NUTRIENT INTAKE AND GROWTH RESPONSE OF PREGNANT WEST AFRICAN DWARF GOATS FED DIETS CONTAINING WHEAT OFFAL REPLACED WITH TIGER NUT

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ABSTRACT

A feeding trial was conducted to determine the performance of pregnant West African Dwarf (WAD) goats fed diets containing wheat offal replaced with Tiger nut at 0% (T1), 5% (T2), 10% (T3), 15% (T4) and 20% (T5). Twenty(20) WAD does of 8.54 – 8.90 kg were allotted to the five dietary treatments in a Completely Randomized Design (CRD), with four individually housed animals representing a treatment and each serving as a replicate. Animals were fed a concentrate diet at 3.5% of their body weight. Oestrus was synchronized in the does using 1 mL/10kg of Prostaglandin-Fα intramuscularly. Animals were mated with a proven buck. The does were weighed at mating and fortnightly before parturition. Parameters assessed were; nutrient intake, does weight at mating, before parturition and weight gained during pregnancy. The highest dry matter intake (DMI) (347.28 ± 2.37 g/day) was recorded for animals on diet B, weight gained was significantly higher (p<0.05) in does fed Tiger -based diets. The best feed conversion ratio (7.14 ± 0.39) was recorded in animals fed diet T5. Animals on Tiger nut-based diets gained more weight than those on diet T1 (control) due to the higher feed efficiency of these diets. It can therefore be concluded that 15% inclusion of Tiger nut can be used to replace wheat offal supplying both protein and energy in the diet of pregnant animals.

Keywords: West African Dwarf goat, Tiger nut-based diets, Nutrient intake, Weight gain

INTRODUCTION

Improvement of animal production is one of the key ways to tackle the low protein intake due to the increase in world population, especially in developing countries like Nigeria. This cannot be achieved without paying keen attention to the performance, productivity, health status and overall management of goats which form the basic part of the protein source. One of the major determinants of the animal's feed intake is the physiological state of that animal. Adequate nutrition in terms of quantity and quality for pregnant does is of utmost importance to sustain the growth, and development of the foetus and enhanced performance of the animal (Ibhaze, 2021). However, in the tropics, inadequate nutrition is a great challenge contributing to production losses in ruminants, hence attention should be paid to the utilization of unconventional feedstuff like Tiger nut.

Tiger nut *Cyperus esculentus* L. (Poales: Cyperaceae) is an underutilized tuber that grows freely and is widely consumed in Nigeria and other parts of Africa (Ejoh *et al*., 2006). FAO (1988) and Ndubuisi (2009) reports revealed that

Tiger nut tubers are rich in starch (20 – 30% of DW) and fat (20 – 28% DW) with protein of (5.43 – 10.63%) is twice that of cassava, energy value between 417.46 – 515.44 Kcal (1753 - 2165 KJ). Tiger nut is also rich in minerals, predominantly phosphorus, potassium and vitamins C and E (Ejoh *et al.*, 2006). There are no reported cases of Tiger nut toxicity but may contain OchratoxinA (OTA) (Ndubuisi, 2009). Due to its nutritional value, its inclusion in the diet is expected to improve the animal's overall performance. Pregnant animals need diets that can provide for their metabolic needs and the overall well-being of the animal and the foetus. This study evaluated the nutrient intake and growth performance of pregnant West African Dwarf goats fed diets containing Tiger nut in the place of wheat offal.

MATERIALS AND METHODS

Experimental Site: The study was carried out at the Small Ruminant Unit of the Teaching and Research Farm of the Federal University of Technology, Akure, Ondo State, following the animal research ethical guidelines (NENT, 2019). The experimental site lies between longitude 4.944055°E and 5.82864°E, and latitude 7.491780°N, characterized by 6 – 7 months of rainfall between 1300 and 1650 mm and daily temperature ranges between 27 and 38°C (Daniel, 2015).

