



**Research Paper**

**EFFECT OF CASHEW INCORPORATION IN FINISH PIG DIET ON GROWING PERFORMANCE AND BLOOD PARAMETERS**

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**Abstract**

The aim of this study is to analyze the effect of cashew nuts supplementation in diet on tropical pig growing performance and sanitary statute. 120 pigs (Large White x Pietrain) x (Landrace x Duroc) were used. Study was conducted on finish stage from 24 to 30 weeks old. Four diets were formulated with different range of cashew nut. Diets were F<sub>0</sub>, F<sub>8</sub>, F<sub>10</sub> and F<sub>12</sub> that are contained respectively 0, 8, 10 and 12 percent of cashew nut. In 8, 10 and 12% cashew nut groups', body weight was 2, 4 and 6kg lower than control. Daily gain was decreased by 50, 75 and 102 g/d respectively with 8, 10 and 12 % cashew to the control (F<sub>0</sub>). Cashew nut ingestion was 100 g/d lower than control (P<0.05). Daily ingestion of 8, 10 and 12 % cashew nut diet was 100 g/d lower than control (P<0.05). Feed efficiency was not affected by cashew nut. Sanitary statute was not also affected by cashew nut incorporation. However, creatinine concentration has been affected (3 and 5 mg/l). It is lower in 10 and 12% cashew diet than control (P<0.05).

Key words: cashew, growth, health, blood, pig.

**INTRODUCTION**

The effect of *Anacardium occidentale* was studied in livestock on poultry, cow, rabbit, and pig. Studies were mainly conducted with dried cashew apple on swine. Thus, in a feeding trial conducted by [1], 12 pigs averaged 13.5 kg divided into four groups were selected and fed with diets containing 0, 50, 100 and 150 g dried cashew pulps. The study reveals that level of dried cashew pulp was no effected fed intake. However, live weight was decreased. Indeed, the average values of final body weights were 58.67, 53, 59.67 and 48.67 kg respectively for diets with 0, 50, 100 and 150 g of dried pulp cashew nuts in diet. Studies of dried residues of cashew apple were also conducted by [2]

(1995) on 18 pigs weighing between 20 and 50 kg and 12 pigs weighing between 40 and 90 kg. The study was showed that, if pig weighs 20 to 50 kg, broken rice substitution by 5 and 10% dried residue cashew apple increase average daily gain and final live weight 17.08 g/d and 1.2 kg respectively. Between 40 and 50 kg weigh, corn substitution by 5 and 10% dried residue cashew apple decreased daily weigh gain and final live weight average was 28.8 g/d and 2.91 kg respectively. However, feed conversion ratio was not affected. Other studies were conducted by [3] from the cashew on the growth of pigs post-weaning growth phase. This study shows that, in post-weaning, there was no effect of cashews on the growth parameters of the pig. In growing, rations contains 7 and 9% cashew, the body weight decreased from 2 to 3 kg compared to control. However, for our knowledge there are no study on tropical pig growth performance and blood status using cashew during finishing phase. The aim of the present work is to study cashew effect on growth performance and blood of finishing stage of the pig breeding in Ivorian semi-modern system.

## MATERIALS AND METHODS

The objective of the study is to determine the influence of cashew on growth performance of pigs in the finishing phase and some health physiological indicators in pigs. Four groups of animals were selected and fed with food contains cashew.

### Animals and feed

This study was conducted in the suburb of Abidjan Côte d'Ivoire. 120 barrows and females crossbred (Large White x Pietrain) x (Landrace x Duroc) were used. Animals were bred in individual box (3 m<sup>2</sup> x 0.90 m) with at 29.5 ± 2.4 ° C and 76 % humidity. Four groups of 30 animals were formed and fed *ad libitum* with a specific diet different by the incorporation rate of cashew (*A. occidentale*) dried (Table 1). The first feed was made at 8 am after pigsty cleaning and the 2<sup>nd</sup> at 2 pm after the 2<sup>nd</sup> cleaning. Between 24 and 30 weeks of age, the four groups of animals received diet F<sub>0</sub>, F<sub>8</sub>, F<sub>10</sub> and F<sub>12</sub> containing respectively 0, 8, 10 and 12% cashews. The nutritional characteristics of foods were determined by food analysis. Preventive antibiotic treatment (oxytetracycline 10%) and internal deworming (kelamectin 1%) was applied to all animals in accordance with tropical pigs sanitary prophylaxis.

