

## Growth Performance and Nutrient Digestibility of West African Dwarf Goat Fed Unsalable Pumpkin Leaves and Cassava Peels Concentrate

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**ABSTRACT:** The study examined Growth Performance and Nutrient Digestibility of West African Dwarf Goats (WADG) Fed Unsalable Pumpkin Leaf Wastes (UPLW) and Cassava Peels Concentrate (CPC) Diets: WADG (n=45) weighing 4-6 kg at 4-5 months old were allotted randomly to five dietary treatments (9 goats each) in a completely randomized design for 12 weeks. Treatment one (UPLW 100%), while T2 (50%+50%), T3 (60%+40%), T4 (70%+30%), and T5 (80%+20%) UPLW+CPC respectively. Data collected: Initial Body Weight (IBW), Final Body Weight (FBW), Total Body Weight Gain (TBWG), Average Daily Weight Gain (ADWG), and Feed Conversion Ratio (FCR). At study's end, rumen content was collected from 3 goats per treatment for pH, ammonia nitrogen, and Total Volatile Fatty Acids (TVFA) determination. Dietary treatments had significant ( $P<0.05$ ) effects on FBW, TBWG, ADWG, butyric acid, and pH. Goats fed UPLW 70% and CPC 30% were significantly ( $P<0.05$ ) higher than those of T1-T5. FCR was significantly ( $P>0.05$ ) lower in T4 (5.91) and T5 (5.89). Goats fed diet 4 exhibited the highest butyric acid (6.29) production and a pH (6.05). It can be concluded that a 70:30 UPLW to CPC ratio increased growth performance of WADG.

**Keywords:** Cassava peels, Digestibility, Performance, Pumpkin leaves, Rumen content, Goats

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### INTRODUCTION

Goat consumption is on the increase, but its production has not been able to meet its demands, thus resulting in increasing number of goat farms in Nigeria (FAO, 2010). Despite this increase in goat farms, limitations such as high cost of feed and conventional feed stuffs inhibiting its capacity to maximize goat production output to satisfy demands of consumers (Ademosun, 2014). Traditionally, indigenous goats are raised in Africa for meat although quite a number of them are also milked. These goats, a small and hardy breed commonly found in West Africa (Agossou *et al.*, 2017). These West African Dwarf (WAD) goats possess the ability to adapt and thrive in any environment, resistant and productive in trypanosome-endemic zones, high fertility and prolificacy (Peacock, 2015).

In ruminant animals, the rumen is what gives them their distinctive feeding status. The fermentation of ingested feed in the rumen is dependent on two important phenomena: rumen temperature and pH (Ajagbe *et al.*, 2020). FAO (2015) stated that feeds for ruminants could be processed with various components of cassava plant such as tuber, peels, pulp etc as non-structural carbohydrates and fermentable energy source. Cassava peel is an important source of energy in ruminant feeding,

servicing either as the basal diet or as a supplement (Akinfala and Tewe, 2012). Cassava is produced throughout the year which ensures a consistent supply of peels for livestock feeding. It is estimated that approximately 4 million tonnes of cassava peeling useful as livestock feed are produced annually as a by-product in Nigeria alone during processing of cassava roots (Ajagbe *et al.*, 2020). Cassava peel is low in protein and fibre hence, the need to supplement it with alternative feed resources of high protein and fibre contents such as pumpkin leaf waste (Kolan *et al.*, 2016). Fluted pumpkin (*Telfairia occidentalis*) is an important vegetable supplement in the carbohydrate dominated staple food chain of Nigeria. Aregheore (2007) indicated that the foliage of fluted pumpkin is a potential rich and cheap source of protein, oil, vitamins and minerals and has been proposed to have some medicinal values. The tender vines, leaves and seeds are consumed by humans, while the mature vines constitute an important fibre source in animals' diet (Kayode and Kayode, 2011).

Though, various researches have been conducted on the nutrient value of different feed sources used as supplement in goat production. There is dearth information about the combined use of cassava peels and unsalable

pumpkin leaves waste diets in goat production, hence, this study was designed to examine the growth performance and nutrient digestibility of West African Dwarf Goats fed unsalable pumpkin leaf wastes and cassava peels concentrate.

