

Carcass Composition of West African Dwarf (WAD) Goats Fed Cassava Peel-Based Diets

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Abstract

To investigate the effects of cassava peel-based diets on the meat composition of WAD goats, 24 five month-old goats were used for the experiment. Results show that the Dry Matter (DM), Crude Protein (CP) and Nitrogen Free Extract (NFE) content of the meat were not significantly ($P>0.05$) different. The DM, CP and NFE content ranged from 29.96-30.00%, 89.77-90.43% and 2.00-4.03% respectively. The mineral composition revealed no significant ($P>0.05$) differences in Iron (Fe), Calcium (Ca), Sodium (Na), Zinc (Zn), Magnesium (Mg), Potassium (K), Phosphorus (P) and Copper (Cu) content. The Fe, Ca, Na, Zn, Mg, K, P and Cu content ranged from 1.95-2.20mg, 23.65 -25.29mg, 72.86-77.05mg, 4.00-4.32mg, 55.65-57.83mg and 1.62-1.73mg respectively. From the results, it appears that cassava peels supplemented with sweet potato foliage could improve the meat composition of WAD goats.

Keywords: chevon, carcass composition, alternative feed sources, cassava peels

1. Introduction

Carcass quality is defined as the proportion of muscle to bone and fat in the carcass (Obioha, 1992). According to Agiang et al. (2009), meat quality depends largely on the nutritive values, proximate and mineral compositions of the feeding materials. Ihekoronye and Ngoddy (1985) also noted that the age of the animal could influence meat quality as impact of marbling increases as the animal matures. Several studies indicated that carcass quality can be improved by the reduction of fat contents in the meat through dietary manipulation involving changes in the physical form of feed, energy to protein ratio (Ojewola & Longe, 1999) and inclusion of high fibre levels (Tewe & Egbunike, 1992). One of the feed resources exploited for its high fibre contents is Cassava peel (CSP).

Cassava has played a minor role as an ingredient in livestock feed in sub-Saharan Africa as cassava was often more expensive than imported maize (Tewe, 2004). The recent rising cost of maize on the continent due to weather induced fluctuations, huge foreign debts and currency devaluation has forced a number of countries in Africa to search for alternatives to maize particularly for its livestock sub-sector (Nweke et al., 2002).

A total production of 87 million tonnes of cassava produced annually in Africa, only 6 percent is used in livestock production mainly in traditional systems. By contrast, in Latin America, 32.4 percent of its cassava is used for livestock feeding while in Asia, over 40 percent of its products is exported in the form of chips and pellets for the European Union livestock industry with another 2.9 percent used for domestic livestock production (International Fund for Agricultural Development - IFAD and Food and Agriculture Organization of the United Nations - FAO 2000).

The share of African cassava production used as livestock feed is probably underestimated because cassava wastes such as peels, and leaves are fed to goats, sheep and pigs on small-scale farms in traditional systems, in fresh or cut-and-dried forms (Nweke et al., 2002). In West Africa, waste from cassava production is between 5 - 52 percent thus, is a potential feed resource for the regions (Tewe, 2004). Goat and sheep rearing are highly complementary because cassava processing is carried out around homes, and goats, sheep and chicken are fed by-products of cassava processing. As a complementary energy source, CSP can undergo stratification within the rumen, so it can be regurgitated with forages and chewed during rumination.

Effects of feeding cassava peels (CSP) on animal performances have been documented (Smith, 1992; Tewe et al., 2002). However, there is no report concerning the effects of dietary inclusion of CSP on meat composition in WAD goats. According to Al-Bachir and Zeinou (2014) goat meat compared to other traditional red meat is recognized as an important protein source and is preferred due to its lower total fat and higher unsaturated fatty acid content.

Therefore, this study evaluated the effects of treated and foliage supplemented-cassava peel diets on the meat composition of West African Dwarf goats. To improve the per capita animal protein intake and profitability of goat farming, the best CSP-forage feeding regime was evaluated.

