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Efficacy of Fungus Treated Ackee Apple *(Blighia sapida)* Seed Meal on Milk Quantity and Quality of Lactating Goat

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Abstract

*The study evaluates the efficacy of Aspergillus niger treated Ackee (**Blighia sapida)** Apple seed meal on milk quantity and quality of lactating West African dwarf goats (n= 12). The goats were randomly allocated to four dietary treatments with three replicates per treatment in a Completely Randomized design model. Treatment A (Control, without fungus treated Ackee Apple meal inclusion), Treatment B (2.5% inclusion level of fungus treated Ackee Apple seed meal), Treatment C (5.0% inclusion level of fungus treated Ackee Apple seed meal) and Treatment D (7.5% inclusion level of fungus treated Ackee Apple seed meal). The results revealed significant differences in the milk yield thus: 79.26kg (A), 86.65 (B), 82.79 (C) and 121.79kg (D). The butter fat was highest for Treatment A followed by B, C, and D in that order however, Treatments A and B are similar. The highest Solids not fat (SNF) content was recorded for Treatments D>B>C and the least was A. The milk protein was greater for Treatment s D, B and C and lowest for Treatment A (Control). However, Treatment B had the highest Total Solids (18.22%) hile D was 15.09%, C was 14.85% and A was 13.38%. The Lactose content was 6.79% (D), 6.60% (B), 6.09% (C) and 4.61 (A). It could be concluded that inclusion of Aspergillus niger treated Ackee Apple seed meal in the diet of lactating West African dwarf goat should be encouraged among dairy farmers.*

***Keywords:** Ackee Aple seed meal, lactating goat, milk quantity andquality, Aspergillus niger*

Introduction As the world population continues to increase, man and animals rely on feed for survival. The conventional feeds that are available are expensive and there is greater competition between man and livestock hence,there is the need to source for alternative food /feed without compromising the quality. It was also noted that the conventional feedstufs had taken a downward trend due to lack of utilization of agricultural wastes. However, many plant protein and energy feedstuffs contain diverse array of anti-nutritional factors that harm livestock if ingested in their virgin state. The need for alternative protein and energy sources in livestock diet in developing countries stimulated research into the use of Ackee Apple seed meal in this study

Ackee Apple *(Blighia sapida*) which originated from Ivory Coast, Gold coast and Nigeria was noted for a variety of purposes including food, fodder for goats, building materials, soap, insect repellant and poisons for catching fish. The tree is also planted for their ornamental qualities and shade (Goldson *et al.*,2005*).* The aril is edible when fully mature but highly toxic when immature. The mature aril is

consumed fresh, added to sauce as alternative to sesame seed or peanuts. The young leaves may be parboiled and use like any other African leafy vegetables (Goldson *et al.*,2005*).* The leaf juice is used for washing or as drops for sore eyes, conjunctivitis and trachoma. The bark is one of the ingredients used in a concoction administered for epilepsy.

Nutritional composition of Ackee Apple reported by Morton *et al.* (1987) includes protein, 8.95%; fat, 18.78%; fibre, 3.45%; calcium, 83g; phosphorus, 98mg, iron, 5.52mg, ascorbic acid 65mg, riboflavin, 0.18mg, niacin, 3.74mg; thiamine, 0.10mg .

The fruits are poisonous when unripe while ripe fruits are consumed. The fruit also contains potent alkaloids which are toxic amino acids known as hypoglycins A and B which when consumed in the fruits without processing elicit syndrome of vomiting, seizures and fatal hypoglycemia known as Jamaica vomiting sickness. The toxic chemicals limit the body's ability to release the backup supply of glucose and glycogen store in the liver on which the body depends to keep the blood sugar level till the next meal (Barenness *et al.,* 2004).

Hence, thee is the need to detoxify the seed meal using biotechnological method described by Beewu (2001). The choice fungus is *Aspergillus niger* due to its ubiquitous nature and ability to colonize wide range of substances. The spores are wide spread, and are often associated with organic materials and soil (Raper and Fennel, 1965). Aside its products of fermentation, it is resistance to several antifungal agents, it is used to test the efficacy of preserative treatments (Jong and Gantt, 1987). There is also interest in using this fungus to perform certain enzymatic reactions that are very difficult to accomplish by strictly chemical means, such as specific additions to steroids and other complex rings (Jong and Gantt, 1987). The thrust of this study was to evaluate the effect of *Aspergillus niger* treated Ackee Apple seed meal based diet on the quantity and quality of milk of lactating West African dwarf goat.

