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Influence of supplemental cassava root sieviate - cassava leaf meal based diets on carcass and economics of production of West African dwarf goats.

Influencia del suplemento suplementario de raíz de mandioca - dietas basadas en harina de hoja de yuca en carcasa y economía de producción de cabras enanas de África occidental.

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ABSTRACT

The experiment was conducted to evaluate the carcass yield, organ characteristics and economics of production of West African Dwarf (WAD) goats fed cassava root sieviate-cassava leaf meal (CRSCLM) based diets as supplement to *Panicum maximum* using 36 WAD goats of about 8 to 10 months of age. Four diets T_1, T_2, T_3, and T_4, were formulated at the levels of 0%, 20%, 40% and 60% CRSCLM respectively, in a completely randomized design. Each animal received a designated treatment diet in the morning for 97 days. Feed offered was based on 3.5% body weight per day; the animals in addition were fed a kg of wilted and chopped *Panicum maximum* later in the day as basal diet to enhance rumination and chime chewing. Result on carcass indices showed significant ($p<0.05$) influence on live weight at slaughter, empty carcass weight, warm carcass weight, dressing percentage, shoulder, leg, lion, end and shank weights with T_4 having relatively best results. The dressing percentage was numerically (49.59%) best at T_4. On the offal weights, head and full guts were significantly ($p<0.05$) improved for T_4 and T_1 goats. The organ characteristic proved the safety of using CRSCLM through the significantly ($p<0.05$) lower organ weights at T_4 goats. Cost per kg feed, feed cost/weight gain and cost/benefit ratio were positive influenced ($p<0.05$) at T_4 with expected income of ^4.79 per ^1 invested. It could therefore be concluded that WAD goats fed 60% CRSCLM had the best carcass and organ yields at a reduced feed cost.

Keyword: WAD goat, Cassava leaf meal, cassava root sieviate, cost/benefit ratio.

RESUMEN

El experimento se realizó para evaluar el rendimiento de la carcasa, las características de los órganos y la economía de la producción de cabras enanas de África Occidental (HAR) alimentadas con dietas basadas en harina de hoja de mandioca (CRSCLM) como suplemento a Panicum maximum utilizando 36 cabras WAD de aproximadamente 8 10 meses de edad. Se formularon cuatro dietas T1, T2, T3 y T4 en niveles de 0%, 20%, 40% y 60% de CRSCLM, respectivamente, en un diseño completamente aleatorizado. Cada animal recibió una dieta de tratamiento designada en la mañana durante 97 días. El alimento ofrecido se basó en un 3.5% de peso corporal por día; los animales además fueron alimentados con un kg de Panicum picado marchito máximo más tarde en el día como dieta basal para mejorar la rumia y masticar carillón. El resultado en los índices de carcasa mostró una influencia significativa (p <0.05) en el peso vivo en el sacrificio, peso de la canal vacía, peso de la canal caliente, porcentaje de aliño, hombro, pierna, león, extremo y tallo con T4 teniendo relativamente mejores resultados. El porcentaje de aliño fue numéricamente (49.59%) mejor en T4. En los despojos, la cabeza y las tripas completas mejoraron significativamente (p <0.05) para las cabras T4 y T1. La característica del órgano demostró la seguridad de usar CRSCLM a través de los pesos de órgano inferiores significativamente (p <0,05) en cabras T4. El costo por kg de alimento, el costo de alimentación / ganancia de peso y la relación costo / beneficio fueron influenciados positivamente (p <0.05) en T4 con un ingreso esperado de ^ 4.79 por ^ 1 invertido. Por lo tanto, se puede concluir que las cabras WAD alimentadas con un 60% de CRSCLM tenían los mejores rendimientos de cadáveres y órganos a un costo de alimento reducido.

Palabra clave: WAD cabra, harina de hoja de yuca, raíz de mandioca, relación costo / beneficio.