2. Materials and Methods

2.1 Experimental Diets and Management

To assess the effects of cassava peels based- diets on the meat composition of West African dwarf (WAD) goats, four dietary treatments; cassava peels treated with Urea (CSP + U), cassava peels treated with broiler litter (CSP + BL), cassava peels supplemented with cassava foliage (CSP + CSF) and cassava peels supplemented with sweet potato foliage (CSP + SPF) were fed to 5 months -old bucks for 90 days. The chemical compositions of the four diets were analyzed using standard methods (AOAC, 2000).

A total of 24 bucks were studied with each treatment having 3 replicates of 3 bucks. Each replicate were housed in individual pens. Each supplement was included at 3% Bw (i.e. 162.24 g of cassava plus 40.56 g supplement per treatment). The average daily feed intake for each treatment was: 104.27 g (CSP + U), 107.82 g (CSP + BI), 276.07 g (CSP + CSF) and 265.45 (CSP + SPF). Prior to the commencement of the experiment, one week acclimatization period was permitted. The animals had free access to water during the experiments. The total amounts of mixed rations offered and refused were recorded daily and the daily voluntary intake (DVI) was recorded.

2.2 Meat Sampling and Analyses

At the expiration of the 90 days growth trial, one animal was selected per replicate for proximate and chemical analysis. Prior to slaughter these animals were fasted for 24 hours and was provided with portable drinking water. The animals were cleaned by the use of over-head water sprays which helps to cool the animal and facilitates the removal of blood as they move one after the other into the slaughter room. The animals were killed as quickly as possible to avoid stress and depletion of glycogen reserves by inserting a sharp knife in front of the breast or brisket and severed the carotid arteries and jugular vein. The animals with their hind legs tied were flayed hanging upside down by archile tendon for bleeding for 30 minutes. This is followed by skinning and evisceration-removal of viscera. The carcasses were cut into wholesale cuts. The thigh and forearm muscles were deboned and washed. A total of 18.80 g meat sample was collected from each animal and refrigerated for 24 hours at a temperature of between 6 °C to 10 °C for glycolysis to take place converting the muscles to meat. These samples were chopped into smaller pieces using a kitchen knife, thereafter oven dried at 45 °C to a constant weight. The dried meat samples were milled using Thomas Wiley laboratory mill model 4 (WM4 mill) with 1mm sieve. The homogenous powder was stored in well-labeled sample bottles for chemical analysis.

2.3 Proximate Analysis

Dry Matter (DM), crude protein (CP), ether extract (EE), ash and nitrogen free extract (NFE) from muscle samples of the four treatments were determined using standard methods (AOAC, 2007).

2.4 Mineral Determination

Ten grams of each meat sample was weighed into analytical round bottomed flask. Minerals in the ash were brought into solution by wet digestion using concentrated nitric acid (63%), concentrated perchloric acid (60%) and concentrated sulphuric acid (98%) mixture in the ratio of 4:1:1 (Harris, 1970). Potassium and Sodium were determined with flame photometer (Collins and Polkin Horne model) Baush-Lamb spectronic 20 was used for phosphorous, (Allen, 1974) method. The other minerals were determined using Perkin-Elmer Atomic Absorption Spectrophotometer (AAS) model 290B (AOAC, 2000). All determinations were in triplicates and mean values were evaluated.

2.5 Statistical Analysis

All data were subjected to one-way analysis of variance (ANOVA) and treatment means were separated using the Duncan's new multiple range test (Steel et al., 1996). Means and Standards deviations were calculated following established statistical procedures (J. C. Miller & J. N. Miller, 1986). A probability $P < 0.05$ was used to test the statistical significance.

3. Results

Results obtained from the study are summarized in Tables 1-3.

3.1 Proximate Composition

Table 1 shows the proximate composition of experimental diets. The acid detergent fibre (ADF) and the neutral detergent fibre (NDF) were significantly ($P < 0.05$) different. The calculated metabolizable energy (ME) of the feedstuffs were significantly ($P < 0.05$) different.

