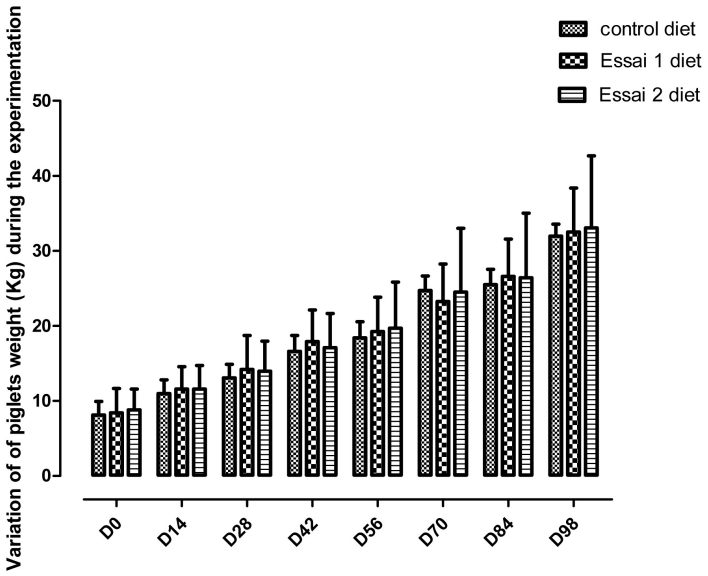

Figure 1. Variation of piglets weight during the duration of the experimentation. (*): ($p \leq 0.05$), significant difference variation; (): ($p \geq 0.05$), no significant difference variation.

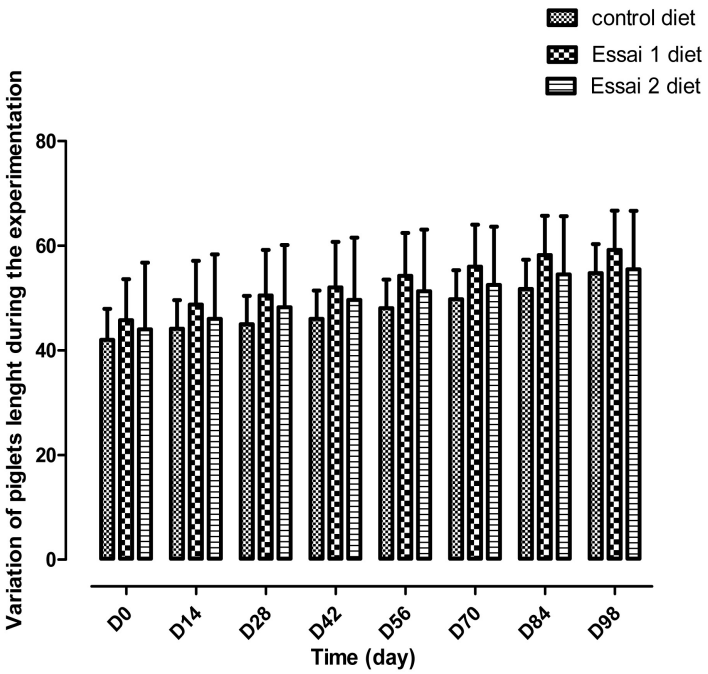

Figure 2. Variation of piglets length during the duration of the experimentation. (*): ($p \leq 0.05$), significant difference variation; (): ($p \geq 0.05$), no significant difference variation.

group and ESSAI 2 group respectively. At the end of the experimentation, the mean piglets garrot height of control group was 44.75 ± 3.3 cm, that of ESSAI 1 group was 50.25 ± 7.54 cm and that of ESSAI 2 group was 48.25 ± 6.55 cm (**Figure 3**).

3.4.4. Study of the Brisket Tour of Piglets

Any difference ($p > 0.05$) was observed throughout the experimentation between the mean brisket tour of each homegeneous group of piglets formed. In fact, at the beginning of the experimentation mean brisket tour of piglets were 44.75 ± 2.75 cm, 45 ± 6.68 cm and 46 ± 12.03 cm respectively for control goup, ESSAI 1 group and ESSAI 2 group. At the middle of the experimentation (day 56) mean brisket tour of piglets were 52.75 ± 3.3 cm for the control group, 54.82 ± 7.99 cm for ESSAI 1 group and 55.47 ± 11.54 cm for ESSAI 2 group. At the end of the experimentation (day 98), these values become 58.12 ± 3.7 cm, 59.5 ± 7.85 cm and 58.5 ± 11.09 cm respectively for control goup, ESSAI 1 group and ESSAI 2 group. Neither at the middle nor at the end of the experimentation, no significant difference ($p > 0.05$) was observed between the mean brisket whatever the group of piglets. These values are shown in **Figure 4**.