Dietary Ingredients, Feed Formulation, Experimental Animal Management and Experimental Design: Dried Tiger nut (*C. esculentus*) was sourced from Shasha Market, Akure, Ondo State, Nigeria. Before use, dirt and contaminants were removed and milled. Composite cassava peels and other ingredients were sourced from the cassava processing industry and reputable feed mills respectively. *Panicum maximum* Jacq (Poales: Poaceae) was harvested within the university community and allowed to wilt before chopping for easy mastication. A total of 20 WAD does of about 1 to $1^{1}/_{2}$ years, weighing 8.54 – 8.90 kg were used in this study. The goats were randomly distributed into five treatment groups of four goats per replicate using the completely randomized design (CRD) with the following model: $Y_{ij} = \mu + a_i + e_{ij;}$ where Y_{ij} = any of the response variables, μ = the general mean, a_i = effect of the *ith* treatment (*i* = substitution levels of Tiger nut T1, T2, T3, T4 and T5) and e_{ij} = random error due to experimentation.

Five concentrate diets (T1, T2, T3, T4 and T5) were made to contain 0, 5, 10, 15 and 20% Tiger nuts respectively (Table 1). The animals were fed with an experimental diet of 3.5% of their body weight early in the morning (7:00 am), while cool, clean and fresh drinking water was provided *ad libitum* throughout the feeding trial. However, the diets were supplemented with *P. maximum* grass to facilitate rumination, and to keep a balance of the rumen ecology.

The goats were synchronized using prostaglandin (PGF2α) at 1 ml/10 kg intramuscularly to bring all the animals to oestrus and were then exposed to proven bucks for mating. Data collection commenced when animals did not return to oestrus. Parameters investigated were; feed intake, nutrient intake, weight of does at mating, before parturition and weight gained during pregnancy.

Growth Performance and Nutrient Intake during Pregnancy: Evaluating the growth response, the initial weight of the experimental goats was determined and weekly weight changes were monitored using a weighing balance. The difference in total feed offered and feed leftover was taken as the feed intake while the feed conversion ratio (FCR) was deduced by dividing total feed consumed (g) by weight gain (g).

Laboratory Analysis of the Diets: The proximate compositions of feed samples were assayed for dry matter (DM), ash, crude protein (CP) and ether extract (EE) according to AOAC (2005).

Table 1: Ingredient and nutrient composition of experimental diets containing wheat offal replaced with Tiger nut fed to pregnant WAD goats

Ingredients	Diets				
	T1	T2	T3	T4	T5
Tiger nut	0.00	5.00	10.00	15.00	20.00
Wheat offal	20.00	15.00	10.00	5.00	0.00
Cassava peel	55.00	55.00	55.00	55.00	55.00
Palm kernel cake	21.00	21.00	21.00	21.00	21.00
Dicalcium phosphate	1.00	1.00	1.00	1.00	1.00
Salt	1.00	1.00	1.00	1.00	1.00
Mineral-vitamin premix*	1.00	1.00	1.00	1.00	1.00
Sulphur	1.00	1.00	1.00	1.00	1.00
Total	100	100	100	100	100
Nutrient composition (%DM)					
Dry Matter	84.79 ± 0.22^{ab}	85.01 ± 0.21^{b}	83.66 ± 0.22^{a}	85.17 ± 0.22^{b}	83.29 ± 0.21^{a}
Crude Protein	11.01 ± 0.42^{ab}	12.82 ± 0.43^{c}	14.76 ± 0.42^{d}	11.52 ± 0.42^{b}	10.55 ± 0.41^{a}
Ether Extract	2.87 ± 0.11^{a}	2.95 ± 0.11^{a}	3.38 ± 0.12^{b}	3.45 ± 0.11^{b}	3.91 ± 0.11^{c}
Nitrogen-free extract	42.35 ± 0.51^{c}	43.01 ± 0.50^{c}	39.98 ± 0.51^{a}	45.42 ± 0.52^{d}	42.86 ± 0.51^{b}
Crude Fiber	15.87 ± 0.31^{a}	15.75 ± 0.32^{a}	16.82 ± 0.32^{ab}	17.38 ± 0.32^{b}	18.72 ± 0.31^{c}
Ash	12.69 ± 0.57^{a}	10.49 ± 0.59^{b}	8.74 ± 0.59^{c}	7.41 ± 0.58^{d}	6.54 ± 0.60^{e}
Acid detergent fiber	15.17 ± 0.59^{d}	11.81 ± 0.59^{c}	9.18 ± 0.57^{a}	10.26 ± 0.59^{b}	9.55 ± 0.59^{a}
Acid detergent lignin	5.34 ± 0.16^{e}	4.39 ± 0.16^{d}	4.27 ± 0.18^{c}	4.04 ± 0.16^{b}	3.70 ± 0.16^{a}
Neutral detergent fibre	43.00 ± 0.95^{d}	39.42 ± 0.95^{c}	33.65 ± 0.95^{a}	37.39 ± 0.94^{b}	43.00 ± 0.96^{d}
Metabolizable Energy (Kcal/kg)	2145.56 ± 15.25^{a}	2241.92 ± 15.23^{ab}	2241.36 ± 15.25^{ab}	2320.09 ± 15.25^{c}	2256.75 ± 15.23^{b}