Table 1. Proximate composition of experimental diets (as fed basis)

Nutrients (%)	Feed samples				Mean	±SEM	±STD
	T ₁ (CSP+U)	T ₂ (CSP+BL)	T ₃ (CSP+CSF)	T ₄ (CSP+SPF)			
Dry matter (DM)	89.07	89.77	86.24	88.65	88.43	2.90	1.33
Crude protein (CP)	30.05 ^a	25.00 ^b	16.02 ^d	18.04 ^c	22.28	1.95	5.59
Ether extract (EE)	6.04 ^c	10.05 ^b	14.00 ^a	13.00 ^a	10.77	1.17	3.66
Crude fibre (CF)	15.05	17.00	19.55	20.06	17.92	1.38	2.02
Ash	16.00	16.05	20.04	18.01	17.53	1.49	1.66
Nitrogen free extract (NFE)	32.86 ^a	31.90 ^a	30.39 ^b	30.89 ^b	31.51	1.06	0.95
Acid detergent fibre (ADF)	16.00 ^d	26.00 ^c	32.00 ^b	34.00 ^a	27.00	1.96	7.00
Neutral detergent fibre (NDF)	30.06 ^d	40.00 ^c	50.05 ^b	56.00 ^a	44.03	3.05	9.88
*Metabolizable energy (MJ/kg DM)	12.00 ^a	10.55 ^b	7.94 ^c	7.95 ^c	9.61	0.58	1.74

Not significantly different ($P > 0.05$). ^{a,b,c,d} Means bearing different superscripts along the same row are significantly different ($P < 0.05$). **EE (MJ/kgDM).

CSP+U – Cassava peels treated with urea. CSP +BL – Cassava peels treated with broiler litter.

CSP+CSF-Cassava peels supplemented with cassava forage.

CSP + SPF – Cassava peels supplemented with sweet potato forage.

Table 2 Shows the Proximate Composition of meat from WAD goats fed cassava peel diets. The DM, CP and NFE content of meats between dietary treatments.

Table 2. Proximate composition of meat from WAD goats fed cassava peel diets

Nutrients (%)	Meat samples				Mean	±SEM	±STD
	T ₁ (CSP + U)	T ₂ (CSP + BL)	T ₃ (CSP+CSF)	T ₄ (CSP+SPF)			
Dry matter (DM)	30.00	29.99	29.96	29.97	29.98	2.20	0.016
Crude protein (CP)	89.77	90.38	89.87	90.43	90.11	2.38	0.295
Ether extract (EE)	6.67 ^a	6.04 ^b	5.25 ^c	4.25 ^d	5.55	0.37	0.905
Ash	2.00 ^c	2.00 ^c	3.59 ^b	4.03 ^a	2.91	0.23	0.918
Nitrogen free extract (NFE)	1.56	1.58	1.29	1.29	1.43	0.01	0.140

^{a,b,c,d} Means with different superscripts are significantly ($P < 0.05$) different across row.

CSP+U – Cassava peels treated with urea. CSP +BL – Cassava peels treated with broiler litter

CSP+CSF-Cassava peels supplemented with cassava forage.

CSP + SPF – Cassava peels supplemented with sweet potato forage

3.2 Minerals

Table 3 shows the Mineral Composition of meat from WAD goats fed cassava peel diets. The results of mineral composition revealed no significant ($p > 0.05$) differences. Potassium had the highest across all the meat samples.

Table 3. Mineral Composition of meat from WAD goats fed cassava peel diets

Minerals (mg/100g)	Meat samples				Mean	±SEM	±STD
	T ₁ (CSP + U)	T ₂ (CSP + BL)	T ₃ (CSP+CSF)	T ₄ (CSP+SPF)			
Iron (Fe)	2.00	1.95	2.05	2.20	2.05	0.36	0.093
Calcium (Ca)	24.50	23.65	24.82	25.29	24.57	1.12	0.598
Sodium (Na)	73.90	72.86	75.90	77.05	74.93	2.68	1.642
Zinc (Zn)	4.00	4.30	4.32	4.29	4.23	0.32	0.132
Magnesium (Mg)	24.05	23.25	24.01	23.70	23.75	2.47	0.320
Potassium (K)	306.75	308.00	308.32	307.83	307.73	3.51	0.589
Phosphorus (P)	56.50	55.65	56.78	57.83	56.69	1.86	0.778
Copper (Cu)	1.62	1.65	1.68	1.73	1.67	0.04	0.041

No significant ($P > 0.05$) differences across row.

