

Performance and Haematological Parameters of West African Dwarf (WAD) Goats Fed Diets Containing Graded Levels of Treated Plantain Pseudostem.

¹Beketin T. O, ¹Alikwe P. C. N., ¹Nodu M. B. and ²Omu P. B.

¹Department of Animal Science, Niger Delta University, Wilberforce Island, Amassoma, ²Department of Agric Education Isaac Jasper BoroCollege of Education Sagbama.

Corresponding Author: olubukolataiwo24@gmail.com/cheryl2kt@yahoo.com:

ABSTRACT

Effect of Fermented Plantain Pseudostem Supplementation on performance and haematological response of West African Dwarf Goats were investigated in a 12 – week trial; in a completely randomized design. West African Dwarf (WAD) Goats (n = 24) aged 8 – 12 months weighing 8.09 to 9.23kg were randomly allotted to four groups (3 treatment and 1 control) of three replicates and each replicate comprised two animals. The goats were allowed 2 weeks adaptation period followed by dietary supplementation with fermented plantain pseudostem PP at 0(T1), 25(T2) 50(T3) and 75(T4). Performance and haematological parameters were monitored. Data were subjected to ANOVA and means were separated by Duncan multiple range tests. Result showed that increased level of plantain pseudostemas supplement in the diet increased the dry matter (T1 to T2) 91.72 to 92.97 and crude protein (8.8 to 14.67) as the inclusion rate of plantain pseudostem decreased. There was significant difference ($p < 0.05$) across the treatment. Metabolic rate ranged from 1.15 to 1.93 kg with the highest in T2. The haematological parameters (PCV, RBC, WBC, Neutrophils and Eosinophils) were within the normal range which indicate that the fermented plantain pseudostem does not have any deleterious effect on the experimental animals. The experimental animals on T2 gave the best result. This study revealed that fortified plantain pseudostem can serve as supplemental feed for ruminant animals. I therefore recommend between 25 to 50% inclusion level of fortified plantain pseudostem as supplemental feed for ruminant animal especially during the dry season.

Keywords: Plantain pseudostem, haematology, Supplement, WAD Goats.

INTRODUCTION: Livestock production is an important aspect of the agricultural sector in many tropical countries, accounting for roughly 4% of agricultural GDP (Steinfeld, Gerber, Wassenaar, Castel, Rosales, De Haan, 2006). Goats are a crucial part of farming, especially for smallholder farmers, because they wander and eat on natural pastures and low-protein kitchen waste (Amole, Augustine and Balehegn 2022). The fundamental issue in cattle production is the inconsistency in fodder availability and quality throughout the year (Ajayi, Adeneye and Ajayi., 2019). Furthermore, during the dry season, the fibrous quality of ruminant feed and feedstuff leads to low digestion and poor animal output (Amole *et al.*, 2022). Suitable legumes, grass, and crop residues have the ability to alleviate these feed shortages, especially

for ruminants during the dry season. The biggest challenge in increasing goat production is their poor nutritional state, which might alter blood parameters (Omotoso, Ajayi and Boladuro, 2021). Gramb, Uchechi and Kehinde . (2011) discovered that the quality and quantity of diet might affect goat hematological components. Plantain pseudostem is a type of crop residue that has the potential to support forages in livestock production, after harvesting plantain, the whole stem wastes away: there is great improvement in feed intake, weight gain and health status of WAD Goats after supplementation with crop residues (Ajayi, Omotoso and Taiwo, 2019) .

The aim of the research was to determine the effect of feeding graded levels of treated plantain pseudostem

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as supplement on performance and haematological components of West African Dwarf Goats.

Materials and Methods

Location and site description: The experiment was carried out at the Teaching and Research Farm of Niger Delta University, Wilberforce Island, Amassoma Located at Longitude 50° and 60°N and Latitude 60° and 70°E of the equator. The mean temperature is 24.0°C – 38.0°C.

The mean annual rainfall is between 2000-2483mm. The Soil is sandy loam in texture with an average ph of 5.5. Climatologically, there are two seasons i.e. the rainy season (April to October) and the dry season (November to March) (BSM, 2023) Ministry of Land and Survey. Bayelsa State is bounded in the North, Imo State, on the South by the Atlantic Ocean in the West by Delta and on the East by Rivers State.

