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Performance and Nutrient Digestibility of West African Dwarf Goats Fed Different Dietary Levels of Cattle and Goat Rumen Contents

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Abstract
Hundreds of cattle and goats are slaughtered on daily basis in abattoirs and rumen contents are disposed in large amount as wastes, which could possibly serve as an alternative non-conventional feed source to ruminants. This study was carried out to investigate the utilization of cattle and goat rumen contents in the diets of West African dwarf goats. Twenty five West African Dwarf goats were fed five treatment diets containing Cattle Rumen Content (CRC) and Goat Rumen Content (GRC) at 0%, 20% and 40% inclusion levels, respectively, using a completely randomized design. Daily feed intake and weekly weight gain were measured. Metabolism cages were used for total collection of faeces and urine. Dry Matter Intake, Organic Matter Intake and weight gain were similar (P>0.05) for all the treatments, although goats on diet 5 (40% GRC) had the least Dry Matter and Organic Matter digestibility. And OM digestibility of 58.58% observed in this study is still capable of supporting productivity in goats. Also, there was a gradual reduction in cost of feed from N26.45 at 0% RC to N18.53 at 20% CRC and GRC. In like manner, cost/kg live weight gain decreased from N33.86 at 0% RC to N16.93 for 40% CRC. The only exception was Diet 5 (40% GRC) which increased to N36.85 for cost/kg live weight gain. Cattle and goat rumen contents can therefore be incorporated in the diets of goats up to 40% inclusion level without any deleterious effect on their health, thereby minimizing cost of production.

Keywords: Feed intake, digestibility, growth

Introduction

Rumen content (RC) of cattle, sheep and goats are abattoir waste materials causing serious environmental hazards. They serve as breeding medium for micro-organisms. Rumen contents are partially digested food materials in the rumen and are therefore rich in nutrients comprising food particles and fermentation products (Adeniji and Balogun, 2001). In addition, it contains the end products of rumen microbial activities, which are microbial protein, amino acids, vitamins and volatile fatty acids (VFA) (Cherdthong *et al*., 2014). Rumen content varies in crude protein content. Amoo *et al*. (1990) gave the crude as 13.5%, while Okorogbona (1994) reported a value of 13.5%, Dairo *et al.* (2005) estimated a value of 9-20% crude protein, for rumen content. It may therefore be used as an ingredient in ruminant feed. Rumen content has been fed successfully to monogastrics (Adeniji, 2001). It has been used in the diets of rabbits to replace groundnut cake up to 10% dietary level without any adverse effects (Dairo *et al*., 2005). Similar dietary level was found appropriate in the diets of starter chicks (Adeniji and Balogun, 2001), and the low dietary level tolerated by monogastrics is attributed to high fibre content of rumen content, given as 25% (Adeniji, 2008). Rumen content – barley mixture has been used up to 50% in the diets of lambs (Abouheif *et al*., 1999). Also, it has been used in the diets of sheep and buffalo with scanty information for goats. This study was therefore designed to determine the performance of WAD goats fed cattle and goat rumen contents.

Materials and Methods

The study was carried out at ruminant unit of the University of Benin Farm Project in Benin City, Edo State, Nigeria. Which is located on latitude 6^0 and 30^0 N and longitude 5^0 40′ and 6^0 E in the rainforest zone. It has an average temperature of 27.6°C; annual rainfall of 2162mm and mean relative humidity of 72.5% (Orheruata *et al*., 2010). Cattle and goat rumen contents were collected immediately after slaughtering from two different abattoirs located at Ewa and Aduwawa Road,

Benin City, Edo State. The rumens were disemboweled into a clean plastic. The contents were sun-dried on concrete slabs for 4-5 days and milled in a hammer mill. A sample of the rumen content (RC) was subjected to proximate analysis. The dried Cattle Rumen Content (CRC) and Goat Rumen Content (GRC) were used to formulate four experimental diets containing 20% and 40% for CRC and GRC respectively. As shown in Table 1, a fifth diet without RC (0% RC), served as the control diet. The diets were made to be isocaloric and isonitrogenous.

