
NUTRIENT INTAKES AND NITROGEN UTILIZATION BY WEST AFRICAN DWARF GOATS FED DIETS CONTAINING DRY LOCUST BEAN PULP

Ismaila E.O.¹, Oderinwale O.A.^{1&3}, Toviesi D.P.¹, Bomodeoku G.T.¹, Oluwatosin B.O.¹, Adekunle E.O.²

¹Department of Animal production and Health, Federal University of Agriculture, Abeokuta, PMB 2240, Ogun State, Nigeria

²Department of Animal Physiology, Federal University of Agriculture, Abeokuta, PMB 2240, Ogun State, Nigeria

³Department of Animal Sciences, North Carolina A&T State University, Greensboro, NC 27401, USA
Corresponding Author: ismailaemmao@gmail.com, +234(0)7044342843, +234(0)9057202860

ABSTRACT

A feeding trial was conducted to investigate the nutrient intakes and nitrogen utilization of West African Dwarf goats fed diets containing dry locust bean pulp (DLBP) in a completely randomized design (CRD) for twelve weeks. The research was carried out at the Small Ruminant Unit of the College of Animal Science and Livestock Production (COLANIM), Federal University of Agriculture, Abeokuta (FUNAAB), Nigeria. A total number of twenty (20) WAD goats of less than one (1) year were randomly allotted on weight equalization into four (4) dietary treatments consisting of five (5) goats per treatments which were: 0, 10, 20 and 30% DLBP inclusion levels. Data obtained at the end of the study were subjected to a one-way analysis of variance (ANOVA) and significant means were separated using Duncan's Multiple Range test at a 5% probability level. The dietary treatments significantly ($p < 0.05$) influenced all the nutrient intake parameters observed. Goats fed 20% DLBP recorded the highest total dry matter (430.49%), total crude fibre (72.95%), total ether extract (41.58%), total acid detergent fibre (109.28%) and total acid detergent lignin (64.72%) intake compared with other dietary treatments. Total nitrogen intake (6.29%), total nitrogen excreted (2.55%) and nitrogen absorbed (5.00%) were significantly ($p < 0.05$) different with 0% DLBP having significantly higher values while 20% DLBP had the highest nitrogen retained (3.89%). The results of this study indicated that the inclusion of dry locust bean pulp at 20% level enhanced nutrients intakes and nitrogen utilization by West African Dwarf goats.

Key words: Nutrient intake, nitrogen utilization, goats, agricultural waste, locust bean pulp

INTRODUCTION

Feeding is a very essential part of goat farming and may constitute the highest expense of goat production (Jiwuba, 2020). Feed availability has been the major constraint to the expansion of global goat production. Seasonal variability and high cost of conventional feeds has necessitated the need for cheap and readily available feed ingredients, especially among smallholder farmers who rely on low-cost feed sources to support their livestock production (Jiwuba and Udemba, 2019). Among such low cost feeds are agricultural wastes which have no direct nutritional value to man and are mostly considered valueless as they are discarded as waste hence may constitute an environmental nuisance when not properly disposed of. Locust bean pulp is one of the common agricultural wastes which are hitherto not eaten by humans and are mostly found in refuse dumps and river banks. Since fermented locust bean pulp contained 11.75% crude protein, 15.86% ash content, 21.55% crude fibre, 32.14% starch and 93.5% dry matter and with its ability to influence weight gain, nutrient intakes, digestibility, and feed efficiency, it is therefore suitable for ruminant feeding (Akegbejo *et al.*, 2004; Aduku *et al.*, 2019). Utilizing DLBP in goat feeding will help reduce cost of production and the rate of its pollution in the environment (Okah *et al.*, 2012). This study was therefore designed to determine the nutrients intake and nitrogen utilization of West African dwarf goats fed graded levels of dry African locust bean pulp.

MATERIALS AND METHODS

Experimental site: This study was carried out at the Small Ruminant Unit of the College of Animal Science and Livestock Production (COLANIM), Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State, Nigeria. The area lies within the derived savannah zone on latitude 7°13'

49.46° N and longitude 3° 26' 11.98" E and altitude of 98m above sea level. The mean annual rainfall is 1,037mm, while the annual temperature range is between 22.50°C - 30.72°C. Relative humidity ranges from 63% in January to 96% in August with a yearly average of about 82%. (Google Earth, 2023).