INTRODUCTION

Goat is a small ruminant animal of great importance to man. The animal is produced basically for meat, milk and fibre, but could also be used in the generation of organic manure. In developing and developed countries, goats fulfil important economic and social functions due to the position as a source of investment and animal protein for the teeming population (Jiwuba *et al*., 2017). The products are however in short supply due to seasonal fluctuation in feed quality and quantity, thus making feeding an important constraint to improved goat production. The provision of adequate nutrition (Lufadeju and Lamidi, 1993) could thus be a pathway to enhanced goat production. Grasses which are the most abundant basal feed for goats dry up during the dry season thus resulting to highly lignified feed material with very poor digestibility coefficient, low energy and protein values. This will in turn lead to poor performance of the animals (Jiwuba *et al*., 2016a). This however has necessitated the need for a dry season supplementation to augment for the shortfall in the deficient nutrients so as to meet the nutrient requirements of goats. One of the readily, abundant and cheaply sourced feedstuff which could be used to formulated a dry season supplement for goats is cassava root sieviate and cassava leaf meal due to their high energy, fibre and protein profile.

The supplemental diets must be formulated in such a way not to compromise the nutritional need of the goats, but should be however be at affordable cost. The use of cassava or its by-products in the formulation of supplemental diets for ruminants has been extensively researched. Goats (Oni *et al*., 2012; Jiwuba *et al*., 2016a; Oni *et al*., 2017), sheep (Fasae *et al*., 2015; Fadiyimu *et al*., 2016) and cattle (Oduguwa *et al*., 2013) fed with cassava or its by- products showed improved feed intake, nutrient utilization, blood profile, growth rate, carcass and organ characteristics. Cassava root sieviate and cassava leaf meal have been identified as an underutilized feed resources for goats, its nutritional quality has necessitated its utilization as goat feed. Cassava leaf meal is a non-conventional feed stuff that is readily available at little or no cost. The root sieviate has a high energy and fibre profile which are essential for goats. Cassava and its by products have been however, implicated with anti-nutritional factor majorly cyanide (Morgan and Choct, 2016) which has been reported to affect nutrient availability, blood formation and utilization when not properly processed (Jiwuba *et al*., 2016b). Thus, the fermentation, drying and further milling employed in this study would perhaps further reduce the anti-nutrients to tolerable level for goats. This experiment was designed therefore to determine the carcass yield, organ weights and economics of production of WAD goats fed cassava root sieviate-cassava leaf meal based diets.

MATERIALS AND METHODS

Location of the experiment: The experiment was carried out at the sheep and goat Unit of Animal Production Technology, Federal College of Agriculture, Ishiagu, Ivo L.G.A., Ebonyi state, Nigeria. The College is located at about three kilometers (3km) away from Ishiagu main town (Jiwuba *et al*., 2016c). The College is situated at latitude 5.56^{0}N and longitude 7.31^{0}E, with an average rainfall of 1653 mm and a prevailing temperature condition of 28.500^c and relative humidity of about 80%.

Experimental feeds: The cassava root sieviate and cassava leaf were sourced and harvested within Ishiagu and Agwu communities. The cassava root sieviate is a by product of cassava root processing. It was gotten after the cassava roots meant for fufu (a popular food in Nigeria) production are peeled or not, washed clean and soaked in clean water for 3-5 days to ferment so as to reduce the hydrogen cyanide level and also to soften the roots to enable sieving. Thereafter, the soaked cassava roots are sieved, the sieviate (waste) collected and sundried for about 5 days to reduce the moisture contents and possible anti-nutrients that were not removed during the fermentation process. The cassava leaves were harvested from the College cassava farms after root harvesting. The both were coarsely milled using hammer mill to encourage chyme chewing. The cassava root sieviate meal (CRSM) and cassava leaf meal (CLM) were mixed in the ratio of 3:1 and used in the formulation of the experimental diet. Four diets T_1, T_2, T_3, and T_4, were formulated. The cassava root sieviate-cassava leaf meal (CRSCLM) was included at the levels of 0%, 20%, 40% and 60% for T_1, T_2, T_3, and T_4, respectively as presented in Table 1. All feeds and test ingredients were analyzed for proximate compositions using the method of AOAC (2000). Gross energy was calculated using the formula $T = 5.72Z_1 + 9.50Z_2 + 4.79Z_3 + 4.03Z_4 \pm 0.9\%$; where T = Gross energy, Z_I = Crude protein, Z_2 = Crude fat, Z_3 = Crude fibre, Z_4 = Nitrogen free extract (Nehring and Haelein, 1973).