Experimental Animals and Management

Twenty post weaned WAD goats of similar age, between 6 to 11 months old and an average weight of 8.13kg, were used for this experiment. The goats were quarantined, treated for internal and external parasites and transferred to experimental pens, were they were made to adapt to both pen and experimental feed for a period of 14 days, The were divided into five groups of four goats each. The goats were fed at 3-4% of their body weight, twice daily at 0800hr and 1600hr for a period of 12 weeks. Water was made available *ad libitum*

Experimental Designs

Goats were balanced for weight and randomly assigned to the five dietary treatment diets in Completely Randomized Design (CRD) adopting Statistical Analytical System software (2000).

Data Collection

Daily feed intake was recorded by subtracting the refused feed from feed offered. The animals were weighed at the start of the trial and subsequently on weekly basis to determine weight changes. In other to collect faeces and urine separately for a period of 7 days, the goats were moved into metabolism cages on the 10^{th} week for digestibility trial. Total amount of faeces and urine collected were recorded and daily aliquots taken and frozen until analyzed. Urine was collected in plastic containers acidified with few drops of 25% sulphuric acid.

Statistical Analysis

Data collected were subjected to analysis of Variance using Statistical Analytical System software (SAS, 2000). Variations among the treatment means that are significant were computed using Duncan Multiple Range Test of the same SAS (2000) software.

Results and Discussion

Chemical composition of rumen content

Cattle and goat rumen contents (Table 2) had lower crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF) and cellulose, compared to values of 14.4, 63.3, 41.1 and 27.0 reported by El-Yassin *et al.* (2010). These differences in the nutrient may be attributed to the type of feed consumed by the cattle and goats before slaughtering (Basher *et al*., 2002). Adeniji and Balogun (2001) also noted that the time interval between feeding and slaughtering will affect the nutrient composition of rumen content collected.

Nutrient intake and weight gain

There were no significant differences (P>0.05) between the dry matter intake values of 270.28-274.49g/day and 205.63-239.48g/day for CRC and GRC respectively. Adeniji (2008) reported a similar trend in dry matter intake. This agrees with observations of Whyte and Wadak (2002), which attributed the similarity in dry matter intake to the isonitrogenious nature of the diets. Also, an increase in CRC and GRC from 20% to 40% had no effect on dry matter intake and organic matter intake, which are determinant of growth. Hence, live weight gain was similar among the diets. There were no significant differences (P>0.05) between the weight gains of 2.93kg, 2.93, 2.90, 2.90 for the 4 treatment diets and 1.70kg for goats on the control diet. All the goats gained weight, indicating that intake of energy and protein from the diets were well above maintenance requirement. Thus, corroborating the report of Whyte and Wadak (2002) that rumen content incorporated into livestock feeding improved growth performance.

Dry matter and organic matter digestibility

The least DM (53.05%) and OM (58.58%) digestibility were observed in goats fed diet 5 (40% GRC), while diets 1, 2, 3, and 4 had similar digestibility values. Anigbogu and Okocha (2003) stated that OM digestibility of 58.58% is still capable of supporting productivity in goats. The concentration of fibre in a diet results in a decrease in digestibility of nutrients (Farinu *et al*., 2005). Table 1 showed that GRC offered to the animals contained more fibre than CRC. The goats ate more feed since nutrient digestibility was negatively correlated to feed intake. There was a gradual reduction in cost of feed from N26.45 at 0% RC to N18.53 at 20% CRC and GRC. In like manner, cost/kg live weight gain decreased from N33.86 at 0% RC to N16.93 for 40% CRC. The only exception was Diet 5 (40% GRC) which increased to N36.85 for cost/kg live weight gain. This trend may be attributed to the low digestibility of the diet that necessitated an increase in feed intake so as to meet the nutrient requirement of the goats.