Experimental animals and design: Twenty four West African Dwarf Goats of both sexes were obtained from Ahoada Market. Their weight ranged between 8.09 to 9.23 kg. The goats were divided into 4 groups T1 (Controlo%P.P) T2 (25% P. P.) T3 (50% P.P) and T4 (75% P.P) of six animals per group and randomly allotted to four treatment in a completely randomized design. The goats were allowed adaptation period of two weeks and were dewormed to prepare them for the feeding trial. The record of performance was taken.

Experimental feeds and feeding: Crop residues (Plantain Pseudostem) were collected after harvest from Amassoma Environs, chopped, wilted, and thereafter urea-molasses mixture (probiotic complex) was added. They were bagged and allowed to undergo fermentation process for 12 days since yeast was also part of the treatment. The levels of treated plantain pseudostem varied from 0, 25, 50 and 75 which formed the four dietary treatments respectively. Panicum maximum was given as basal diet.

The ingredient composition is shown on Table 1.

Feeding Period: Feeding period was scheduled twice daily i.e. experimental diet in the mornings and basal

diet in the evening according to 5% of their body weight. Leftover were collected and weighed on daily basis to compute feed intake.

DURATION OF EXPERIMENT: The experiment was carried out between February and May, 2023.

Chemical Analysis: The percentage Dry matter (DM) Crude Protein (CP), Crude Fibre (CF), Ether Extract (E.E) and ash content of diets were analysed. The chemical analysis was carried out according to A. O. A. C. (2000) Procedure.

Data and Sample Collection: The researchers collected information on the amount of feed consumed, the body weight of the goats, and several blood indicators. They calculated daily feed consumption by deducting leftover feed from the total amount provided to each goat each day. This data was then utilized to compute total feed intake for each treatment. They computed the feed conversion ratio by comparing feed intake to weight growth and calculating weight increase by subtracting the beginning body weight from the end body weight. Blood samples were taken from the goats in each treatment at the end of the experiment by bleeding them via the jugular vein. The blood was drawn first thing in the morning to reduce stress on the goats and prevent excessive bleeding.

To avoid clotting, the samples were packed in plastic vials with anti-coagulated ethylene diamine tetra-acetate (EDTA). The researchers used the Fieldman *et al.* (2002) technique to calculate the total white blood cell count (WBC), packed cell volume (PCV), and count of distinct kinds of white blood cells (neutrophils, eosinophils, basophils, and monocytes).

Data Analysis: The collected data was subjected to analysis of variance using the SAS (1999) statistical analysis system's General Linear Model (GLM) algorithm. A completely randomized design sampling procedure was utilized, and the Duncan Multiple Range Test (DMRT) as described by Obi (2021) was used to differentiate across means when significant differences were detected.

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**Table 1: Ingredient Composition of Experimental Diets
Inclusion Levels of P. P. in Diet (%)**

Parameters	T1	T2	T3	T4
Corn Chaff(kg)	100	75	50	25
Plantain Pseudostem(kg)	0	25	50	75
Urea + Molasses + Yeast (mls)	100		100	100

Source: Beketin, 2023.

Table 2.0 PROXIMATE COMPOSITION OF THE EXPERIMENTAL DIETS

Parameter	T1	T2	T3	T4	SEM
Dry matter	91.72b	92.97 a	91.96 b	92.86 a	0.02
Crude protein	8.88 c	14.67 a	10.16 b	10.03 b	0.01
Crude Fiber	25.37 a	22.98 c	24.30 b	22.00 d	0.02
Either extract	1.87 b	2.07 a	1.84 b	1.94 ab	0.01
Ash	15.17 b	9.97 c	15.98 a	8.95 d	0.02
NFE	40.43 ^b	43.28 ^d	39.68 ^c	49.94 ^a	0.02
NDF	66.12 a	60.97 d	65.27 b	62.56 c	0.02
ADF	44.33 b	40.37 d	45.00 a	41.73 c	0.02
ADL	21.15 b	18.53 d	22.17 a	19.07 c	0.02
Cellulose	23.18	21.84	22.83	22.66	0.02
Hemicellulose	21.79	20.60	20.67	20.83	0.02