Table 1. Composition of the experimental diets for West African Dwarf Goat

	Dietary levels (%)			
Ingredients	T_1	T_2	T_3	T_4
CRSCLM	0.00	20.00	40.00	60.00
PKM	48.00	38.00	30.00	20.50
BDG	47.50	37.50	25.50	15.00
Molasses	2.00	2.00	2.00	2.00
Bone meal	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50
Limestone	1.00	1.00	1.00	1.00
Total	100	100	100	100

Animal management: Thirty six (36) WAD goats of about 8 – 10 months of age and averaging 7.19kg in weight were selected from the College flock for this experiment.

The goats were randomly divided into four groups of nine animals each with three goats constituting a replicate. The groups were randomly assigned the four experimental diets (T_1, T_2, T_3, and T_4) in a completely randomized design (CRD).

The animals were housed individually in a well-ventilated cement floored pens equipped with feeders and drinkers. Each animal received a designated treatment diet in the morning (8am) for 97 days. Feed offered was based on 3.5% body weight per day; the animals in addition were fed 1kg wilted chopped *Panicum maximum* later in the day (5pm).

Regular access to fresh drinking water was made available: carcass and organ evaluation: After the 97 days feeding trial, one goat from each replicate was starved of feed for 24 hours and weighed prior to slaughter. The goats were cut at the throat, and then slaughtered by severing the heads at its articulation with the atlas bone. After dressing, the carcasses were weighed to determine the warm carcass weight. This represented the weight of the goats after removal of head, skin, thoracic, abdominal and pelvic contents and the limb distal to the joints. The dressing out percentages were calculated by dividing the warm carcass weight by the live weight prior to slaughter and multiplied by 100%. Other carcass components, organ, guts and muscles were weighed as well. The empty weights were determined by subtracting the weights of the gut contents from the live weights at slaughter. The warm carcasses were divided into two with a saw through the spinal column. The left halves were cut into various parts. The leg/thigh was severed from the attachment of the femur to the acetabulum. The lion consisted of the lumber region plus a pair of ribs and the ends (9 spare ribs and the belly) of six abdominal ribs. The shoulder consisted of the scapula, humerus, radius, ulna, carpals while the sets are made up of the breast and the neck. Each of the cut parts was weighed and doubled in each case before being expressed as a percentage of warm carcass weight.

Economics of production: The prevailing market prices of the feed ingredient at the time of the experiment were used to estimate the unit cost of the experimental diet (^362 = $1 at the time of the experiment). The variable cost of feeding the goats considered as the cost of the feed and all other cost (i.e. labour, capital investment and housing) were the same for all the treatments. The cost of processing the cassava root sieviate-cassava leaf meal (CRSCLM) was included as the feed cost. The cost per 100kg feed (^) was determine by the summation of the cost of each feed ingredient used in the formulation per treatment. The cost per kilogramme of feed (^) was determined by dividing the cost per 100kg feed by 100. Total cost of feed (^) was calculated by multiplying total feed consumed by cost per kg of feed and daily feed cost was calculated by dividing total feed cost by the number of experimental days. Feed cost/weight gain

(^) was determined by dividing total cost of feed by total weight gain. Cost benefit ratio was calculated by dividing cost/kg live weight by feed cost/weight gain.

Statistical analysis: The results were statistically analyzed using the Statistical Package for Social Sciences Window 17.0. One-way analysis of variance (ANOVA) was employed to determine the means and standard error. Treatment means were compared using Duncan's new multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of the experimental diets, CRSM, CLM and *Panicum maximum* are presented in Table 2. The dry matter (DM), crude fibre (CF) and gross energy increased with increasing levels of CRSCLM while crude protein (CP), Neutral detergent fibre (NDF) and Acid detergent fibre (ADF) decreased with increasing levels of CRSCLM. Ash, ether extract (EE), Nitrogen free extract (NFE) and hemicellulose failed to follow a specific trend across the treatment groups. The proximate composition of *Panicum maximum* in this study is in comparison with the values reported by Odedire and Babayemi (2008), Onyeonagu and Eze (2013) and Jiwuba *et al.,* (2016c) for the same forage. The cassava leaf meal (CLM) is comparable with the DM, CP, ash and NFE values reported by Allen (1984) and Akinfala *et al*. (2002). The crude protein content of the CRSM is below the acceptable 7% CP for ruminant performance as recommended by ARC (1980) and 8% suggested by Norton (1994) for ruminal function. The fibre fractions (NDF, ADF and hemicellulose) have implication on the digestibility of plants. The NDF, which is a measure of the plants' cell wall contents, which is the chemical component of the feed that determines its rate of digestion. The NDF comprises mainly the cell wall fraction of forages and roughages and includes a complex matrix of lignin, small amounts of protein, and various polysaccharides. Odedire and Babayemi (2008) noted that the higher the NDF, the lower the plant's digestible energy. The values obtained for the CRSM may imply moderate cell wall content, moderate digestible energy and DM intake. The ADF consist mainly the lignin and cellulose. Hemicellulose has been reported to be more digestible than cellulose (Gillespie, 1998). The reportedly lower values of the fibre fractions are in agreement with the findings of Boonnop *et al*. (2009) for the same cassava by product. The high energy value reported for the CRSM is in agreement with Khampa *et al*. (2009) who noted that cassava roots contain high levels of energy and have been used as a source of readily fermentable energy in ruminant rations. The high dry matter value reported is favourably compared with the values of Boonnop *et al*. (2009). The proximate composition of the experimental diets revealed that the crude protein and the energy requirements are within the ranges reported for goats (ARC, 1980; NRC 1981; Norton, 1994). The DM, CP, ash NDF, ADF and hemicellulose were higher in the control, but however compared to the treatment groups.