### Cashew harvest

Cashew (*Anacardium occidentale*) used in this study was discharged from the treatment of nuts after for the extraction of almond in it. They were harvested in Dimbokro area (Côte d'Ivoire) about 200 km from Abidjan by OLAM Ivoire company (company of production and marketing of agricultural products: cashew, cotton and coffee and cocoa in Côte d'Ivoire). Nuts were dried in direct sunlight for 3 days. Impurities on the seeds were then removed by dry cleaning. Seeds were separated and grouped according to their size. After calibration and before roasting, seeds were placed in the washer and they were rewetted by soaking in water for at least 1 hour as recommended by [4]. Seeds were placed in balm bath at 185 ° C for 90 seconds. They were spin-dried by centrifugation to remove the balm. After spin-drying, seeds were cooled down, cracked and shelled to extract the cashew kernel. Cashew seeds used in this work were touch from crushing stage but which are not shelled. They account for about 20-30% of the treated seeds. An electric machine brand CHM, capacity 200 kg, power 24 kilowatts and 2700 x 1260 x 1550 size mm was used for the treatment of cashews. Nuts were collected in plastic bags and transported to the factory where they were incorporated into the diets according to varying proportions.

**Table 1:** Composition of diet (g/100 g)

Ingredients	Finish stage			
	F <sub>0</sub>	F <sub>8</sub>	F <sub>10</sub>	F <sub>12</sub>
Cashew	0	8	10	12
Corn	52	44	42	40
Bran	10,1	10,1	10,1	10,1
Rice flour low	13	13	13	13
Copra cake	16	16	16	16
Soybean meal	2	2	2	2
Fishmeal	3	3	3	3
Shell	2	2	2	2
Salt	0,5	0,5	0,5	0,5
CMV	1,4	1,4	1,4	1,4
Total	100	100	100	100
Chemical composition (%)				
Dry matter	92,4	90,9	91,5	93,5
Protein	14,15	14,34	14,52	14,68
Fat	4,47	7,90	8,62	9,39
Cellulosic material	5,56	5,47	5,38	5,34
Calcium	0,92	0,88	0,89	0,90
Total phosphorus	0,48	0,51	0,52	0,53
Saturated fatty acids	39,4	29,1	27,7	25,5
Unsaturated fatty acids	60,6	70,9	72,3	74,5
Metabolizable energy (kcal)	2802,1	2825,9	2855,8	2885,7

### Diet chemical composition, feed intake and growing performance

Four samples (500 g) for diets F<sub>0</sub>, F<sub>8</sub>, F<sub>10</sub> and F<sub>12</sub> were carried out from 24 to 30 weeks of age. The 4 collected samples were pooling by diet. 500g were sampled again for each pool to determine diets chemical composition. AOAC method of analyze was used [5]. Animals growing performances and feed intake were carried by weighing from 24 to 30 weeks of age. Pigs weight and feed intake were carried using a balance EKS® type, capacity 100 kg and 100g precision and EKS® brand, capacity 5 kg and precision 1g respectively. The average weight of the animals was noted at the beginning of the test to obtain the initial weights. The effect of diet on the individual growth was measured weekly. Weights were performed in the morning before diet supply. Daily feed intake was measured in the morning. Daily intake was measured by weighing the quantity of diet distributed and refusal.

### Effect of diet on pigs health

The animals were inspected every morning to detect mortality and morbid with apparent diarrhea. Blood samples were used to study blood physiologic and pathologic parameters. Thus, 5 ml of blood were collected in a vacuum tube corked VENOSAFE® 6 ml, size: 16 x 100 mm, using a needle DECTON DICKSON VACUTAINERE SYSTEM®, precision glide, reference 360748, dimension 1.2 x 38 mm, at the jugular vein of all animals on an empty stomach. The samples were collected from beginning of study to end at 30 week old and stored at 4°C in a thermostatic container COLEMAN® POLYLITE 40 less than 12 hours before laboratory analyses. Samples were centrifuged at 3000 G and serum recovered in 5 ml tubes to determine the rate of blood urea, glucose,

creatinine, total cholesterol, triglyceride, phosphorus and calcium. These assays were performed using a spectrometer-BIOLABO BIO CARE® brand.

### **Statistical Analysis**

Effect of cashew in diet on pigs' growing performances, feed intake and digestive health were analyzed by ANOVA (analysis of variance) using STASTISCA 7.1 software. Tukey's test was used to compare the means of impact of cashews.

## **RESULTS**

### **Impact of cashew on animal performance**

Growing performance decreases with incorporation of cashew nut in the pig's diet from 24 to 30 weeks of age (Table 2). Body weight at 30 weeks of age with 8, 10 and 12 % cashew in diet was lower than control respectively from 2, 4 and 6 kg ( $P < 0.05$ ). Body weight was decreased when cashew nut proportion was increased ( $P < 0.0$ ). Thus, final weight of animals which were feed with diet F8 (8 % cashew nut) was 1.8 and 3.8 kg higher than diets F10 (10 % cashew nut) and diet F12 (12 % cashew nut) respectively. The weight of pigs feed with high cashew nut in diet was the lowest. Similarly for daily gain, averages were decreased by 51 and 102 g/d, respectively with 8, 10 and 12% cashew in diet than control ( $P < 0.05$ ). Daily gain with diet F8 was 26 and 53 g/d higher than diet F10 and diet F12 respectively. Daily gain with diet F12 was the lowest. However, feed intake with control group was 107 g/d. it is the highest ( $P < 0.05$ ). But, there is no significant difference between all cashew nut groups. Average feed intake of cashew nut diets was 2028 g/d. Feed conversion was not differed with 4 diets. Average was 2.8 from 24 to 30 weeks of age.