Source: University of Ibadan, 2023

Results: The chemical composition of diets is shown in Table 2. Results showed that there was significant difference among the treatments ($p < 0.05$)

The Dry matter ranged from 91.72 to 92.97 with the highest figure on T2. The CP ranged from 8.88 to 14.67 with the highest value in T2. The crude Fibre ranged from 22.00 to 25.37 with the highest in T1. Ether extract ranged from 1.84 to 2.07 with the highest in T2. Ash ranged from 8.95 to 15.98 with the highest in T3. Lowest NDF (60.97) was recorded in T2, Lowest ADF (40.37) was recorded in T2. Also, cellulose and hemicellulose had their lowest values in T2. There was significant difference in the NDF, ADF and ADL. The lowest values were recorded in T2.

Table 2.0- The dry matter of the experimental diets ranged from 91.72-92.86 and this is similar to the values reported by Aregheore, 1998 where dry matter of plantain peel fed to goats ranged from 55.62 to 90.38%. The values obtained from this study is also similar to the values reported by Adedeji *et. al.*, 2018 where goats were fed with urea treated wild cocoyam. Their values ranged from 90.67 to 90.97. This could be due to the fact that utilization of low protein feed by ruminant improved when urea is added to such feeds (Khampa and Wanapat 2006). The dietary treatment had significant ($p < 0.05$) influence on the dry matter intake of the animals. The dry matter of the experimental diet *also* compared favourably with the values reported by (Fajemisin and Ibhaze, 2018) (91.26-91.69) when

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West African dwarf goats were fed with urea-molasses treated cassava peel diets. The crude fibre ranged from 22.00 to 25.37% with highest value recorded on T1 (control diet) the fibre ranged was well above the critical level of 12.6% for a suitable diet for ruminant animal. The crude protein ranged from 8.8%- 14.67% with the highest value recorded on diet 2 (25% pp). The crude protein of the diets were more than the critical 7% CP recommended for ruminant animals by NRC, (2001). It implied that the crude protein (CP) content of the diets was adequate to support the goats during growth and reproduction. The values obtained in this study were similar to the values of 9-12% reported by Aregheore, 1998 in a study on the nutritive value of dry ripe plantain peels as replacement of maize for goats. The highest value of 14.67% was recorded on diet 2 with the 25% inclusion of plantain pseudostem. It could be as a result of fortification with probiotic complex on the plantain pseudostem. The value of ether extract obtained in this study (1.84-2.07) was similar to the values (2.92- 6.68%) reported by Omotoso *et al.*(2021) for experimental diet containing mixed ration of crop residue for WAD sheep. The values were also similar to the values of (1.06-5.58) reported by Mydhili, and Pugalendhi (2022). Higher values than these recorded can lead to quick spoilage of animal feed due to rancidity. The ash values ranged from 8.95-15.98. This is an indication that the experimental diets contained enough mineral to support the growth and physiological function of WAD goats. High crude protein makes it a suitable feed ingredient since protein is an expensive nutrient in animal feed. Low ether extract indicate the shelf life of the feed. High fibre makes it a suitable feed for

Table 3

Table 3.0 SHOWS THE GROWTH PERFORMANCE OF THE EXPERIMENTAL ANIMALS

Parameters	T ₁	T ₂	T ₃	T ₄	SEM
Initial weight (kg)	8.10 ^{ab}	8.09 ^{ab}	9.23 ^a	9.12 ^a	0.01
Average final live weight (kg)	9.30 ^b	10.50 ^{ab}	10.90 ^a	10.50 ^{ab}	0.26
Average weight change (kg)	1.20 ^c	2.41 ^a	1.27 ^c	1.38 ^b	0.01

ruminant since they can utilize fibre sources better. High ash content indicates availability of minerals which are essential for life.