*T1 = (Control diet) 0% Tiger nut inclusion with 20% Wheat offal: (0.00% replacement), T2= 5% Tiger nut inclusion with 15% Wheat offal: (25.00% replacement), T3 = 10% Tiger nut inclusion with 10% Wheat offal (50.00% replacement), T4 = 15% Tiger nut inclusion with 5% Wheat offal (75.00% replacement), T5 = 20% Tiger nut inclusion with 0% Wheat offal (100.00% replacement), *To provide the following per kg of feed (Vitamin A 10,000 IU, Vitamin D3 2000 IU, Vitamin E 12 mg, Vitamin K 2 mg, Vitamin B1 1.5 mg, Vitamin B2 4 mg, Vitamin B6 1.5 mg, Vitamin B12 12 mg, Niacin 15 mg, Pantothenic acid 5 mg, Folic acid 5 mg, Biotin 2 mg, Choline chloride 100 mg, Manganese 75 mg, Zinc 5 mg, Iron 2 mg, Copper 5 mg, Iodine 10 mg, Selenium 2.0 mg, Cobalt 5 mg, Anti-oxidant 125 mg), abcde = Means within the same row with different letter superscripts are significantly different (p<0.05)*

The neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were assayed using the methods of Van Soest *et al.* (1991). The metabolizable energy (ME) contents of the experimental diets were determined against thermo-chemical grade benzoic acid standard using a bomb calorimeter (Kim *et al.*, 2022).

Statistical Analysis: Data collected from experimental animals and laboratory analysis were subjected to one-way analysis of variance (ANOVA) using the general linear model procedure of Statistical Package for Social Sciences Version 21 (SPSS, 2017) and significant differences were separated using Duncan's Multiple Range Test (DMRT) of the same package (Duncan, 1955). The level of significance was taken as $p<0.05$.

RESULTS

Chemical Composition of Diets: The chemical composition of the experimental diets indicated that the parameters assessed were significantly influenced ($p<0.05$) by the experimental diets (Table 1). The CP, EE and crude fibre (CF) of the diets ranged from 10.55 ± 0.42 to 14.76 ± 0.42 %, 2.87 ± 0.11 to 3.91 ± 0.11% and 15.75 ± 0.32 to 18.72 ± 0.32% respectively. The DM content, ash and NDF ranged between 83.29 ± 0.22 and 85.17 ± 0.22 %, 6.54 ± 0.59 and 12.69 ± 0.59 % and 33.65 ± 0.95 to 43.00 ± 0.95 % respectively. Diet T3 which had 5% inclusion of Tiger nut had the highest CP content (14.76 ± 0.42 %), Diet T5(20% inclusion) had the highest CF (18.72 ± 0.32 %) and metabolizable energy (2256.75 ± 15.25 kcal/kg). Diets T1 and T5 had the highest NDF (43.00 ± 0.95 %).