CSP+U – Cassava peels treated with urea. CSP +BL – Cassava peels treated with broiler litter.

CSP+CSF-Cassava peels supplemented with cassava forage.

CSP + SPF – Cassava peels supplemented with sweet potato forage.

4. Discussion

4.1 Proximate Composition

Results on Table 1 shows that CP content varied significantly ($P < 0.05$) between feed samples Urea treated cassava peel had the highest value, while the least was recorded in the cassava peel and foliage group. Ether extract was also influenced by dietary samples. Urea treated cassava peel had the least EE value. Comparable NFE was recorded in Urea and broiler litter groups as well as cassava and sweet potato groups. ADF and NDF content were lower in Urea treated group value compared to the foliage groups. Metabolized energy was highest in Urea group value followed by broiler litter, cassava and sweet potato foliage values. The (ME) values of the feedstuffs are within the recommended levels (6-13MJ/KgDM) for maintenance and production for goats (Steele, 2006).

Results on proximate analysis (Table 2) showed that EE values decreased significantly ($P < 0.05$) in meat from cassava and sweet potato foliages compared to meat fed Urea treated cassava peels. On the other hand, ash content was highest ($P < 0.05$) in cassava and sweet potato leaves than in Urea and broiler litter groups. However, differences were observed in the values for DM, CP, and NFE contents of meat between dietary treatments. The effect of higher CP content observed in the diet of bucks supplemented with Urea was not reflected in the meat composition. This could suggest that Urea could have been undergoing further decomposition or utilized by the microbes in the goat's rumen rather than for muscle growth. Supplementation with sweet potato foliages however increased ($P < 0.05$) CP and ash content of the meat while decreasing the amount of fat in the meat, thus improving the nutritive value of the meat compared to those supplemented with cassava foliage and broiler litter. The values for CP content of the meat samples were similar to those reported by Agiang et al. (2009) for rabbits but higher than those reported by Eniolorunda et al. (2011) for Yankasa rams fed graded levels of biscuit wastes. The NFE and ash contents of meat samples were higher than those reported by Agiang et al. (2009) for rabbits. The EE content of meat were less than those by Eniolorunda et al. (2011) for Yankasa rams but greater than those reported by Agiang et al. (2009) for rabbits.

4.2 Mineral Elements

The results of mineral composition on Table 3 revealed no significant ($P < 0.05$) differences. Value for potassium was the highest across all meat samples followed by Na, P, Ca, Mg, Fe with the least value in copper

content. The values obtained were slightly higher than the values reported by Johnson (1987) for wood and wood crossbred goats of Florida. According to Agiang et al. (2009) differences observed in the crude protein content of meat samples is a function of the nutrient composition of the diet. Similarly, Ahmed et al. (2010) noted that the chemical composition of meat could be improved by factors such as animal species, breed, anatomical location of muscle and nutrition. The variations observed in the proximate and mineral composition of the meat from WAD goats may be attributed to the degree of interactions between the diet and the genetic constitutions of the goats.

5. Conclusion

From the study, results indicated that varying materials used for cassava peel supplementation may not have adverse effects on the nutritional qualities of the meat of WAD goats. Variations in the chemical composition of the feeding materials (cassava peels treated with N- sources or forage supplementation) had no significant impact on the nutritional qualities of meat from WAD goats. Nevertheless, cassava peel supplemented with sweet potato forage improved the nutritive qualities of meat of WAD goats.

Thus, this study concludes that sweet potato foliage should be supplemented into cassava peel-based diet, for improved meat quality for WAD goats.

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