## MATERIALS AND METHODS

### Location of Experiment Site

The study was carried out at the Goat and Sheep unit, of the Teaching and Research Farm, Delta State University, Abraka.

### Experimental Animals and Management

Forty five (45) unsexed West African Dwarf Goats (WADG) of 4-6kg live weight at 4-5 months old, were randomly separated into five (5) dietary treatments (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>) of nine (9) goats each, with three (3) replicates, having three (3) goats per replicate, in a Completely Randomized Design (CRD). Goats were kept under intensive management system in pen units, where feeds and water were supplied *ad libitum*. The animals were treated with ivermectin against internal and external parasites, while, oxytetracycline (LA) and multivitamins were also administered before the commencement of the experiment.

### Preparation of Experimental Feeds

Unsalable pumpkin leaves and cassava peels were obtained from local farms and markets. They were sorted and chopped into smaller portions, washed and air-dried (cassava peels were sundried) to constant weight, milled and stored in airtight containers. Cassava peels together with other required feed ingredients formed the concentrate which were combined with the processed unsalable pumpkin leaves, in different proportions. The gross composition of the concentrate feed is as presented in (Table 1).

### Combination (%) and order of placement of experimental Diets

- T1: Unsalable pumpkin leave waste 100%
- T2: Unsalable pumpkin leave waste 50% + Cassava Peels concentrate 50%
- T3: Unsalable pumpkin leave waste 60% + Cassava Peels 40%
- T4: Unsalable pumpkin leave waste 70% + Cassava Peels concentrate 30%
- T5: Unsalable pumpkin leave waste 80% + Cassava Peels concentrate 20%

### Data Collection and Analysis

Initial Body Weight (IBW) were obtained at the onset, Final

Body Weight (FBW) and Total Body Weight Gain (TBWG) were determined from weekly weights. Average Daily Weight Gain (ADWG) of goats were obtained, Total Feed Intake (TFI) was determined from weighed amounts of feed offered and weighed amount rejected, while Feed Conversion Ratio (FCR) were calculated from the record of feed intake and weight gain. At the end of the experiment, fifteen millilitres (15ml) rumen liquor was collected from three (3) goats in each treatment, using a special catheter tube according to (Wanapat and Khampa, 2007) into a thermos flask that had been pre-warmed to 30°C, cocked tightly and immediately were transferred to the laboratory for Volatile Fatty Acids determination (Cheesebrough, 2000). Collected samples of experimental diets were subjected to analysis in the laboratory for proximate determination (AOAC, 2005).

### Data analysis

Data were subjected to one-way Analysis of Variance (ANOVA) and means separated using Duncan's Multiple Range Test (SPSS, 2023).

## RESULTS AND DISCUSSION

### Growth Performance of WAD goats

The effect of the experimental diets on growth performance, of West African Dwarf (WAD) goats fed unsalable pumpkin leaves and cassava peels concentrate are as shown in (Table 2). The final body weight 10.54 (T<sub>4</sub>) were significantly ( $p < 0.05$ ) higher in goats fed Pumpkin leave wastes 70% and 30% cassava peels concentrate, when compared with other treatments which were not significantly ( $p < 0.05$ ) different from one another. Total body weight gain significantly ( $p < 0.05$ ) differ, which ranged from 4.45 (T<sub>4</sub>) to 3.36 (T<sub>5</sub>). The final Weight gains recorded, are indications of the animals' ability to efficiently modify and utilize the feeds for better and improved digestion, nutrient absorption and utilization. This has resulted in significant total weight and final weight gains in WAD goats. This realization is in line with the report of (Osakwe and Udeogu, 2007) who stated that efficient utilization of feed by animals provided with sufficient amount of nutrient requirements at the point of metabolism resulted in high weight gain.