Feed Intake of Pregnant West African Dwarf Does Fed Experimental Diets and Guinea Grass (*Panicum maximum*): The feed intake of pregnant WAD goats fed experimental diets and guinea grass showed that there were no significant differences ($p>0.05$) in the total feed intake (TFI) and total dry matter intake (TDMI) at the three trimesters (Table 2). However, at early gestation, TFI ranged from 581.23 ± 3.69 g/day in Diet T5 to 596.90 ± 3.69 g/day in Diet T4, at mid-pregnancy, values were 605.96 ± 3.54 g/day in Diet T5 to 626.46 ± 3.54 g/day in Diet T2, while at late pregnancy, values ranged from 639.21 ± 2.31 in diet T5 to 643.94 ± 2.31 g/day in diet T1. At early gestation, TDMI ranged from 319.81 ± 2.83 – 335.49 ± 2.83 g/day, at mid-pregnancy, values were 327.72 ± 3.09 – 348.17 ± 3.09 g/day, while at late pregnancy, values ranged from 350.26 ± 2.05 – 359.84 ± 2.05 g/day.

Nutrient Intake of Pregnant WAD Goats Fed Experimental Diets Supplemented with Guinea Grass (*Panicum maximum*) at the Three Trimesters: The nutrient intake of pregnant WAD goats fed experimental diets and guinea grass is presented in Table 3. Parameters observed were significantly influenced ($p<0.05$) by dietary treatment except for the average dry matter intake (DMI). The average DMI ranged from 332.59 ± 2.37 g/day in animals fed Diet T5 to 347.28 ± 2.37 g/day in animals fed Diet T2. Crude protein intake (CPI) was highest in does-fed Diet T3 (22.55 ± 0.51 g/day) and least in does-fed Diet T5 (16.60 ± 0.51 g/day). The CF intake ranged from 31.29 ± 0.36 to 34.19 ± 0.36 g/day and the ether extract intake (EEI) ranged from 5.27 ± 0.11 to 6.45 ± 0.11 g/day. The ash intake was observed to be highest in does fed Diet T1 (19.16 ± 0/67 g/day) and least in does fed Diet T5 (10.97 ± 0.67 g/day). The NDF and ADF intake were highest in does fed Diet T1 having 85.51 ± 1.11 and 35.53 ± 0.67 g/day respectively and the least in does on Diet T2 with a value of 73.42 ± 1.11 and 27.60 ± 0.67 g/day respectively.

Growth indices of Pregnant WAD Goats Fed Experimental Diets Supplemented with Guinea Grass (*Panicum maximum*): The growth performance of WAD-fed diets containing wheat offal replaced with Tiger nut showed that there were significant differences ($p<0.05$) in all parameters except the final weight (Table 4). The average total weight gain was highest in does fed diet T4 (6.59 ± 0.21 kg) with a daily weight gain of (45.56 ± 1.52 g/day) and the least in T1 having 4.68 ± 0.21kg and 32.73 ± 1.52 g/day respectively. The feed Conversion Ratio (FCR) ranged from 7.14 ± 0.39 – 10.67 ± 0.37, with the lowest value in does fed diet T5 and the highest in does fed diet T1. The feed efficiency value was however highest in T4 (0.14 ± 0.00) and lowest in T1 (0.09 ± 0.00) does and no observed case of mortality during the feeding trial.

DISCUSSION

Chemical Composition of the Experimental Diets: The proximate composition of *P. maximum* used in this study was within the range reported by Adebayo *et al*. (2022) and also higher than the values reported by Tona (2014) and Jiwuba *et al*. (2018) for the same tropical forage. *P. maximum* used in this study contained high NDF and ADF. Van Soest (1994) reported that feeds with higher NDF (more than 35 %) have lower digestibility because NDF generally ferments and passes from the reticulorumen more slowly than other dietary constituents leading to a greater filling effect over time than non-fibrous feed components. The NDF, ADF and ADL values of the diets ranged from 33.65 – 42.99%, 9.55 – 15.17% and 3.47 – 5.34% respectively.