Experimental Animals and Management:

A total number of twenty (20) growing and apparently healthy West African Dwarf goats were purchased from a reputable livestock market in Osun State. The management system was intensive system as feed and water were supplied to the goats in their pens for twelve (12) weeks. During this period, the goats were randomly allotted into four (4) treatments with five (5) goats per treatment. Feed of 5% of their body weight was given daily.

Preparation of Experimental Diets:

Wet African locust bean pulp was obtained from a reputable locust bean processing factory in Abeokuta. The locust bean pulp was sorted and unwanted materials were removed, thereafter exposed to pressure to remove the excess moisture in it. The pulp was sundried to a constant weight. The dry locust bean pulp was ground using a hammer mill and stored until needed for incorporation with other ingredients for making the experimental diets. Other feed ingredients were purchased and milled at a reputable feedmill.

Digestibility Trial Procedure:

At the end of the feeding trial, the goats were subjected to a digestibility trial for fourteen (14) days, where the first seven days was used for adjustment of the animals to the metabolic cage, while the remaining seven days were used for daily faecal and urine samples collection. A proportion of each daily faecal sample was collected, weighed and recorded, wrapped with foil paper, and oven dried at 60°C until a constant weight was obtained. It was then removed from the foil paper after drying, milled, and stored for subsequent analysis. Daily urine samples were also collected and released into a sample bottle containing 10mL of 10% concentrated sulphuric acid and refrigerated until required for laboratory analysis.

RESULTS AND DISCUSSION

The quality of any feed is dependent on a complex balance of its nutrient contents, particularly the energy and protein content and also by the digestibility and form of the feed. While a higher nutrients intake may be a sign of a well-formulated diet, it is not a guarantee that the animal is actually utilizing those nutrients properly. In this study, the inclusion of DLBP influenced the nutrient intakes of WAD goats. The total DM intake (383.38 to 430.49g/day) was comparable with 367.32 to 407.08g/day reported by Jiwuba (2020) when cassava root sievate and cassava leaf meal mixture were fed to WAD goats. The CP intake (33.64 to 39.32g/day) reported in this study fall within the range required for goats in the Tropics (Devendra and McLeroy, 1982). The CF, EE, NDF and ADF intakes were lower than the values reported by Muhammad *et al.* (2016) for Uda rams fed graded levels of African locust bean pulp. Nitrogen utilization was significantly different ($p<0.05$) across the treatment. The value of total nitrogen intake (5.38 to 6.29g/day) obtained was higher than 1.95 to 7.75g/day reported by Gabriel *et al.* (2018) for WAD goats fed cassava peels with urea molasses multi-nutrient blocks supplement. The faecal nitrogen value (0.97 to 1.29g/day) obtained was comparable with the values of 0.61 to 1.23g/day obtained by Wada *et al.* (2014) for Yankasa rams fed *Parkia biglobosa*. The urinary nitrogen value obtained in the study was also different across the treatments with 0% DLBP having the highest value (1.27g/day) of nitrogen lost through urine which could probably be due to the CP content in the experimental diet that was not well utilized and thus was excreted. The higher nitrogen retention observed at 20% DLBP could be attributed to the relatively high degree of protein content contributed by the dry locust bean pulp. This suggests that dried locust bean pulp in 20% DLBP was well utilized and efficiently used as a fermentable nitrogen source for microbial growth in the rumen which promoted higher positive nitrogen balance and retention compared to other treatments. Nitrogen absorbed values (4.33 to 5.00g/day) was lower compared to 6.20 to 10.68g/day and total nitrogen excreted values (2.86 to 2.55g/day) was lower compared to 4.56 to 5.65g/day obtained by Jiwuba (2020). Generally the faecal and urinary nitrogen intakes, nitrogen retained and nitrogen absorbed was significantly ($p<0.05$) influenced by the dietary treatment groups.