The crude fibre ranged from 22.00- 25.37 with T1 having the highest fibre (25.37). The fibre content observed in this experiment were similar to 22.00% reported by Bake *et. al.* (2013) and Adesogan *et al.* (2019). High level of crude fibre has been acknowledged by Odedire and Babayemi, 2007, Adesogan *et al.* 2019 to be inversely related to feed digestibility and nutrient availability. The NDF and hemicellulose content decreased and increased again with T2 having the lowest value. This was due to degradation of its fibre component during ensiling or fermentation. Olafedehan *et al.* (2012), and Olafedehan and Adebayo (2016) previously attributed reduced fibre level of ensiled cassava peel and threshed sorghum tops to the breakdown of the fibre by certain anaerobic microbes during fermentation/ ensiling. However, ADF and cellulose increased from T2 to T3. The lowest values of NDF, ADF and lignin were recorded on T2.

The performance of West African Dwarf goat fed diets containing graded levels of plantain pseudostem is shown in Table 3 Result indicated that initial live weights of the experimental animals ranged from 8.09 to 9.23kg with the lowest in T2. Average final live weight ranged from 9.30 to 10.90kg. Average weight change ranged from 1.20 to 2.41 with the highest in T2. The feed intake ranged from 55.37 to 91.88 with the highest in T2. The feed conversion ratio (FCR) ranged from 6.60 to 15.70 with the least value in T1. The metabolic rate ranged from 1.15 to 1.93kg with the highest in T2.

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FCR	6.60 ^a	12.63 ^c	15.70 ^b	7.02 ^{ab}	0.05
Mortality	0	0	0	0	0.00
BW ^{0.75}	1.15	1.93	1.19	1.27	0.01

Source: Beketin, 2023

Means with different superscripts within the same rows vary significantly (p<0.05)

Table 3.0 result indicated that initial live weight of the experimental goats in different dietary treatment varies (P< 0.05) significantly. The final weight differed significantly (p<0.05) with goat on T3 having the highest value of 10.9kg while the lowest average final weight value of 9.3kg was recorded in the control group (T1). The highest average weight change was recorded on T2 (25%PP)

The average weight change maintained a similar trend across the treatment groups except T2 which recorded the highest value of 2.41kg. The highest feed intake was also recorded on T2 (91.88kg). The feed intake was significantly (p<0.05) higher at T2 (25% pp inclusion) followed by T3 (59.62 kg) before reducing to 58.14 on T4. The highest weight gain recorded on T2 could have been due to the highest protein intake obtained from plantain pseudostem and corn chaff at ratio 25:75. This result was however similar to the one obtained in a study where protein supplement increased feed intake and enhanced growth of Yankassa sheep (Sani *et al.*,2021).

Feed intake was significantly (P< 0.05) higher in T2 and lowest in T1 (0%) indicating the degree of acceptability of the various feeds which declined with the inclusion of plantain pseudostem. Feed intake has been observed to be governed by some factors such as dietary crude protein, palatability, gut fill, body fat and health factors (Ukanwoko&Ironkwe, 2012) and(Omotoso *et. al.*, 2021).The higher values of weight gain and feed intake within the treatment groups suggests that treated plantain pseudostem can also help WAD goat production. The increase weight gain and feed intake among the treatment groups also suggests that treatment diets were palatable and also acceptable by the experimental animals. The feed conversion ratio recorded the least value in T1 (0% pp). It could be due to some other factors that affect feed conversion ratio such as the level of feeding, energy, breed, the energy concentration of the feed and body weight gain. Also, appropriate temperature and ventilation can affect feed conversion ratio

Table 4.0 HAEMATOLOGICAL PARAMETERS OF WEST AFRICAN DWARF GOATS FED EXPERIMENTAL DIET

Parameters	T ₁	T ₂	T ₃	T ₄	SEM
PCV (%)	32.00 ^a	25.00 ^{bc}	22.00 ^c	27.00 ^b	0.15
Hb (g/dl)	10.20 ^a	8.50 ^b	7.20 ^c	8.80 ^b	0.02
RBC (x10 ⁶ mm ³)	13.24 ^a	12.40 ^b	11.28 ^c	12.43 ^b	0.01
WBC x10 ⁶ mm ³	5.25 ^b	4.20 ^c	3.90 ^d	7.10 ^a	2.60