### **Impact of cashew on digestive health and physio-pathologic parameters**

No digestive disorder or mortality was observed during the test. However, five pigs at least one group, were infected with bacterial such as bronchopneumonia. All infected animals were treated with antibiotics (20% oxytetracycline and Pen-Trep).

Rate of blood parameters was equal except creatinine (Table 3). Rate was 3.0 and 5.0 mg/l lower in F10 and F12 groups than control ( $P < 0.05$ ). There was no difference between control and F8 and between F8, F10 and F12. The average creatinine in control and F8 group was 20.3 mg/l. Average rate of urea, glucose, cholesterol, triglyceride, calcium and phosphorus are 0.29 g/l, 0.70 g/l, 0.76 g/l, 0.55 g/l, 83 mg/l and 56 mg/l respectively.

## **DISCUSSION**

### **Effect of cashew nut in diet on growing performances and feed intake**

In this study, feed intake, final body weight and daily weight gain were decreased when the rate of cashew nut in diet was increased except feed efficiency. Unlike this result, several studies using oleaginous were not showed any negative effect on pig performance. Indeed, the incorporation of 25 % pea and 8 % sunflower seed in diets for fattening pigs were showed that feed intake and average daily gain are not modified [6; 7]. Chemical analyse was showed that fat rate in their diets was low (4-5%). However, growing performance was decreased significantly when fat level in diet was high. In this study, fat level in cashew nut final diets was at 7.9 %. The high fat rate in diet could increase its total energy. The increasing in diet energy could partially explain the decreasing of feed intake. Indeed, increasing fate such as unsaturated fatty acids and energy in pigs diet could reduce animal appetite [8; 9]. High unsaturated fatty acids rate could reduce nutrients digestibility [10], increase risk of laxative bowel and decrease

animal growth [11]. For other authors such as [12] and [13] the decrease of feed intake could be related to a better balance of amino acids in cashews protein.

### Blood parameters

Creatine rate in blood and body weight were decreased with high proportions of cashew nuts (10 and 12%) in diet. Body weight can increase when animal muscle mass increases. Moreover, creatine production increases with muscle mass [14]. The low body gain could explain the low rate of creatine in cashew nut group in this study. Blood parameters in this study were confirmed by other literature results. That, 10 % canola oil in swine diet was not changed their blood calcium, phosphor, sodium, potassium and urea concentration [15]. However, significant interaction was found between effect of canola and animal age from weaning to slaughter (from starting up to finishing state). Thus, phosphor, urea, sodium and potassium rate in pig blood were increased during growing with canola rate in diet. In this study, tests were made at finish state only. That could explain the invariability of those mineral during the test. Moreover, *Anacardium occidentale* use in diet have not negative effect on pig's health status.

**Table 2:** Effect of rate of incorporation of cashew nuts in the diet on feed intake, growth performance and feed efficiency in pigs during the finishing phase

Growth parameters	Finish stage			
	F <sub>0</sub>	F <sub>8</sub>	F <sub>10</sub>	F <sub>12</sub>
Feed intake (g/d)	2132 ± 151 <sup>a</sup>	2045 ± 117 <sup>b</sup>	2030 ± 106 <sup>b</sup>	2010 ± 124 <sup>b</sup>
Feed conversion	2,70 ± 0,2	2,76 ± 0,2	2,84 ± 0,2	2,92 ± 0,2
Average Daily Gain (g/d)	788,6 ± 76,5 <sup>a</sup>	739,3 ± 32,5 <sup>b</sup>	713,3 ± 52,1 <sup>c</sup>	686,7 ± 43,5 <sup>d</sup>
Average Live Weight (kg)	93,5 ± 2,7 <sup>a</sup>	91,3 ± 2,3 <sup>b</sup>	89,5 ± 3,1 <sup>c</sup>	87,5 ± 2,5 <sup>d</sup>

<sup>abcd</sup>Averages of the same physiological stage affected by different letter are significantly different ( $P < 0.05$ ).