Diets had significant ($p<0.05$) effects on all the carcass parameters (Table 3), except for set that remained significantly ($p>0.05$) similar across the treatments. T_3 had the lowest slaughter weight which significantly ($p<0.05$) differed from T4. The difference in the slaughter weight may be attributed to lower initial weight of T_3 animals or may be due to high final weight observed for T_4 goats. T_3 showed significantly ($p<0.05$) lower empty weight in comparison to other treatments. The meat cuts are expressed as percentage of warm carcass weight apart from set, were influenced ($p<0.05$) by the dietary levels. The empty weight (7.75-11.35kg) obtained in this study is lower than 13.09-19.72kg reported by Marques *et al*. (2014) for Moxotó growing goats, but somehow comparable with 8.1-9.2kg reported by Ukanwoko and Ibeawuchi (2012) for WAD goats. The warm carcass weight (4.43-7.17kg) obtained in this study is lower than 11.01kg reported by Rodriguez *et al.* (2014) and higher than 3.40-4.65kg reported by Odoemelam *et al*. (2014). The warm carcass weights are however in agreement with the findings of Odoemelam *et al.* (2014) and Marichal *et al.* (2003) who reported significant values in warm carcass weights. The values obtained in this study also fell within the range of 2.9-9.81kg reported by Marichal *et al*. (2003). According to Devendera and Burns (1983), dressing percentage (DP) is affected by plane of nutrition and other factors such as breed, age and sex. However, the significant ($p<0.05$) differences observed in this study may be attributed to nutrition, age and slaughter weight of the goats. The dressing percentage obtained in this study however, fell within 38 and 56% baseline reported for goats. This is an indication that the diets were nourishing and supported lean meat deposition across the treatment groups. The effect of nutrition on dressing percentage cannot be over emphasis because changes in goat diets may improve both the quantity and quality of the goat meat as a final product (Geay *et al*., 2001). The influence of nutrition, age and slaughter weights (Warmington and Kirton, 1990; Marichal *et al*., 2003) has been reported to positively influence dressing percentages in goats.

Table 2. proximate composition of the experimental diets, cassava root sieviate meal, cassava leaf meal and *Panicum maximum*

Nutrients (%)	Treatments						
	T1(0)	T2(20)	T3(40)	T4(60)	CRSM	CLM	PM
Dry matter	89.95	90.40	91.00	91.44	88.60	89.12	30.93
Crude protein	15.36	14.87	13.64	13.00	2.57	17.66	5.34
Crude fibre	18.96	18.96	19.65	20.11	18.96	5.38	12.64
Ash	5.44	5.59	4.91	4.50	1.80	9.87	4.01
Ether Extract	2.15	3.26	3.38	2.90	2.71	3.93	3.17
Nitrogen free extract	48.04	42.72	50.14	50.93	68.14	52.28	26.37
Gross energy (MJ/kg)	3.94	3.89	4.07	4.04	3.79	3.76	2.27
Neutral detergent fibre	62.44	42.08	35.75	33.93	25.34	39.90	58.31
Acid detergent fibre	58.35	38.30	25.11	23.69	6.68	33.25	28.60
Hemi cellulose	4.09	3.78	10.64	10.24	8.66	6.65	19.17