The range of values obtained for dietary CP in this study (10.55 – 14.76%) was above the 8% CP required by ruminants for optimum microbial activities in the rumen (Asaolu *et al*., 2012). The CP in this study was also within the range of values of 10 and 14% reported by Aziz (2010) and Okafor *et al.* (2012) respectively, for optimum sheep and goat production.

Table 2: Feed intake of pregnant WAD Does fed experimental diets containing wheat offal replaced with Tiger nut

Parameters		Feed intake (g/day)				
		T1	T2	T3	T4	T5
Early Pregnancy	GI	292.03 ± 2.29	291.66 ± 2.27	286.65 ± 2.29	302.54 ± 2.29	290.99 ± 2.29
	CONI	292.04 ± 3.23	302.61 ± 3.23	303.34 ± 3.20	294.38 ± 33.21	290.24 ± 3.23
	TFI	584.17 ± 3.69	594.27 ± 3.69	589.99 ± 3.64	596.90 ± 3.67	581.23 ± 3.69
	TDMI	325.94 ± 2.83	335.49 ± 2.83	330.67 ± 2.85	331.87 ± 2.83	319.81 ± 2.83
Mid Pregnancy	GI	314.97 ± 1.13	316.91 ± 1.13	315.20 ± 1.13	319.17 ± 1.12	313.45 ± 1.12
	CONI	297.48 ± 3.40	309.54 ± 3.42	305.86 ± 3.42	303.65 ± 3.41	292.51 ± 3.42
	TFI	612.45 ± 3.50	626.46 ± 3.51	621.06 ± 3.54	623.62 ± 3.54	605.96 ± 3.54
	TDMI	336.73 ± 3.09	348.17 ± 3.09	340.43 ± 3.06	344.45 ± 3.06	327.72 ± 3.08
Late Pregnancy	GI	321.12 ± 1.02	319.00 ± 1.01	316.49 ± 1.01	318.69 ± 1.02	322.58 ± 1.02
	CONI	322.81 ± 2.12	320.65 ± 2.12	321.20 ± 2.09	322.55 ± 2.12	316.63 ± 2.12
	TFI	643.94 ± 2.31	639.65 ± 2.31	637.69 ± 2.34	641.24 ± 2.31	639.21 ± 2.31
	TDMI	359.84 ± 2.04	358.19 ± 2.05	353.62 ± 2.05	360.21 ± 2.06	350.26 ± 2.06

T1 = (Control diet) 0% Tiger nut inclusion with 20% Wheat offal: (0.00% replacement), T2 = 5% Tiger nut inclusion with 15% Wheat offal: (25.00% replacement), T3 = 10% Tiger nut inclusion with 10% Wheat offal (50.00% replacement), T4 = 15% Tiger nut inclusion with 5% Wheat offal (75.00% replacement), T5 = 20% Tiger nut inclusion with 0% Wheat offal (100.00% replacement), GI = Grass intake, CONI = Concentrate intake, TFI = Total feed intake, TDMI = Total dry matter intake

Table 3: Nutrient intake of pregnant WAD goats fed experimental diets containing wheat offal replaced with Tiger nut