**Table 3:** Effect of rate of incorporation of cashew nuts in the diet on some indicators pathophysiological pigs during the finishing phase

Blood parameters	Finish stage			
	F <sub>0</sub>	F <sub>8</sub>	F <sub>10</sub>	F <sub>12</sub>
Urea (g/l)	0,30 ± 0,05	0,29 ± 0,05	0,28 ± 0,05	0,29 ± 0,05
Glucose (g/l)	0,69 ± 0,06	0,69 ± 0,07	0,70 ± 0,08	0,71 ± 0,10
Creatinine (mg/l)	21,39 ± 1,97 <sup>a</sup>	19,20 ± 2,18 <sup>ab</sup>	18,43 ± 2,10 <sup>b</sup>	16,36 ± 2,37 <sup>b</sup>
Total cholesterol (g/l)	0,76 ± 0,13	0,76 ± 0,14	0,77 ± 0,14	0,75 ± 0,14
Triglyceride (g/l)	0,55 ± 0,04	0,56 ± 0,04	0,54 ± 0,05	0,55 ± 0,06
Calcium (mg/l)	84,20 ± 9,38	82,81 ± 8,17	82,86 ± 8,59	83,74 ± 8,04
Phosphorus (mg/l)	54,80 ± 7,94	56,30 ± 8,93	56,55 ± 7,65	56,69 ± 7,15

<sup>abcd</sup> Averages of the same physiological stage affected by different letter are significantly different ( $P < 0.05$ )



## CONCLUSION

Cashew nut *Anacardium occidentale* at 8, 10 and 12 % in diet decreased finishing pig growing performance. Average daily gain and feed intake with cashew nut were lower than control. However, cashew nut was not affected animal sanitary status and blood parameters except creatinine rate. Further experiments are however essential to determine the digestibility of nutrient and fibres fermentescibility.

## REFERENCES

- [1] Armah I., 2011. *The effect of starter-grower pigs fed diets containing varying levels of dried cashew (anarcadium occidentale l.) pulp*. Phd thesis, kwame nkrumah university of science and technology of kumasi, ghana, 180p.
- [2] Nguyen Nghi, 1995. *Study of processing and using cashew residues as animals feeds*. Institute of Agricultural Sciences of South Vietnam. 13p.
- [3] Yao KSA, Kimsé M, Soro D et Fantodji A, 2013. Effet de l'incorporation de la noix de cajou dans les rations alimentaires sur les performances de croissance des porcs : phases post-sevrage et de croissance. *Int. J. Biol. Chem. Sci.* 7(2): 479-488.
- [4] MCF (Ministère de la Coopération Française), 1980. *Mémento de l'Agronome*. Collection "Techniques rurales en Afrique": 1600p.
- [5] AOAC. 2000. *Official method of analysis of Association of Official Analytical Chemists*. 17<sup>th</sup> Ed., USA, ISBN 0-935584-42-0.
- [6] Albar J, Chauvel J, Granier R., 1992. About the use of spring field peas in dry or wet feeding for fattening pigs. *Journées Recherches Porcine à Paris-France*, 24: 179-186.
- [7] Albar J, Royer E, Massabie P, Mourot J, Vendevre JL., 2000. The use of oleic acid-rich sunflower seed in diets for growing pigs: effects on backfat quality. *Journées Recherches Porcine à Paris-France*, 32: 297-303.
- [8] Atteh, JO, Balogun OO, Annogu AA, Kolade MA., 1992. Replacement value of maize milling waste for maize in the diet of growing pullets. *Tropical Agriculture (Trinidad)*, 70: 267-270.
- [9] Leeson S, Caston L, Summers JD., 1997. Layer performance of 4 strains of Leghorns subjected to various rearing programmes. *Poultry Science*, 76: 1-5.
- [10] Noblet J, Jaguelin-Peyraud Y, Quemeneur B, Chesneau G., 2008. Valeur énergétique de la graine de lin chez le porc: impact de la technologie de caisson-extrusion. *Journées recherches porcine*, 40, 203-208.
- [11] Mourot J et Lebret B., 2009. Modulation de la quantité de la viande de porc par l'alimentation. *INRA Prod. Anim.*, 22, (1): 33-40.
- [12] Fetuga BL, Babatunde GM, Oyenuga VA., 1974. Composition and nutritive value of cashew nut to rats. *Journal of Agriculture and Food Chemistry*, 22: 678-680.
- [13] Mba AV, Njike MC, Oyenuga VA, 1974. The proximate composition, and the amino acid content of some Nigerian oilseeds. *Journal Sciences Food Agriculture*, 25: 1547-1553.
- [14] Tietz NW., 1999. *Text book of clinical chemistry*, 3<sup>rd</sup> Ed C A Burtis E R Ashwood W B Saunders: 1241-1245.
- [15] Flipot P, Tremblay AV, Dufour JJ., 1983. Effet, sur quelques paramètres sanguins, de l'addition de tourteau de canola CV. Tower à la ration des truies. *Canadian Veterinary Medical Association*, 24: 278-280.