3.5. Biological Parameters of Piglets in Relation with the Diet Consumed

There was no significant difference ($p > 0.05$) between the mean glycemic index value measured in piglets group whatever the diet consumed at day 56 and also at day 96.

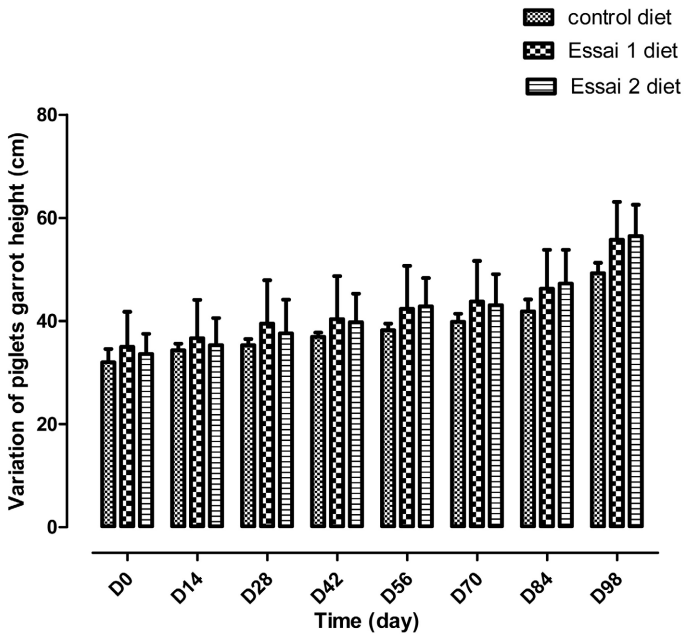

Figure 3. Variation of piglets weight during the duration of the experimentation. (*): ($p \leq 0.05$), significant difference variation; (): ($p \geq 0.05$), no significant difference variation.

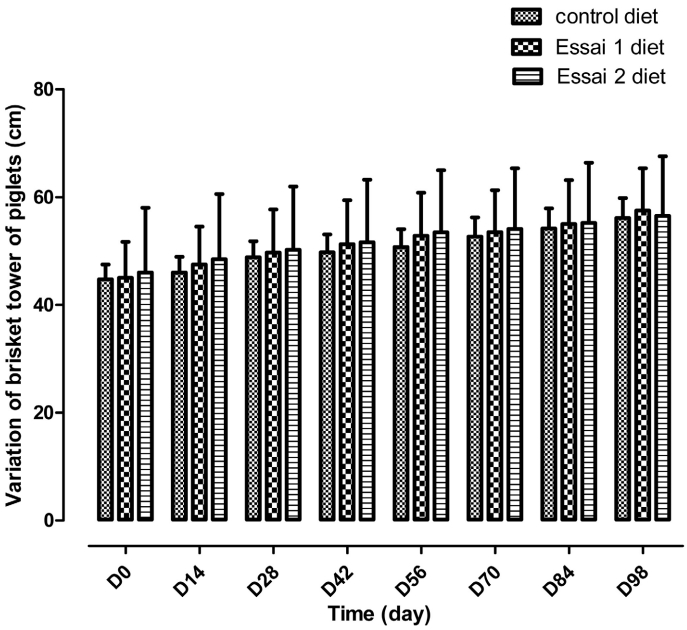

Figure 4. Variation of brisket tower of piglets during the duration of the experimentation. (*): ($p \leq 0.05$), significant difference variation; (): ($p \geq 0.05$), no significant difference variation.