Feed intake varied significantly ( $p < 0.05$ ) and it ranged from 28.51 (T<sub>2</sub>) to 26.67 (T<sub>4</sub>). The total feed intake (T<sub>4</sub>) was significantly ( $p > 0.05$ ) lowest. It is pertinent to note that when goats consume less and are able to efficiently utilize the feed to produce meat by attaining more weight than those that had higher feed intake, then it is beneficial to the farmers as resources are preserved. Feed conversion ratio (FCR) which measures feed intake per unit weight gain was lowest in diets T<sub>4</sub> (5.91) and T<sub>5</sub> (5.89), indicating better feed efficiency. The higher weight gain of WAD goats in T<sub>4</sub> (4.45kg) and FCR of the diet containing the experimental ingredients can attest to the superiority of the

**Table 1.** Gross composition (%) of concentrate feed

Ingredients	Composition
Cassava peel	53.00
Wheat offal	21.50
Palm Kernel Cake (PKC)	20.50
Limestone	4.00
Salt	1.00
Total	100

**Table 2:** Growth Performance (g/kg) of WAD Goats

Parameters	T1	T2	T3	T4	T5	SEM	Sig.
Initial body weight	6.24	6.23	6.45	6.28	6.24	0.18	0.36
Final body weight	9.38 <sup>b</sup>	9.56 <sup>b</sup>	9.69 <sup>b</sup>	10.54 <sup>a</sup>	9.35 <sup>b</sup>	0.18	0.01
Total body weight gain	3.42 <sup>c</sup>	3.87 <sup>b</sup>	3.89 <sup>b</sup>	4.45 <sup>a</sup>	3.36 <sup>c</sup>	0.03	0.00
Average daily weight gain	0.03 <sup>c</sup>	0.05 <sup>a</sup>	0.04 <sup>b</sup>	0.04 <sup>b</sup>	0.03 <sup>c</sup>	0.00	0.00
Total feed intake	28.48	28.51	26.86	26.67	27.23	0.69	0.07
Feed conversion ratio	7.36 <sup>a</sup>	7.26 <sup>a</sup>	6.98 <sup>b</sup>	5.91 <sup>c</sup>	5.89 <sup>c</sup>	0.23	0.00

abc: means in the same row with different superscripts are significantly ( $P < 0.05$ ) different. WAD: West African Dwarf, Sig: significance.

diets. This observation was in contrast with the work of Mohlatlole *et al.* (2015) who stated that the more digestible a feedstuff is, the more it is eaten by the ruminants. The increase in digestibility percentage could be as a result of crude fibre and protein content of the experimental diets (Okoruwa and Ikhimiyoa, 2020).

#### Rumen digestibility of WAD goat fed unsalable leave waste and cassava peel concentrate

Rumen parameters of WAD goat fed unsalable pumpkin leave wastes and cassava peel concentrate are presented in (Table 3). The Total Volatile Fatty Acids (TVFA) showed that there were no significant ( $p > 0.05$ ) differences observed among the treatments. Treatment ratios did not affect the production of TVFA, indicating that the fermentation of unsalable pumpkin leaves and cassava peel concentrate in the rumen did not significantly ( $p > 0.05$ ) alter total volatile fatty acid production. The Propionic Acid showed no significant ( $p > 0.05$ ) differences among the treatments. But T(4) exhibited numerical level of propionic acid production. The result showed that the acetic acid levels did not significantly ( $p > 0.05$ ) vary among the treatments. However, Butyric Acid (6.29) production in treatment (4) showed a significantly ( $p < 0.05$ ) higher value among the treatments. The results in this study indicated that WAD goats had demonstrated that production of propionic (4.10%) and butyric (6.29%) acids from digestion of pumpkin leave waste and cassava concentrate diet at 70:30 (T4) were significantly ( $p < 0.05$ ) higher compared to other groups. The increase in rumen digestibility parameters, is in line with Ademosun *et al.* (2014) who reported that, increasing digestibility means that high proportion of the feed is digested and absorption is complete with the Volatile Fatty Acids (VFA) showing a lower proportion of acetic acid, the least useful VFA, and with the presence of higher proportions of the more useful volatile fatty acids such as propionic and butyric acids.