Table 1: Proximate and fibre fractions of experimental diets and Guinea grass

Parameters (%)	Experimental Concentrate Diets				Guinea Grass
	0% DLBP	10% DLBP	20% DLBP	30% DLBP	
Dry Matter	90.81	90.81	90.00	88.77	96.65
Crude Protein	11.20	9.28	9.10	8.92	7.00
Crude Fibre	10.00	9.90	14.41	11.82	26.51
Ash	15.50	16.00	14.75	18.75	9.00
Ether Extract	11.42	11.25	11.00	10.10	9.46
Nitrogen Free Extract	51.88	53.57	50.74	50.41	48.03
Neutral Detergent Fibre	47.74	64.43	56.44	67.33	64.60
Acid Detergent Fibre	15.84	18.18	21.78	21.67	39.00
Acid Detergent Lignin	9.82	8.08	15.84	11.77	12.00
Hemicellulose	31.90	46.25	34.66	45.66	25.60
Cellulose	6.02	10.10	5.94	9.90	27.00

Table 2: Nutrient intakes and Nitrogen utilization by West African Dwarf goats fed diets containing dry locust bean pulp

Parameters (g/day)	Experimental Concentrate Diets				SEM
	0%DLBP	10% DLBP	20% DLBP	30% DLBP	
Total Nutrient Intake					
DM	384.05 ^c	383.38 ^d	430.49 ^a	415.86 ^b	403.44
CP	39.32 ^a	33.64 ^d	37.11 ^b	35.37 ^c	36.41
CF	52.93 ^c	52.033 ^d	72.95 ^a	63.19 ^b	60.02
EE	37.86 ^b	37.50 ^c	41.58 ^a	37.13 ^d	38.51
Ash	53.81 ^d	55.41 ^c	58.31 ^b	69.33 ^a	59.21
NFE	200.13 ^d	204.80 ^c	220.37 ^a	211.83 ^b	209.28
NDF	198.18 ^d	247.16 ^c	250.34 ^b	277.58 ^a	243.31
ADF	81.21 ^d	87.35 ^c	109.28 ^a	105.48 ^b	95.83
ADL	39.63 ^c	34.30 ^d	64.72 ^a	49.15 ^b	46.95
Nitrogen Utilization					
Total Nitrogen Intake	6.29 ^a	5.38 ^d	5.97 ^b	5.66 ^c	5.83
Faecal Nitrogen	1.29 ^a	1.05 ^b	1.28 ^a	0.97 ^d	1.15
Urinary Nitrogen	1.27 ^a	1.21 ^a	0.79 ^c	0.90 ^b	1.04
Total Nitrogen Excreted	2.55 ^a	2.26 ^b	2.07 ^c	1.86 ^d	2.19
Nitrogen Absorbed	5.00 ^a	4.33 ^c	4.68 ^b	4.69 ^b	4.68
Nitrogen Retained	3.74 ^a	3.13 ^b	3.89 ^a	3.80 ^a	3.64
Nitrogen Digestibility (%)	79.54 ^b	80.50 ^b	78.49 ^b	82.88 ^a	80.35

^{abcd} Means on the same row having different superscripts were significantly different ($p < 0.05$)

0% DLBP is concentrate diet without dry locust bean pulp, 10% DLBP is concentrate diet with 10% dry locust bean pulp, 20% DLBP is concentrate diet with 20% dry locust bean pulp, 30% DLBP is concentrate diet with 30% dry locust bean pulp, **SEM** is Standard Error of Mean, **DM** is Dry Matter, **CP** is Crude Protein, **CF** is Crude Fibre, **EE** is Ether Extract, **NFE** is Nitrogen Free Extract, **NDF** is Nitrogen Detergent Fibre, **ADF** is Acid Detergent Fibre, **ADL** is Acid Detergent Lignin.

CONCLUSION

From the present study, it was concluded that the inclusion of Dry Locust Bean Pulp (DLBP) enhanced nutrient intakes and nitrogen utilization fed to West African Dwarf goats. It is therefore recommended that Dry Locust Bean Pulp up to 20% could be included in goats' diet.

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