Conclusion

This study was designed to determine the performance of WAD goats fed cattle and goat rumen contents. This study showed that cattle and goat rumen contents can replace conventional feedstuffs in the diets of WAD goats up to 40% inclusion level, without any deleterious effect on the animals.

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Table 1: Composition of the experimental diets

Ingredients	Control	20% CRC	40% CRC	20% GRC	40% GRC
Cattle rumen content	-	20.00	40.00	-	-
Goat rumen content	-	-	-	20.00	40.00
Palm kernel meal	48.00	40.00	20.00	40.00	20.00
Wheat Offals	5.04	19.04	17.39	19.04	17.39
Maize	22.73	7.50	5.00	7.50	5.00
Soyabean meal	2.00	2.00	2.00	2.00	2.00
G. nut cake	13.19	7.46	11.61	7.45	11.61
Bone meal	1.00	1.00	1.00	1.00	1.00
Lime stone	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50
Vit/Min Premix	1.50	1.50	1.50	1.50	1.50
Total	100.00	100.00	100.00	100.00	100.00
Cost/kg feed (₦/kg)	26.45	18.53	16.95	18.53	16.95
ME Kcal/kg	2452.64	2324.28	2471.85	2324.28	2471.85

CRC – cattle rumen content, GRC – goat rumen content

Table 2: Proximate Composition (g/100gDM) of rumen contents

Composition	CRC	GRC
Dry matter	87.57	88.89
Organic matter	92.58	72.44
Crude protein	10.94	6.13
Neutral Detergent Fibre	62.81	67.50
Acid Detergent Fibre	30.83	59.62
Acid Detergent Lignin	25.37	29.72
Ash	7.42	27.56
Cellulose	5.46	29.90
Hemicellulose	31.98	7.88

CRC – cattle rumen content, GRC – goat rumen content

Table 3: Chemical composition (g/100gDM) of the experimental diets

Ingredients	Control	20%CRC	40%CRC	20%GRC	40%GRC
Dry matter	88.90	88.21	86.89	88.15	87.84
Organic matter	91.01	89.80	89.07	87.52	84.06
Crude Protein	17.99	18.92	18.41	17.96	16.48
Neutral Detergent Fibre	60.71	63.49	73.66	65.80	74.00
Acid Detergent Fibre	30.35	34.01	39.13	41.95	40.98
Acid Detergent Lignin	16.65	15.11	3.38	24.53	3.17
Ash	8.99	10.20	10.93	12.48	15.94
Cellulose	13.70	18.90	35.75	17.42	37.81
Hemicellulose	30.36	29.48	34.53	23.85	33.02

Table 4: Weight gain, feed intake and dry matter digestibility

Variables	Control	20%CRC	40%CRC	20%GRC	40%GRC	SEM
Final LW (kg)	11.53	11.00	11.63	10.50	10.30	2.01
Initial LW (kg)	8.60	8.07	8.73	7.60	8.60	ND
Total No. of days)	82	82	82	82	82	ND
Total weight gain (kg)	2.93	2.93	2.90	2.90	1.70	0.83
Total feed intake (g)	3756.41	3617.28	2959.18	2929.29	3695.65	ND
FCE	0.78	0.81	0.98	0.99	0.46	0.31
Feed cost/LW gain (₦/kg)	33.86	22.87	16.93	18.72	36.85	ND
Dry matter intake (g/day)	284.94	274.49	270.28	205.63	239.48	70.66
Organic matter intake (g/day)	259.33	246.50	240.74	179.94	201.31	62.65
Crude protein intake (g/day)	34.91	36.71	49.68	29.70	34.58	12.98
Dry matter digestibility (%)	72.53a	59.45a	71.62a	68.84a	53.05b	3.80
Organic matter digestibility (%)	74.65a	72.73a	74.81a	70.59a	58.58b	3.62
Crude protein digestibility (%)	76.26c	88.17ab	97.89a	91.33b	88.40ab	2.28

FCE-Feed Conversion Efficiency. SEM – Standard Error of Mean. abc – mean along the same row with different letters are significantly different (p<0.005)