Lipids parameters such as triglycerides, total-cholesterol, LDL-cholesterol, HDL-cholesterol and calculation of atherogenicity index showed that there was no significant difference ($p > 0.05$) between the mean values measured on group of piglets at day 56 and at day 96. It was the same result when we measured parameters which explained the kidneys functioning (urea and

creatinine) and the liver functioning (TGP and TGO). On the whole, the values of minerals measured were not significantly difference ($p > 0.05$) whatever the diet consumed by piglets. All these values are shown in Table 4 and Table 5.

4. Discussion

According to the cost of 100 Kg of each diet formulated, diet ESSAI 1 and diet ESSAI 2 appeared to be less expensive than control diet. This is an opportunity for pig breeders to reach the objective of every breeder which is to produce enough with quality but at a lower cost. But, the problem is to know if these diets (diet ESSAI 1 and diet ESSAI 2) which are less expensive are good nutritious value. The analysis of the two cattle-cakes add into the formulation of diet ESSAI 1 and diet ESSAI 2 showed that the proportions of their components are not significantly difference ($p > 0.05$). Besides, analysis of the composition of diet ESSAI 1 and diet ESSAI 2, which were distinguished each other by the kind of cattle-cake used (cattle-cake of coconut or cattle-cake of palm kermel) indicated that their compositions are almost similar. When components of diet ESSAI 1 and diet ESSAI 2 are compared to that of control diet, we again notice that, the control diet has similarities in its composition with diet ESSAI 1 and diet ESSAI 2, solely its mineral content is slightly higher than that of diet ESSAI 1 and diet ESSAI 2.

Table 4. Variation of biological parameters measured after two months of experimentation.

Parameters	Control diet	ESSAI 1 diet	ESSAI 2 diet
Urea (g/l)	0.54 ± 0.41	0.57 ± 0.33	0.63 ± 0.27
Glycemia (g/l)	0.82 ± 2.57	0.92 ± 0.72	0.88 ± 0.47
Creatinine (g/l)	26.5 ± 23.60	27.75 ± 23.37	34.25 ± 19.87
Triglycerides (g/l)	2.14 ± 0.50	2.91 ± 1.78	3.09 ± 0.58
Total cholesterol (g/l)	1.49 ± 0.49	1.72 ± 0.46	2.20 ± 0.67
LDL-cholesterol (g/l)	0.76 ± 0.35	0.78 ± 0.05	0.85 ± 0.06
HDL-Cholesterol (g/l)	0.28 ± 0.09	0.34 ± 0.08	0.39 ± 0.09
AI	2.75 ± 0.67	2.40 ± 0.44	2.21 ± 0.41
Conjugated bilirubin (g/l)	89.50 ± 67.66	91.75 ± 64.78	129.75 ± 77.90
Total bilirubin (g/l)	251.50 ± 174.20	247.25 ± 172.90	311.00 ± 81.02
Sodium (g/l)	98.25 ± 42.55	99.25 ± 41.64	137.00 ± 14.21
Chlorine (g/l)	114.75 ± 6.02	115.25 ± 4.43	121.75 ± 10.21
Calcium (g/l)	89.25 ± 4.50	91.75 ± 6.24	92.75 ± 3.30
Phosphorus (g/l)	69.00 ± 27.89	70.75 ± 21.49	93.50 ± 16.70
ASAT (g/l)	363.75 ± 472.71	507.50 ± 887.67	684.00 ± 891.40
ALAT (g/l)	3391.50 ± 6637.05	3224.75 ± 6366.84	4031.00 ± 7642.00

Values are means ± SE for six determinations. AI: atherogenicty Index.

Table 5. Variation of biological parameters measured after four months of experimentation.