Parameters	Nutrient intake (g/day)				
	T1	T2	T3	T4	T5
Dry matter	340.84 ± 2.37	347.28 ± 2.37	341.57 ± 2.37	345.51 ± 2.35	332.59 ± 2.37
Crude protein	17.64 ± 0.51^{ab}	20.39 ± 0.51^{c}	22.55 ± 0.51^{d}	18.54 ± 0.51^{b}	16.60 ± 0.51^{a}
Crude fibre	31.29 ± 0.34^{a}	31.64 ± 0.34^{a}	32.52 ± 0.36^{ab}	33.69 ± 0.36^{b}	34.19 ± 0.36^{b}
Ash	19.16 ± 0.67^{e}	16.66 ± 0.67^{d}	14.11 ± 0.67^{c}	12.53 ± 0.69^{b}	10.97 ± 0.67^{a}
Ether extract	5.27 ± 0.11^{a}	5.46 ± 0.10^{a}	5.95 ± 0.10^{b}	6.09 ± 0.11^{bc}	6.45 ± 0.11^{c}
ADF	35.53 ± 0.68^{d}	31.56 ± 0.68^{c}	27.60 ± 0.67^{a}	29.89 ± 0.67^{b}	27.88 ± 0.65^{a}
ADL	18.87 ± 0.19^{c}	17.78 ± 0.19^{b}	17.40 ± 0.21^{b}	17.43 ± 0.19^{b}	16.31 ± 0.19^{a}
NDF	85.51 ± 1.11^{d}	82.19 ± 1.11^{c}	73.42 ± 1.11^{a}	79.37 ± 1.10^{b}	83.71 ± 1.11^{cd}
NFE	76.97 ± 0.76^{b}	79.21 ± 0.79^{c}	73.98 ± 0.79^{a}	82.04 ± 0.76^{d}	76.75 ± 0.76^{b}
Metabolizable energy	3785.77 ± 32.31^{a}	3982.09 ± 32.31^{c}	3916.78 ± 32.33^{bc}	4065.88 ± 32.33^{d}	3835.95 ± 32.31^{b}

T1= (Control diet) 0% Tiger nut inclusion with 20% Wheat offal: (0.00% replacement), T2= 5% Tiger nut inclusion with 15% Wheat offal: (25.00% replacement), T3 = 10% Tiger nut inclusion with 10% Wheat offal (50.00% replacement), T4 = 15% Tiger nut inclusion with 5% Wheat offal (75.00% replacement), T5 = 20% Tiger nut inclusion with 0% Wheat offal (100.00% replacement), ADF = Acid detergent fibre, ADL = Acid detergent lignin, NDF = Neutral detergent fibre, NFE = Nitrogen free extract. abc = means within the same row with different letter superscripts are significantly different ($p<0.05$)

Table 4: Growth indices of pregnant WAD goats fed experimental diets containing wheat offal replaced with Tiger nut

Parameters	Growth indices				
	T1	T2	T3	T4	T5
Average initial weight (kg)	10.93 ± 0.23^{a}	11.97 ± 0.23^{bc}	12.85 ± 0.23^{c}	11.40 ± 0.22^{b}	11.20 ± 0.22^{b}
Average final weight gain (kg)	16.53 ± 0.10	17.85 ± 0.10	17.53 ± 0.11	17.99 ± 0.10	17.75 ± 0.11
Average total weight gain (Kg)	4.68 ± 0.21^{a}	5.88 ± 0.21^{b}	5.60 ± 0.22^{ab}	6.59 ± 0.21^{c}	6.55 ± 0.21^{c}
Average daily weight gain (g/day)	32.73 ± 1.52^{a}	41.08 ± 1.52^{c}	38.42 ± 1.52^{b}	45.56 ± 1.53^{d}	46.68 ± 1.53^{d}
Total dry matter intake (g/day)	340.84 ± 2.36	347.28 ± 2.34	341.57 ± 2.37	345.51 ± 2.37	332.59 ± 2.37
Feed conversion ratio	10.67 ± 0.37^{d}	8.75 ± 0.35^{c}	8.87 ± 0.37^{c}	7.60 ± 0.37^{b}	7.14 ± 0.39^{a}
Feed efficiency	0.09 ± 0.00^{a}	0.12 ± 0.00^{c}	0.11 ± 0.01^{b}	0.13 ± 0.01^{d}	0.14 ± 0.03^{e}

T1= (Control diet) 0% Tiger nut inclusion with 20% Wheat offal: (0.00% replacement), T2 = 5% Tiger nut inclusion with 15% Wheat offal: (25.00% replacement), T3 = 10% Tiger nut inclusion with 10% Wheat offal (50.00% replacement), T4 = 15% Tiger nut inclusion with 5% Wheat offal (75.00% replacement), T5 = 20% Tiger nut inclusion with 0% Wheat offal (100.00% replacement), abcd = Means within the same row with different letter superscripts are significantly different (p<0.05)