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Platelet mm ³	(x10 ⁶ 7.40 ^c	10.20 ^a	5.80 ^d	9.80 ^b	2.85
Lymphocytes (%)	63.00 ^a	59.00 ^b	55.00 ^c	60.00 ^b	0.13
Neutrophils	33.00 ^b	38.00 ^a	41.00 ^a	38.00 ^b	0.13
Monocytes	3.00 ^a	1.33 ^b	2.00 ^{ab}	2.00 ^{ab}	0.05
Eosinophils	1.33	2.00	2.00	1.33	0.05

Source: University of Ibadan,2023

Means with different superscript along the same row vary significantly ($p < 0.05$); T₁: 0% inclusion of plantain pseudostem, T₂-25% inclusion of plantain pseudostem, T₃-50% inclusion of plantain pseudostem, T₄-75% inclusion of plantain pseudostem

Table 4.0 Haematology: The haematological parameter of West African Dwarf goats fed graded levels of pseudostem corn chaff diets is shown in table 4

The PCV ranged from 22.00 to 32.00%, the haemoglobin vary significantly ($p < 0.05$) across the treatments. The red blood cell varied significantly ($p < 0.05$) across the treatment with the highest value recorded in T₁ (control) except the blood platelet where T₂ recorded the highest value of 10.20\

The same trend was observed for neutrophils, monocytes and eosinophils. The white blood cell reduces across the treatments except T₄ where it increased again. The control group had the highest PCV (32%)

The significant differences in the values of lymphocytes in this study agreed with the report of Tambuwal *et al.* (2002) and Mydhili *et al.* (2022) 5x10⁶ /dl- 11x10⁶/dl, also agreed with the report of Omotoso *et al.* (2021) The value obtained in this study ranged from 5x10⁶/dl- 6.3x 10⁶/dl

It also agreed with the range reported by Aiello (2000) and Omotoso *et al.* (2021) for sheep and goat. The lower level of white blood cell below the normal range is an indication that no foreign organism was introduced into the blood that would have made the white blood cells counts to increase in order to fight against any invasion in the animal body (Egbe-Nwiye *et al.*, 2017 and Adedeji *et al.*, 2018) High lymphocyte count above the normal

range is a response of the body to virus, bacteria or parasite infection (Mvdhil *et al.*, 2022).

This indicates that the inclusion of plantain pseudostem in their diets did not introduce any infection to the body or expose the animal to infectious organism.

The significance difference ($P < 0.05$) in the neutrophils values did not affect the levels of plantain pseudostem in the diets. There were similarities in the trend of monocytes and Eosinophils across the treatment it indicate that the inclusion of plantain pseudostem did not introduces any harmful organisms in the body of experimental animals.

The values obtained in this study were similar to the values reported by Adedeji *et al.*, (2018), while feeding urea treated cocoyam to West Africa dwarf goats. The RBC counts obtained in this study were within the range of 9.2-13.5 x10⁶ NL reported for West Africa dwarf goats (Tambuwal *et al.*, 2002 and Omotoso *et al.*, (2021). According to Aiello (2000), WBC values fell within the normal range (4to 13x 10³/UL) for healthy goats. WBC's or leucocytes are the mobile unit of the body's protection system (Aiello, 2000) and Omotoso *et al.* (2021). The lymphocytes values obtained in this study was higher than the normal range of values (49.8 to 53.7%) for WAD goats as reported by Belewu and Ojo (2007) whereas fell within the normal range (50-70%) for goats (Aiello, 2000). Lymphocytes play an important role of imparting

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immunity (Sembulingan&sembulingan, 2002) and (Ayele, Urge and Animut *et al.*, (2017). The result from this study revealed that feeding grass or legume alone cannot meet the nutritional requirement of ruminant animal; hence, crop residues such as fermented plantain pseudostem can serve as supplement in addition to basal diet for ruminant animal since it increased the dry matter intake, crude protein, crude fibre and the haematological parameters were within the normal range for goats.

Conclusion: This study revealed that treated plantain pseudostem has potential to serve as feed supplement for ruminant animals especially in the dry season.

Thus, it could be recommended that 25 to 50% inclusion rate of fermented plantain pseudostem could serve as feed supplement for Goats without any deleterious effect on the animal.

Recommendation: I, therefore recommend the use of fortified plantain pseudostem as supplemental feed for ruminant animal without deleterious effect on their health.

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