Materials and Methods

Experimental site

The experiment was conducted at the Small Ruminant Unit, Teaching and Research Farm of the University of Ilorin, Nigeria. University of Ilorin is located in Kwara state of Nigeria. The tate which is about 332,500 square kilometers in area lies between latitudes 7^0 45 N and 9^0 30 N and longitudes 2^0 30 E and $6^0$25 E. The average annual rainfall was 900mm while the temperature was between 31.5 and 35^0C.

Collection and Preparation of Ackee Apple seed meal

Ackee Apple seeds (*Blighia sapida*) were collected within Ilorin metropolis. The collected seeds were separated from the mesocarp and the arils and later sundried and oven dried at 60^0C for 72 hours so as to reduce the moisture

content. The dried seeds were milled in readiness for its inoculation with the fungus and inclusion in the diet at various levels.

Inoculation and Incubation of the Ackee Apple seed meal

Prior to the inoculation of Ackee Apple seed meal, the seed meal was autoclaved at 121^0C for 15 minutes so as get rid of any possible microbes. After which the seed meal was allowed to cool before inoculation with the spores of *Aspergillus niger at* 10^7 spores per gram of the meal. The inoculated seed meal was later incubated for 7days when the spores have enveloped the meal. The fungus treated seed meal was later oven dried at 60^0C to terminate the growth of the fungus before inclusion in the experimental diets.

Composition of the Experimental Diets

The composition of the experimental diets is as shown on Table 1. Ackee Apple seed meal was used to replace Groundnut cake at various levels thus: 2.5% (B); 5.0% (C); 7.5% (D) while A (Control, without Ackee Apple seed meal inclusion).

Table 1 : Composition of the Experimental Diet

Ingredients	Treatment A (Control)	Treatment B	Treatment C	Treatment D
Cassava waste	53.00	53.00	53.00	53.00
ice husk	35.00	35.00	35.00	35.00
Groundnut cake	10.00	7.50	5.00	2.50
Fungus treated Ackee Apple seed meal	0.00	2.50	5.00	7.50
Salt	1.00	1.00	1.00	1.00
Vitamin-mineral premix	1.00	1.00	1.00	1.00

Animal and Management

Twelve healthy pregnant West African dwarf does obtained from the University of Ilorin Teaching and Research farm were used for the experiment. The animals were treated against ecto and endo parasites using Ivomec prior to the start of the experiment.

The animals which were randomized against the experimental diets in the pens were allowed to adjust for three weeks while diets and water were given *ad libitum* .

Parameters Evaluated

Various milk qualities were determined using Lactoscan milk analyser (Total Protein, Total solids, Solids Not-fat, Lactose, Butter- fat, Density, Conductivity, Freezing point , Temperature, Lactic acid, pH, Ash) while average milk yield was determined using weighing scale.

Chemical analysis

Proximate composition of the Fungus treated and untreated Ackee Apple seed meal and the experimental diets were determined using the procedure of AOAC (1990).

Statistical Analysis

All data collected were subjected to analysis of variance of a Completely Randomised design model while treatment means were separated using Duncan (1955) multiple range test.

Results and Discussion

Table 2 shws the Proximate composition of Treated and Untreated Ackee Apple (*Blighia sapida)* seed meal. The seed meal of the untreated sample has Crude Protein and ether extract contents of 15.61% and 12-20% respectively which were lower than that of fungus treated sample. Conversely, the crude fibre and the ash contents were lower in the fungus treated sample compared to the untreated sample.

Conversely, the crude protein content of the fungus treated sample was higher than the untreated sample due probably to the addition of microbial protein during fungus fermentation. This agreed with the work of Jacqueline and Visser (1996) and Belewu (2001) who reported improved Crude protein content when *Aspergillus niger* was used as inoculums on Jatropha Kernel cake. There was an improvement in the ether extract content of the fungus treated meal probably due to the fact that the fungus (*Aspergillus niger)* is lipolytic in nature. The reduction in the crude fibre content of the fungus treated sample compared to the control could be related to the fact that the fungus could have used the fibre content for their growth. The solubilisation and utilization of the fibre is made possible by the secretion of various enzymes (cellulose xynalase etc) secreted by the fungus during their growth stage.

Table 2 : Proximate Composition of Fungus Treated and Untreated Ackee Apple (*Blighia sapida*) seed Meal

Parameters (%)	Untreated seed meal	Treated seed meal
Dry matter	91.90	93.40
Crude Protein	15.65	18.38
ther extract	12.20	15.75
Crude ibre	4.25	3.61
Ash	12.20	4.40

Table 3 revealed the proximate composition of the experimental diets (Treatments A-D). The highest Crude Protein content was recorded for Treatment A (Control) while the Crude Protein content of the fungus treated based diets ranged between 9.52% and 11.16%. The Crude fibre content ranged from 18.99 -23.86% for Treatments A-D. The ether extract recorded was A (11.50%) , B (11.0%), C

(10.75%) and D (11.25%). The highest Ash content was noted in Treatment C followed by D and the least was B.