CRSM = Cassava root sieviate meal; CLM = cassava leaf meal; PM = *Panicum maximum*

The meat cut is an important factor in evaluation of meat yield of goat. T_4 diet showed a superior shoulder, leg, lion, and shank weights than other treatment groups. This suggested that T_4 diet influenced the development of these cut parts better than the other treatment groups. The factors that may have attributed to the variations in the shoulder, leg, lion and shank weights include age, slaughter weight and body condition of the goats. The improved meat cut parts at T_4 may be attributed to higher available energy and lower ADF, NDF and lower protein content of the diet. Thus, high percentages of crude fibre and roughage with low digestibility could contribute to low dressing percentages (Payne and Wilson, 1999), which is a function of the meat cuts. Earlier researchers (Mtenga and Kitaly, 1990; Mahgoub *et al*., 2005) noted that increased level of protein supplement resulted to decrease in the dressing percentage (meat cuts) while increased ME levels resulted to increased carcass weight and DP.

Table 3. carcass characteristics of WAD goats fed cassava root sieviate-cassava leaf meal based diets

Parameters	T_1	T_2	T_3	T_4	SEM
Live weight at slaughter (kg)	13.17^{ab}	13.51^{ab}	11.90^{b}	14.46^{a}	0.38
Empty carcass weight (kg)	10.57^{a}	9.99^{a}	7.75^{b}	11.35^{a}	0.78
Warm carcass weight (kg)	6.20^{a}	5.67^{ab}	4.43^{b}	7.17^{a}	0.63
Dressing percentage (%)	47.08^{a}	41.97^{ab}	37.23^{b}	49.59^{a}	3.19
Meat cuts expressed as percentage (%) of warm carcass weight					
Shoulder	9.23^{ab}	10.39^{ab}	8.58^{b}	13.35^{a}	1.80
Leg	21.13^{b}	34.73^{a}	19.40^{b}	34.40^{a}	22.26
Loin	23.23^{ab}	24.66^{ab}	22.01^{b}	27.61^{a}	2.51
Sets	22.80	24.70	19.69	20.79	2.54
End	3.98^{c}	5.35^{b}	6.66^{a}	6.84^{a}	0.57
Shank	12.31^{b}	12.45^{b}	12.45^{b}	17.32^{a}	2.21

$^{a-c}$ means in the row with different superscripts are significantly different ($p < 0.05$)

The edible offal weights of WAD goats fed CRSMCLM based diets are presented in Table 4. T_1, T_2 and T_4 showed significantly ($p<0.05$) superior head values than T_3 goats. Table 5 summarizes the organ yields of WAD goats fed *Panicum maximum* supplemented with CRSMCLM based diets. The significant ($p<0.05$) value observed in this present study for head is in agreement with Odoemelam *et al.* (2014) and Ukanwoko and Okpechi, (2016) for WAD goats. The full gut also differed significantly ($p<0.05$) with $_{T3}$ having the lowest value. The result however, is in disagreement with Shaljhal (2000) who reported that gut fill could constitute 20 -22% of live weight.

There was significant difference ($p<0.05$) in the organ yields of the treatments evaluated except for spleen weights. It is a common practice in feeding trials to use weight of some internal organs like kidney and liver as indicators of anti-nutritional factors (Jiwuba *et al*., 2016d). Bone (1979) reported that if there is any toxic element in feed samples used in feeding trial, abnormalities will arise because of increased metabolic activities of the organ in an attempt to reduce these toxic elements or anti-nutritional factors to non-toxic forms.

Table 4. Offal characteristics of WAD goats fed cassava root sieviate-cassava leaf meal based diets

Parameters	T_1	T_2	T_3	T_4	SEM
Head	11.55^a	12.97^a	8.68^b	13.97^a	1.78
Full gut	16.85^a	13.23^{ab}	12.07^b	16.60^{ab}	2.31
Feet	6.30	6.66	7.76	7.51	0.30
Skin	8.00	7.56	7.16	6.54	0.31
Empty gut	5.39	5.44	6.59	5.68	0.16

$^{a-b}$ means in the row with different superscripts are significantly different ($p < 0.05$)

Table 5. Organ characteristics of WAD goats fed cassava root sieviate-cassava leaf meal based diets

