PERFORMANCE CHARACTERISTICS OF GOATS FED COCOA SEED (*Theobroma cacao*) TESTA AS A REPLACEMENT FOR PALM KERNEL CAKE CONCENTRATE SUPPLEMENT TO BASAL GRASS (*Cynodon nlemfuensis*)

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ABSTRACT

Twelve West Africa dwarf goat 15-16 months with an average weight of 16.5 kg were randomly allocated to three concentrates diets such that 0%, 50%, 100% of palm kernel cake were replaced with cocoa seed testa. Each of the 3 groups was reared on any of the concentrate supplements fed to a basal diet of grass *Cynodon nlemfuensis*. The experiment lasted for seven weeks including 2 weeks for adjustment of the animals to the cages. The data generated voluntary dry matter intake, weight gain and nutrient digestibility were subjected to one way ANOVA. Multiple range test was used to separate the means. Changes in body weight of group B had the highest mean with treatment that contained 50% CST replacement and the lowest was group A recorded from the diet with 0% CST replacement .The total voluntary dry matter intake ($g/d/kg^{w0.75}$) followed a similar trend as the feed conversion ratio in group B had the highest mean with treatment that contained 50% CST replacement while the lowest was group A with treatment that contain 0% CST replacement. Total dry matter intake (g/d) had the highest mean at group B with the treatment that contained 50% CST replacement while the lowest was group A with the treatment that contained 0% CST replacement. In conclusion, incorporation of the CST at 50% level of replacement of PKC enhanced the performance and nutrient digestibility of the West African Dwarf goat.

1. INTRODUCTION

The long term survival of animal production in Nigeria depends to a large extent on ability to provide adequate feed materials in the right quantity and quality for animal intake (Ettu and Onwuka , 2014). The population of goat is next to poultry in Nigeria. They are more prolific than cattle and are more hardy than sheep within the tropics. Cocoa seed testa is a by- product of Cocoa processing industries in Nigeria (Lagos and Ile - Oluji, Ondo State). The products are either set on fire or allowed to rot away.

Cocoa seed testa (CST) is usually allowed to waste anyway. The crude protein content is close to that of palm kernel cake (PKC) a tested agro-industrial by-product in animal production. If CST is duly evaluated through animal feeding, it can be encouraged as a feedstuff and so be an alternative to one of the conventional feed stuff.

Nutritional evaluation of CST will contribute to the existing knowledge on utilization of lesser known agro- industrial products and the pool of digestible nutrients in these products.

There is need to harness energy available in agriculture waste and agro – industrial by – products for livestock feeding after a nutritional evaluation which would lower the cost of production without sacrificing efficiency in livestock production.

2. MATERIALS AND METHODS

Twelve West African Dwarf bucks, 15-16 months and weighing 16to 17kg were randomly divided into three groups of 4 per group. Each was kept in individual metabolic cage modified for separate collection of faeces and urine. They had access to feed and clean water daily .They were certified free from ecto and endo-parasites through veterinary services.

Table 1: composition (g/100g) of feed stuffs fed to the West African goats.

	Cocoa seed testa	Palm kernel cake	Maize offals	Grass (cynodon)
Crude protein	18.0	17.7	6.0	8.6
Crude fiber	19.0	18.0	15.0	21.0
Ether extract	8.0	11.0	5.1	6.0
Ash	7.8	8.2	5.8	5.0
NFE	47.2	45.1	68.1	59.4
Gross-energy kcal/g DM	4.2	5.6	4.0	3.5

2.1 Experimental Diets

- Three isonitrofenous and isocaloric concentrate diets were formulated such that 0%, 50%, 100% of palm kernel cake (PKC) was replaced with cocoa seed testa (CST).
- Each of the 3 groups of goats was reared on any of the concentrate supplements fed to a basal diet of grass *Cynodonnlemfuensis*.
- Weighed quantities of the chopped grass and supplement were offered daily at 08:00 h*ad-libitum*. Any residue was weighed to obtain voluntary intake. Each animal was also weighed once a week. The experiment lasted for seven weeks including 2 weeks for adjustment of the animals to the cages.

Table 2.Proximate composition (g/100g DM) of the concentrate supplement fed to goats.

	A	B	C
Maize Offals	59.0	59.0	59.0
Cassava flour	10.0	10.0	10.0
Palm kernel cake	30.0	15.0	0.0
Cocoa seed testa	-	15.0	30.0
Mineral/Vitamins premix	0.5	0.5	0.5
Common salt	0.5	0.5	0.5
TOTAL	100	100	100

2.2 Collection Of Faeces

At week 7 of the experiment total faecal output was measured daily 10% of the total was saved in a polythene bag for each animal and taken to the laboratory for drying in the oven. Dried fecal samples were collected for each animal for 6 days and were bulked and kept for analysis.