Table 3: Proximate Composition of the Experimental Diets

Parameters (%)	Treatment A Control)	Treatment B	Treatment C	Treatment D
Dry matter	93.65	92.30	93.00	93.60
Crude Protein	13.13	11.16	11.05	9.52
Crude fibre	21.13	23.86	20.40	18.99
Ether extract	11.50	11.00	10.75	11.25
Ash	11.72	11.44	11.94	11.83

Milk quantity and quality are explained in Table 4. The Crude Protein content of the milk was greater for Treatment D, great for Treatment B and least for Treatment A. The Crude Protein content of Treatments B and D increased by 32 and 46% respectively when compared with the Crude Protein content of the Control (A). This shows that the Ackee Apple fungus treated diets (B-D) were better than the Control (A). Belewu and Olapade (2008) in agreement with Robison *et al*. (2001) reported similar significant increase in the milk protein content when cows and goats were fed yeast culture supplemented diets.

The Solids Not Fat (SNF),Lactose and Ash contents were significantly higher for Treatments D>C > B compared to the Control (A) which was the least. This shows that the fungus treated samples recorded improvement in the percentage of the above named nutrients. This agreed with the report of Robison (1990), Belewu (2005) who fed fungi treated based diets to cows and goats respectively.

There was no significant different in the butter fat content of Treatments A and B. However, the least butter fat content was noted in Treatment D (18.99%) compared to other Treatments A, B and C. The butter fat content of the milk is directly related to the Crude fibre content of the diet (Belewu, 2006).

The percentage Total Solid content was not consistent among the Treatments. The pH value of the Treatments fell within the value reported for milk (Belewu, 2006). Additionally, the fungus treated Ackee Apple seed meal has no effect on the pH, temperature and the freezing point of the milk.

The milk density and conductivity showed significant differences in the fungus treated Ackee Apple seed meal based diets compared to the Control (A) diet. The high milk ensity revealed the concentration of the milk. It shows that the fungus treated Ackee Apple seed meal based diet was more concentrated than that of the Control (A). This is a welcome report to dairy farmers to make more profit. The conductivity followed similar trend as the density. Hence, the fungus treated based diet has more charge density compared to the Control Treatment (A).

The average milk yield was 79.26 (A), 86.65 (B), 82.73 (C) and 121.29 (D). This reflected 53% and 9.32% higher milk quantity of Treatments D and B respectively over the Control (A). The result was consistent with the observation of Robsion *et al.*(1990) and Belewu *et al*.(2008) who used yeast culture to improve milk quantity and quality of goat . The higher milk yield of the Ackee apple based diets (B-D) could be due to the rich content of these diets (Chilliard *et al*., 2003)

Table 4: Average Milk Quantity and Quality of the Experimental Animals

Parameters (%)	Treatment A (Control)	Treatment B	Treatment C	Treatment D	±SEM
Crude Protein	3.27^{a}	4.33^{b}	4.29^{b}	4.78^{c}	0.001
Butter fat	4.64^{a}	3.95^{ab}	3.37^{b}	3.01^{b}	0.028
Solids not fat	8.74^{a}	11.61^{b}	11.48^{b}	12.80^{c}	0.011
Lactose	4.61a	6.61b	6.09b	6.79c	0.003
Total Solids	13.38	18.22	14.85	15.09	
Lactic acid	0.92^{a}	1.31^{b}	1.10^{c}	1.55^{d}	0.00
pH	4.52	4.94	4.84	4.95	0.001
Ash	0.836^{a}	1.10^{b}	1.08^{b}	1.18^{c}	0.00
Temperature	36.34	36.84	38.46	37.38	
Freezing point	-0.558	-0.762	-0.747	-0.808	-0.000
Density	29.66^{a}	40.36^{b}	40.12^{b}	45.00^{c}	0.174
Conductivity	6.61^{a}	5.89^{b}	6.01^{b}	6.30^{ab}	0.004
Milk yield/day (g)	79.26^{a}	86.65^{b}	82.73^{b}	121.29^{d}	3.54

Means along the same row with different superscripts are significantly different from each other ($P<0.05$)

Conclusion

It could be concluded that inclusion of 7.5% *Aspergillus niger* treated Ackee Apple seed meal yielded the best milk quality and quantity. Hence, it is therefore, recommended that inclusion of 7.5% *Aspergillus niger* treated Ackee Apple seed meal should be adopted in order to achieve best milk quantity and quality.

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