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Nutrient digestibility and Nitrogen balance in Yearling Bunaji bulls fed diets containing graded levels of Palm kernel cake

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Abstract
At the end of 90 days feeding trial, A study was conducted to investigate nutrient digestibility and nitrogen retention in 15 yearling white Fulani bulls fed diets containing graded levels of Palm Kernel Cake (at 0%, 10%, 20%, 30% and 40% PKC) in a completely randomized design. 3 bulls were randomly selected from each treatment and moved to metabolic crates for metabolism trial. The bulls were allowed 14days adjustment period and 7 days for faecal collection. Concentrate and basal diets of *Digitaria smutsii* were offered at 2% body weight each. There were significant ($P<0.05$) differences in all the digestibility parameters obtained. Animals on 40% PKC inclusion had the highest digestibility values for all the parameters measured. The result showed a decrease in urinary nitrogen loss, the faecal nitrogen loss and total nitrogen output as the level of PKC increased in the diets. Nitrogen retained and nitrogen retained as % N intake were highest in animals on 40% PKC diets. The supplied nutrients were well tolerated and properly utilized with positive nitrogen balance. Hence, it was concluded that inclusion of Palm Kernel Cake up to 40% in the diets of yearling Bunaji Bulls can be adopted by farmers in Nigeria for increased productivity.

Keywords: Nitrogen balance, Nutrient digestibility, Yearling Bunaji bulls

Introduction

The Nutrient Digestibility is a tool that can be utilized to get how well cattle are absorbing nutrients. A thorough understanding of key digestion elements and unique ways to assess digestibility within the cow increases the probability of achieving optimum animal performance and business results (Bargo *et al,* 2003).Previous works (Adamu *et al.,* 1993, Alimon, 2004; Wong et *al.,* 2010; Silva *et al.,* 2013, among others) have shown that Palm Kernel Cake (PKC) is invaluable in supplying protein to ruminants. However, there are varied reports on its suitability and level of inclusion in the diets of cattle.

Present study is carried out to determine nutrient digestibility and nitrogen balance in yearling Bunaji Bulls fed diets containing graded levels of palm kernel cake.

Materials and methods

The Experiment was conducted at Experimental Pens of the Beef Research Programme of the National Animal Production Research Institute, Shika, Zaria, Nigeria. 20 yearling Bunaji Bulls were allotted to 5 treatments with 4 animals per treatment was used for the growth trial at the end of the 90 days growth trial, 15 yearling bulls was used for digestibility trial with 3 yearling Bunaji Bulls randomly selected from each treatment and housed in metabolic crates for total faecal and urine collection. The animals were allowed 14 days for adjusting to the condition of the metabolic crates before the commencement of the collection period, which lasted for another 7 days. The experimental diets were formulated to be isonitrogenous and isocaloric, they comprised of Palm Kernel Cake (PKC) at 0, 10 20, 30 and 40% inclusion levels (Table 1). The animals were fed daily with concentrate and hay (*Digitaria smutsii*) at 2% of their body weight each.

Daily faecal output was weighed and 10% of each day's collection was sub-sampled and oven dried at 60°C for Dry Matter determination. This was later bulked for laboratory analysis. Daily urine output was collected in a plastic container containing 100mls 0.1N H_2SO_4 (to trap urine nitrogen)placed under metabolic crates, 10% of daily urine output was taken from each bull and store in the refrigerator. At the end of the 7 days collection period, 10% of the urine taken from each bull was sub sampled and stored in the refrigerator pending Nitrogen determination (Osuji *et al.,* 1993). Analysis of experimental diet and faecal samples were carried out by AOAC (2000) procedure. Also, Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF) were determined in all the feed ingredients according to Van Soest (1991) at the Central Laboratory of National Animal Production Research Institute (NAPRI), Shika, Zaria. Metabolizable energy (ME) was determined by equation of Alderman and Cottrill (1985). ME (MJ/Kg DM) = 11.78 + 0.0064 CP + $(0.000665EE)^2$ - CF (0.00414EE) - 0.0118A. Where ME = DM = Dry matter, CP = Crude protein, EE = Ether Extract, CF = Crude fiber and A = Ash. The data from the digestibility trial was analyzed using the General Linear Model Procedure of SAS (2002).

Data from the feeding trials were analyzed to investigate the response of the animals to measured parameters. treatment means were determined using DMRT in the SAS package.

Table 1: Chemical compositions of concentrate diets containing varying levels of palm kernel cake fed to yearling Bunaji Bulls.

	Levels of inclusion				
Parameter	0	10	20	30	40
DM%	97.74	97.81	98.25	98.13	98.80
CP%	17.75	15.82	17.44	17.44	14.19
CF%	26.50	26.36	29.35	34.93	38.77
EE %	18.41	20.57	13,31	12.46	11.36
Ash (%)	6.43	6,79	7.46	6.75	6.40
NDF (%)	44.52	52.64	49.24	57.78	54.46
ADF (%)	27.27	33.92	36.45	33.78	32.85
HC (%)	17.25	18.72	12.79	24.00	21.61
GE	3549.31	3428.93	3217.26	3423.91	3751.85
ME(MJ/KgDM)	11.81	11.80	11.80	11.81	11.79

Where ME = Metabolizable energy, GE= Gross energy DM = Dry matter, CP = Crude protein, EE = Ether Extract, CF = Crude fibre and A = Ash.,,NDF=neutral detergent fiber, ACF=Acid detergent fiber ,HC=hemicellulose. ME=Metabolizable Energy. ME was determined by equation of Alderman and Cottrill, 1985. ME (MJ/Kg DM) = 11.78 + 0.0064 CP + $(0.000665EE)^2$ - CF (0.00414EE) - 0.0118A.