Also, the pH levels showed that there was a significant ( $p < 0.05$ ) difference among the treatments. The WAD goats fed diet (T4) 70:30 and 80:20 (T5) ratios had significantly ( $p < 0.05$ ) higher pH levels (6.05 and 6.12), indicating a more alkaline rumen environment. The Ammonia Nitrogen (N-NH<sub>3</sub>) did not show significant ( $p > 0.05$ ) differences among the treatments. All treatments exhibited similar ammonia nitrogen concentrations, suggesting that the ratios of unsalable leaves to cassava peel concentrate did not impact ammonia nitrogen levels in the rumen.

#### Proximate composition of experimental diets fed to West African Dwarf Goats

Result of proximate analysis of experimental diets is presented in (Table 4). Comparing the Crude protein contents, that of the concentrate feed showed a higher percentage at 20.37%, indicating its richness in essential proteins vital for growth and muscle development. In contrast, unsalable pumpkin waste contained 12.36% crude protein, making it comparatively lower. The higher weight gain of WAD goats in T4 (4.45kg) and FCR of the diet containing the experimental ingredients could be that goats do not require very high crude protein content in their diet, since they can synthesis their own protein from microbial activities in the rumen.. However, it was interesting to know that crude protein values recorded in diets were above the 8% CP minimum value required for goat maintenance (Okoruwa and Ikhimiyoa, 2020). This higher fibre content indicates that while pumpkin leave wastes aid digestion, it could be more challenging for the goats to digest the concentrate. Considering the nitrogen-free extract, representing soluble carbohydrates, the concentrate had a higher value of 45.32%, signifying the presence of readily digestible carbohydrates and a quick source of energy. In contrast, unsalable pumpkin wastes had 73.47% nitrogen-free extract, indicating a higher level of complex carbohydrates that might take longer to

**Table 3:** Rumen digestibility of WAD goat fed unsalable leaves and cassava peel concentrate

Parameters	100:00	50:50	60:40	70:30	80:20	SEM	LoS
TVFA (%)	13.25	13.38	13.36	14.14	14.36	0.18	NS
Propionic acid (%)	3.45	3:86	3.63	4.10	3.91	0.27	NS
Acetic acid (%)	3.50	3:50	3.82	3.92	3.63	1.13	NS
Butyric acid (%)	5.42 <sup>b</sup>	5:44 <sup>b</sup>	5.28 <sup>b</sup>	6.29 <sup>a</sup>	5.42 <sup>b</sup>	0.21	*
pH	5.03 <sup>b</sup>	5.07 <sup>b</sup>	5.08 <sup>b</sup>	6.05 <sup>a</sup>	5.12 <sup>b</sup>	0.18	*
N-NH <sub>3</sub> (%)	2.04	2.06	2.24	2.32	2.55	0.11	NS

ab: within the same row, the superscript are significantly different (P<0.05), NS= not significant, LoS= Level of significant, SEM= Standard error of mean, TVA= Total Volatile Fatty acids, N-NH<sub>3</sub>=Ammonia Nitrogen.

**Table 4:** Proximate composition (%) of experimental diets.

Proximate	Unsalable pumpkin wastes	Concentrate feed
Crude protein	12.36	20.37
Ether extract	4.16	2.50
Crude fibre	12.50	1.60
Ash	4.61	11.52
Nitrogen free extract	73.47	45.32
Dry Matter	95.75	90.39

metabolize and supply energy.

## Conclusion

Growth of West African Dwarf goats increased during the study and this could be attributed to the nutrient composition of the different diets that were supplied to the animals. The goats fed with unsalable pumpkin leaf waste and cassava peel concentrate in 70:30 ratio combination of the test ingredients, performed better in terms of the essential volatile fatty acid; propionic and butyric acid production, which is necessary for energy production that is required for growth. Thus, the goat fed the 70:30 ratio of nutrients had a higher growth performance among all the tested nutrients ratio combinations for West African dwarf goats. It is therefore, recommended that farmers and livestock managers should consider adopting the 70:30 ratio of unsalable pumpkin leaf waste to cassava peel concentrate in formulating the diet for West African dwarf goats. This ratio promotes higher butyric acid production, which is essential for energy metabolism and overall rumen health.

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