Parameters	Control diet	ESSAI 1 diet	ESSAI 2 diet
Urea (g/l)	0.47 ± 0.19	0.48 ± 0.16	0.58 ± 0.10
Glycemia (g/l)	0.26 ± 0.04	0.31 ± 0.09	0.48 ± 0.24
Creatinine (g/l)	24.50 ± 14.08	23.25 ± 12.66	31.75 ± 11.09
Triglycerides (g/l)	1.39 ± 0.44	1.27 ± 0.29	1.66 ± 0.39
Total-Cholesterol (g/l)	1.25 ± 0.20	1.64 ± 0.26	1.83 ± 0.23
LDL-cholesterol (g/l)	0.89 ± 0.16	0.96 ± 0.25	1.11 ± 0.17
HDL-cholesterol (g/l)	0.32 ± 0.08	0.43 ± 0.01	0.39 ± 0.10
AI	2.99 ± 1.23	2.28 ± 0.67	2.99 ± 0.99
Conjugated bilirubin (g/l)	74.00 ± 20.61	71.75 ± 24.32	108.75 ± 45.81
Total bilirubin (g/l)	172.00 ± 56.44	176.50 ± 68.83	278.04 ± 133.97
Sodium (g/l)	117.50 ± 5.00	118.25 ± 5.38	118.25 ± 4.45
Chlorine (g/l)	103.75 ± 2.63	107.50 ± 1.29	108.25 ± 2.50
Calcium (g/l)	89.75 ± 3.30	91.50 ± 4.79	87.75 ± 9.71
Phosphorus (g/l)	54.25 ± 15.78	57.00 ± 20.38	95.25 ± 8.81
ASAT (g/l)	121.25 ± 60.42	123.25 ± 61.15	4926.25 ± 9493.49
ALAT (g/l)	43.00 ± 23.42	43.25 ± 22.94	401.75 ± 620.99

Values are means ± SE for six determinations. AI: atherogenicty Index.

Another question was important to find an answer: In spite of the similarities in their composition, did the three diets (control diet, diet ESSAI 1 and diet ESSAI 2) can permit them to obtain the same performance? Then, the impact of the living organisms should be assessed and it was done with the piglet.

Anthropometrics parameters (weight, daily weight gain, body length, garrot height, brisket power) measured during the experimentation on homogeneous group of piglets formed, permitted us to say that they have the same nutritional values. In fact, there was no significant dissimilarity ($p > 0.05$) between the different anthropometric parameters of homogeneous group constituted. These results suggested that the incorporation cattle-cake (coconut or palm kernel) does not negatively impact growth of piglets. According to the work made by Yao *et al.* [13], we can say that cattle-cake of coconut and cattle-cake of palm kernel would be better in diet for growth of piglets after weaning than the blending of cattle-cake of cashew nut in diet because when these researchers incorporated cattle-cake of cashew nut in pigs diet at degree of 7% to 9%, they observed a deacrease of growth of pigs compared to the growth of pigs fed with the control diet which composition was almost the same with that we formulated.

In order to appreciate health of the experimentation pigs, a biological analysis was done. This analysis was in relation with carbohydrate metabolism (glycaemia), nitrogen metabolism (uraemia and creatinine) and lipids metabolsism (triglyce-

rides, total cholesterol, LDL-cholesterol, HDL-cholesterol and atherogenicity index calculation).

The fact that it wasn't a significant difference ($p > 0.05$) of glyceamia measured whatether the diet consumed explained that carboxydrate metabolism is almost equal.

Pig is an animal which adipose tissue is very developed. With the addition of cattle-cake known to be rich in lipids, respective in the case of diet ESSAI 1 and diet ESSAI 2 consumption was to see lipids parameters and atherogenicty index increase. But, that is not what we observed. It is because the two cattle-cakes were much squeezed and then a high quantity of oil was extracted. Moreover, cattle-cakes analysis as showed that they contain few quantity of oil which were 4.45% ± 0.08% and 7.44% ± 0.08% respectively for cattle-cake of coconut and cattle-cake of palm kermel.

The fact that no significant difference ($p > 0.05$) was observed on urea and creatinine measured on each group of piglets used in the experimentation suggested that glomerulus filtering was almost similar whatever the diet consumed.

When we observed the transaminase and bilirubin rate measured on piglets of each group, there is no suspicion of possible liver or spleen disturbance whatever the diet consumed because standard deviation are very high.

Because there were no significant difference ($p > 0.05$) observed on minerals component suggested a good hepatic fonctionning and good a glomerulus filtering whatever the diet consumed.

5. Conclusions

Cattle-cake of coconut seeds and cattle-cake of palm kermel can be recommended for fattening piglets for four reasons;

- They are available in Côte d'Ivoire;
- They are rich in nutrients because they contain carbohydrates, lipids, proteins and minerals;
- When incorporated into the diet of piglets, good growth performance and health of piglets are sustained;
- Apparent reduction in feed cost was achieved in piglet diets.

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Conflicts of Interest

The authors declare that there is no conflict of interest.

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