Results and discussion

The apparent nutrient digestibility of diets containing graded levels of Palm Kernel Cake fed to Bunaji yearling bulls is shown in Table 2. The dry matter digestibility ranged from 58.06% to 67.42%. There was significant difference (P<0.05) in crude protein digestibility which ranged from 56.30% -69.11%. Crude fibre digestibility ranged from 51.70% to 67.48%. Ether extract digestibility was highest in animals fed 40% inclusion level of Palm Kernel Cake and lowest in animals on 20% inclusion level. There was significant difference (P<0.05) in ADF and NDF digestibility across the treatments with animals on 40% inclusion level of Palm Kernel Cake having the highest digestibility values.

Table 2: Effect of feeding diet containing varying levels of palm kernel cake on the apparent digestibility of yearling bunaji bulls.

	Level of inclusion					
Apparent digestibility (%)	0	10	20	30	40	SEM
DM (%)	62.13^{b}	62.15^{b}	58.06^{c}	65.33^{a}	67.42^{a}	1.20
CP (%)	59.10^{b}	56.30^{b}	57.73^{b}	67.26^{a}	69.11^{a}	1.65
CF(%)	51.70^{d}	62.87^{b}	59.00^{c}	65.90^{ab}	67.48^{a}	1.83
EE (%)	70.59^{b}	71.48^{b}	61.02^{c}	72.40^{b}	76.00^{a}	1.50
Ash (%)	26.92^{b}	27.29^{b}	36.80^{a}	34.38^{a}	40.51^{a}	3.46
NDF (%)	58.29^{bc}	61.53^{b}	56.53^{c}	70.73^{a}	74.14^{a}	2.45
ADF (%)	47.86^{bc}	51.93^{b}	42.03^{c}	59.77^{a}	66.39^{a}	3.70
HC (%)	75.98^{c}	78.78^{b}	88.10^{a}	88.16^{a}	86.46^{a}	1.30

Where DM = Dry matter, CP = Crude protein, EE = Ether Extract, CF = Crude fibre and A = Ash. SEM=Standard Error of mean, ^{abcd} means within the same row with different superscripts are significantly different (P<0.05)

There were significant (p<0.05) differences in all the digestibility parameters obtained from feeding diets containing varying levels of Palm Kernel Cake. The result of nitrogen balance study is presented in Table 3. Total Nitrogen intake was significantly affected by inclusion level of Palm Kernel Cake. Statistically similar values for nitrogen intake were observed in bulls consuming diets containing 0% and 40% inclusion levels of Palm Kernel Cake and the lowest on those fed 20%PKC. The result showed a decrease in faecal nitrogen loss as the level of PKC increased in the diets. Also, the urinary nitrogen loss was highest in the control diet than in other treatments with PKC. Nitrogen retained ranged from 70.06-93.78 g/day with the highest value obtained in animals on 40% PKC inclusion. The result shows a decrease in urinary nitrogen loss, the faecal nitrogen loss and total nitrogen output as the level of PKC increased in the diets. Nitrogen retained and nitrogen retained as % N intake were highest in animals on 40% PKC diet. The observed result is in agreement with the findings of Al-Asfoor (2010) who reported that the nitrogen concentration of faeces of water bufallo strongly depends on the N concentration of the diet. Nitrogen retained ranged from 70.06-93.78 g/day in this study is higher than the value (72.01-79.48 g/day) reported by Yusuf (2016).Also, Nitrogen

retained as a percentage of intake ranged from 54.73-68.08 in this study was also higher than the range of 52.8-64.6% reported (Prakash *et al.,* 2003). All the bulls had positive nitrogen balance irrespective of the level of PKC in their diet. This is an indication that the nitrogen was well metabolized and utilized by the bulls. This is also an indication that there was no detrimental effect on feeding PKC up to 40% inclusion level. Hence, PKC can be utilized for growing bulls without any adverse effect because Nitrogen retention is a major indicator used to assess the protein nutrition status of ruminant livestock (Abdu *et al.,* 2012).This is in agreement with the report of Sarwar *et al*. (2003) who stated that nitrogen depends on good digestibility of nutrients and or utilization. In some cases this effect is sufficient to maintain an adequate N balance (Woodward and Reed, 1997).

Table 3: Effect of feeding diet containing varying levels of palm kernel cake on the Nitrogen balance of yearling bunaji bulls.

	Levels of inclusion					
Nitrogen balance	0	10	20	30	40	SEM
Nitrogen intake (g/day)	140.82^{a}	129.06^{bc}	123.92^{c}	131.44^{b}	138.55^{a}	3.36
Urinary Nitrogen (g/day)	2.16^{a}	2.01^{b}	1.26^{e}	1.71^{c}	1.41^{d}	0.05
Faecal Nitrogen (g/day)	57.68^{a}	56.17^{a}	52.60^{a}	43.97^{bc}	43.36^{c}	3.01
Total Nitrogen Output (g/day)	59.83^{a}	58.18^{a}	53.87^{a}	45.68^{bc}	44.77^{c}	2.98
Nitrogen Retained (g/day)	80.99^{c}	70.88^{d}	70.06^{d}	85.76^{b}	93.78^{a}	1.97
Nitrogen Retained (%N-intake)	57.57^{b}	54.73^{b}	56.70^{b}	65.92^{a}	68.08^{a}	1.63

SEM=Standard Error of mean, ^{abcd} means within the same row with different superscripts are significantly different (P<0.05)

Conclusion

It was concluded that inclusion of Palm Kernel Cake up to 40% in the diets of yearling Bunaji Bulls can be adopted by farmers in Nigeria for increased productivity.

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