This implied that the diets were adequate to meet the protein requirement for ruminant and effective rumen function (Ibhaze *et al.*, 2016), and can also support the does throughout the gestation period. The CF obtained in this study was within the minimum value of 12% CF recommended by Abdu *et al.* (2013) and also similar to the value reported by Belewu *et al.* (2007) i.e. 11.66 to 16.38%. The moderate fibre fractions of the diets could be because the feed was pelletized. Oyaniran *et al.* (2018) reported that pelletized feed can improve the performance of the animal by reducing the fibre content of the feed and binds the nutrients together which will further improve the intake and digestibility of the animals. Moderate fibre content will make the diets ideal for eating, improve digestibility and allow the animals to utilize feed efficiently (Zhang *et al.*, 2023). Ether extract reflects the fat composition of the diet, the value obtained was below the value reported by Belewu*et al.* (2007). However, its substitution increased the fat content of the diet as observed by Belewu *et al.* (2007). Nitrogen-free extract is a relatively soluble carbohydrate portion of the diet which includes the monosaccharides, disaccharides and polysaccharides (starch).

Nutrient Intake: Animals fed Tiger nut-based diets had the highest values for most of the nutrients although there were no significant differences ($p<0.05$) in the DMI. The low DMI observed in animals fed Diet T5 may be that Diet T5 was unpalatable because it did not contain wheat offal and wheat offal is known to be high in protein. It has been reported by Ibeawuchi *et al.* (2002) that beyond nutritional composition, animals tend to consume more palatable diets. Also, Ahamefule *et al.* (2005) reported that a higher level of CPI stimulates DMI. This could also be the reason for the low CPI of Diet T5. The nutrient intake trend showed that at late pregnancy, animals in all the treatment groups had increased TDMI. This observation could be due to the increased need for nutrients by the foetus for rapid growth and development at this stage. This corroborates the report of Ogunjemite and Ibhaze (2020). Salah *et al.* (2014) reported that energy requirement is affected by the stage of production. Nutrient intake is the most important determinant of an animal's performance. The high DMI recorded in this study may be attributed to the protein quality, palatability and acceptability of the experimental diets. This observation was in agreement with the report of Ahamefule *et al.* (2005) that a higher level of CP stimulates DMI. This observation was also in agreement with the report of Colmenero and Broderick (2006) that nutrient intake increases as DMI and CP concentration increases. However, the average voluntary DMI values of the goats were above 3.5% of the body weight recommended for small ruminants (Ogunjemite and Ibhaze, 2020).

Growth Response: The weight gain and feed-to-weight gain ratio of the does were significantly influenced ($p<0.05$) by the diets. The does fed Tiger nut-based diets had better FCR compared to the control. The best FCR was observed in does-fed Diets T4 and T5, indicating the ability of the goats to convert their feed to flesh. The does fed Tiger nut-based diets gained weight during the gestation period, this implied that the feed intake and the nutritional quality of the diets were sufficient for both maintenance and production. The does on Tiger nut-based diets had superior mean weight compared to the control. The values obtained are reflections of an increase in does body weight due to pregnancy and not total weight gain. Ososanya (2015) cited that all aspects of performance were significantly affected by the level of concentrate fed during pregnancy. Weight gained during pregnancy observed in this study was higher than the values Ibhaze (2021) reported for West Africa Dwarf goats fed pulverized bio-fibre waste-based diets. This could be attributed to the excellent nutritional quality of Tiger nut which possesses an adequate amount of nutrients to support the does during gestation.

Conclusion: This study revealed that WAD-fed diets containing Tiger nut had better nutrient intake and daily weight gain as Tiger nut possesses adequate nutritive value and could serve as a good source of energy and protein in ruminant diets to improve growth without any deleterious effects on the animals during gestation. Therefore, the 15% inclusion of Tiger nut can be recommended to replace wheat offal supplying protein and energy in the diet of pregnant animals.

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