2.3 Analytical Procedure

Samples of faeces, CST, grass were dried (for DM), then ground through 0.2 mm sieve in a hammer mill. Accurately weighed quantities were analyzed for CP, CF, EE, and Ash using AOAC (2010) procedure. The gross energy (kcal/g DM) was determined with ballistic bomb calorimeter. The results so obtained were used for calculation of digestibility of CP, CF, EE, Ash and gross energy.

2.4 Statistical Analysis

The experiment was carried out in three treatments and four replications. The data collected were subjected to analysis of variance (ANOVA). If significant, multiple range test as outlined by Duncan (1955) was used to rank the treatment means.

3. RESULT AND DISCUSSION

Voluntary Dry Matter Intake

The summary of the dry matter intake is shown in Table 2

The voluntary dry matter intake (g/day) varied from 849-862. The variations were significant ($p<0.05$) as goats in group B recorded the highest .The value then declined due to the inability of the animals to utilize or handle the anti-nutritional factor (theobromine) in group C .The values 849-862 however conformed to ARC (1910) recommendation which stated that goats would require 3% of their body weight as DM for maintenance and 5% for growth and maintenance.

Minimum of 50% of the VDMI came from the supplement. This suggested that the animals would accommodate up to 50% of replacement with CST .Beyond this value; there was a decline in intake.

Table 3 Voluntary dry matter intake of WAD goats fed varying level of CST based concentrate to basal grass

	GROUPS		
	A	B	C
S/N	0%	50%	100%
1	832.5	891.0	855.0
2	837.0	877.5	868.5
3	855.0	877.5	873.0
4	873.0	859.5	855.0
MEAN	**849.38**	**876.38**	**862.88**
±SEM	9.25422	6.46263	4.63849

VOLUNTARY DRY MATTER (g/d/kg $^{w0.75}$)

Table 3 depicts a summary of VDMI expressed per unit metabolic cage. The apparent variations 98.56-98.81 were significant ($p<0.05$) as goats in group B recorded the highest. The value then declined as a result of anti-nutritional factor (theo-bromine). Hence with this yard stick, the data suggested that PKC could be replaced up to 100% with CST in a diet fed to goats as supplement to grass. Metabolic size of any living organism is the body weight raised to power 0.75($kg^{w0.75}$). This metabolic size provides a yard stick for comparison of voluntary dry matter intake (VDMI) (or metabolic activities) of a mouse with an elephant.

Table 4 Voluntary dry matter (g/d/kg$^{w0.75}$) of WAD goats feed varying levels of CST based concentrate to basal grass.

	GROUPS		
	A	B	C
S/N	0%	50%	100%
1	98.17	99.11	98.62
2	98.35	100.40	98.92
3	98.62	100.40	99.09
4	99.09	99.59	98.62
MEAN	**98.56**	**99.88**	**98.81**
± SEM	0.20014	0.31855	0.11643

CHANGES IN BODY WEIGHT

Changes in body weight are summarized in Table 4.

The values of body weight ranged from 69.30-70.36g. The variations were significant ($p< 0.05$) as goats in group B recorded the highest with an average daily weight gain of 83.57g. It is measured to infer that beyond 50% replacement of PKC with CST, the goats recorded a decline in weight gain which was significant but highest ($p<0.05$) than the mean value (69.30g) for goats on the control (0% CST) diet.

Table 6: Variation in body weight gain obtained for the WAD goats fed varying level of concentrate supplement to basal grass.

	GROUPS		
	A	B	C
S/N	0%	50%	100%
1	71.42	80.00	71.43
2	68.57	85.71	71.42
3	68.60	85.71	68.57
4	68.60	82.86	70.00
MEAN	**69.30[a]**	**83.57[b]**	**70.36[c]**
± SEM	0.70754	1.36651	0.68326

a,b,c= means along the same row with any identical superscript are with significance($p>0.05$)

SEM= Standard Error of Means

4. CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The bulk of evidence obtained from voluntary dry matter intake ($g/kg^{0.75}$) digestibility of nutrients (except DM) seemed to support the fact that 100% of dietary PKC could be replaced with CST. Results from weight gains and CF digestibility indicated that beyond 50% of substitution was not encouraging.

4.2 Recommendation

Since the animals were in positive weight gains, until further studies are done, the result of present study still support 50-100% replacement of PKC with CST.

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