Parameters	T_1	T_2	T_3	T_4	SEM
Spleen	0.985	1.17	1.375	1.14	0.03
Liver	3.505^b	3.640^{ab}	5.725^a	2.070^b	0.81
Heart	1.230^b	1.170^b	1.925^a	0.855^b	0.07
Kidney	0.915^b	1.110^b	2.640^a	0.855^b	0.22
Testes	1.215	0.59	1.445	1.695	0.12
Lungs	1.290^{ab}	1.110^{ab}	1.805^a	0.550^b	0.11

$^{a-b}$ means in the row with different superscripts are significantly different ($p < 0.05$)

The cost/benefit evaluation of WAD goats fed CRSCLM in their diets is presented in table 6. The cost of production per 100 kg feed, cost per kg of feed, total cost of feed and daily feed cost differed ($p<0.05$) significantly across the treatment groups and tended to decrease with increasing levels of CRSCLM inclusion in the diets. As the level of inclusion of CRSCLM in the diets of WAD goats increased from 0% (T_1) 0% to 60% (T_4), the overall cost of feed decreased. The feed cost/weight gain showed significant ($p<0.05$) values decreasing with increasing levels of CRSCLM. The decrease in feed cost maybe attributed to the inclusion of locally non competitive and very cheap unconventional feed (CRSCLM) in the diets of WAD goats. This is in agreement which earlier reports by Jiwuba *et al*. (2016a) who reported a reduced feed cost when *Moringa oleifera* leaf meal (locally and cheaply sourced alternative) was included in the diets of WAD goats. From the result, it could be deduced that CRSCLM also enhanced weight gain which further resulted to lower feed cost per kg weight gain. A similar result was reported by Jiwuba *et al.* (2016a). This further entail that inclusion of some potential locally cheap feed stuffs do not only reduce feed cost, but also increases weight gain. Cost benefit ratio was best for T_4. This was in agreement with the results of earlier studies by Ogundipe *et al*., (2003) who reported that the need to lower feed cost in order to produce affordable meat and other animal products for the populace cannot be over-emphasized in the face of dwindling standard of living. The result demonstrated the qualitative benefits and financial returns of using CRSCLM diets; with T_4 having the highest ratio and T_1 had the lowest value. This entails an expected benefit of ^4.79 for every ^1 cost for T_4 diet. This result suggested that the optimum level of inclusion of CRSCLM in the diet of WAD goat may not have been attained and perhaps incremental level beyond 60% inclusion may still yield higher cost benefit ratio beyond the value recorded for T_4 in this trial. That, however, would be determined by future investigation.

Table 6. Economics of production of WAD goats fed supplemental cassava root sieviate - cassava leaf meal

Parameters	T_1	T_2	T_3	T_4	SEM
Cost/100kg feed (^)	4975.00^{a}	4325.00^{ab}	4120.00^{b}	3854.50^{b}	69.21
Cost/kg of feed (^)	49.75^{a}	43.25^{ab}	41.20^{b}	38.55^{b}	0.69
Total feed consumed (kg)	31.54	33.15	32.71	34.27	1.17
Total cost of feed (^)	1569.12^{a}	1433.74^{b}	1347.65^{c}	1321.11^{c}	47.1
Daily feed cost (^)	16.18^{a}	14.78^{b}	13.89^{c}	13.62^{c}	0.46
Total weight gain (kg)	4.76^{b}	4.67^{b}	5.04^{ab}	5.27^{a}	0.32
Feed cost/weight gain (^)	329.65^{a}	307.01^{ab}	267.39^{ab}	250.69^{b}	8.35
Cost/kg live weight (^)	1200.00	1200.00	1200.00	1200.00	0.00
Cost benefit ratio	1:3.64	1:3.91	1:4.49	1:4.79	0.00

$^{a-c}$ means in the row with different superscripts are significantly different ($p < 0.05$)

In conclusion, this study revealed that cassava root sieviate – cassava leaf meal is rich in nutrients and its inclusion in the diets of WAD goats resulted to superior carcass and organ weights and lower production cost with high return on investment. It also revealed that the processing methods employed in this study for cassava by-products reduced the level of anti-nutritional factors (HCN) to a tolerable level by WAD goats. It could therefore be concluded that WAD goats fed 60% cassava root sieviate – cassava leaf meal had the best carcass and organ yields at a reduced feed cost.

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