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REPLACEMENT VALUE OF COCOA POD HUSK WITH SOURSOP PULP MEALS FOR NAPIER GRASS IN THE PRACTICAL DIET OF WEST AFRICAN DWARF SHEEP

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***ABSTRACT**: The study was conducted to assess the replacement value of cocoa pod husk with soursop pulp meals for napier grass using growth, in vitro gas production characteristics, and nutrient digestibility by West African sheep. Twenty-one (21) growing West African dwarf sheep with an average body weight of* 7.00 ± 0.55 *were randomly assigned to three (3) dietary treatments with seven (7) animals per treatment in a completely randomized design. The compared dietary treatments were T_1 (70% napier grass and 30% concentrate diet which served as the control group), T_2 (45% cocoa pod husk with 25% soursop pulp and 30% concentrate diet) and T_3 (50% cocoa pod husk with 20% soursop pulp and 30% concentrate diet). The results showed that total feed intake (18.63kg), average daily feed intake (221.79g), feed conversion ratio (8.66), gas production from the insoluble but degradable fraction (42.49ml), potential gas production (44.00ml), methane (8.01ml), metabolisable energy (8.42MJ/kg/DM), organic matter degradability (37.72%) and ether extract digestibility (70%) were significantly ($P<0.05$) highest in sheep on T_1 than T_2 and T_3. Nitrogen free extract digestibility (75.38%) was significantly ($P<0.05$) better in sheep on T_2 compared with T_1 and T_3. Final body weight (11.02kg), total body weight (3.66kg), average daily weight gain (43.57g), dry matter digestibility (71.99%), crude protein digestibility (78.93%), crude fibre digestibility (66.89%) and ash digestibility (70.72%) were significantly ($P<0.05$) highest in T_3 than T_2 and T_1. There were no significant ($P>0.05$) difference in initial body weight; gas produced from the soluble fraction, gas production rate constant for the insoluble fraction and short chain fatty acids. It is concluded that 50% cocoa pod husk with 20% soursop pulp has the potential to replace 70% napier grass in the practical diet of West African dwarf sheep.*

KEYWORDS: *Cocoa pod husk, soursop pulp, in- vitro gas, performance and sheep*

INTRODUCTION

Ruminant production is one of the major important livestock activities in most of the developing countries in the tropics. The producing areas in the tropics are characterized by long periods of dry season with little rainfall. This makes ruminant strategy in most of these developing countries like Nigeria often experience unstable level of productivity (Odeyinka and Okunade, 2005). However, the Nigeria small ruminant industry is faced with the problem of meeting the nutritional requirements of their animals (Fasae *et al.*, 2005). This is primarily because of the seasonal fluctuation in nutritive value of the native pastures which further complicated by bush encroachment and stiff competition between man and livestock for conventional feeds. This problem of feed shortage is a contributory factor to high cost of ruminant feeds which make their products unprofitable and unsustainable for humans (Okoruwa *et al*., 2012). Thus, there is need to find reliable and sustainable alternative feed sources with the view to reduce the scarcity of feeds and improve the profitability of small ruminant production in the tropics (Konlan *et al*., 2012). Notwithstanding, the use of cocoa pod husk and soursop pulp as feed sources along side with other strategies would go a long way in increasing feed supply for sheep in the tropics.

Cocoa (*Theobroma cacao) pod* husk is a by-product of cocoa harvesting industries that form about 65% of the cocoa fruit and it is essentially wasted and constituted a nuisance to the surroundings. Recent research has demonstrated that cocoa pod husk is potentially valuable resources that can be developed into high value feedstuffs (Wulandari *et al*., 2014). The major limitation of cocoa pod husk as feeds, is the aikaloid and theobromine that may have cumulative effect in livestock. According to the published values, dried cocoa pod husk may contain about 6-10% crude protein, 24-42% crude fiber, 49-61% nitrogen free extract and 9-16% ash which made up primary of potassium salt (Adamafio *et al.*, 2004). Soursop (*Annona muricata)* belongs to the family of annonaceae which has several fruit bearing species. The fruit consists of 67.50% pulp, 20% skin, 85% seeds and 4% core pite (Iombor *et al.*, 2014). However, soursop pulp is agro-industrial by-product that virtually constitutes waste in fruit processing industries. Potentially, they are characterized by high energy, fibre and minerals but relatively low in protein and vitamins (Akomolafe *et al.*, 2015. Thus, it needs to be added to other feedstuff in preparation of ruminant diets.

Consequently, cocoa pod husk with soursop pulp will serve as good source of protein and energy in livestock diet; if properly harness to reduce the anti-nutritional factors present in the feed. Considerable evident has emerged for long of the possibility of using processed cocoa pod husk as feed for livestock. Attempts to combine cocoa pod husk with soursop pulp in the feed of small ruminant has not yielded much fruit because little information is known about their uses. Hence, there is still paucity of information on their nutritional potential and feeding values in small ruminant most especially in sheep production. The present study was designed to determine replacement value of cocoa pod husk with soursop pulp meals for napier grass on growth, *in vitro gas* production, and nutrient digestibility of West African dwarf sheep.

MATERIALS AND METHODS

Location of Study

The experiment was conducted at the Sheep and Goat Unit of the Teaching and Research Farm, Ambrose Alli University, Ekpoma, Edo State, Nigeria. The area was located within longitude 6.09^0E and latitude 6.42^0N with an average annual rainfall of about 1556mm. The mean annual temperature ranged between 26^0C and 34^0C.

Collection and Preparation of Experimental Diets

Ripe cocoa pods were harvested from the plantation around Ekpoma. They were cracked open to remove the cocoa beans together with the placenta. The cocoa pods were then chopped into

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slices (average size of about 5cm), sun-dried before crushed into cocoa pod husk meal. Soursop pulps collected fresh from fruit processing factory in Edo–State were sun-dried before crush into meal. Napier grass (*Pennisetum purpureum*) was obtained within the Teaching and Research Farm at the Ambrose Alli University, Ekpoma. They were rinsed with water to remove all attached dust and allowed to wilt overnight before being chopped manually using matchet to lengths of approximately 5cm. The concentrate ingredients that comprised 78% wheat offal, 20% dried brewery grain, 0.75% limestone, 0.5% bone meal, 0.5% vitamin premix and 0.25% salt was formulated and added to the diets.

However, three experimental diets that were prepared comprise T_1(70% of napier grass and 30% concentrate diet which served as control treatment group), T_2(combination of 45% cocoa pod husk with 25% of soursop pulp and 30% concentrate diet) and T_3(mixture of 50% cocoa pod husk with 20% soursop pulp and 30% concentrate diet)

Experimental Animals and Design

Twenty one (21) West African dwarf sheep aged between 7 and 8 months old with an average body weight of 7.00 ± 0.55kg were used for the study. The sheep were purchased from weekly market within Ekpoma. They were balanced for weight and randomly allotted to three (3) dietary treatments (T_1, T_2 and T_3) of seven sheep per treatment. Each treatment was replicated seven times with one sheep per replicate in a completely randomized design.

Feeding and Management of Experimental Animals

Experimental pens were cleaned and disinfected before sheep were later allotted to individual pens. Strict veterinary care and vaccination against the common viral and bacterial diseases scheduled typical for the animals were routinely adhered. Treatment diets were offered once daily in the morning at about 08.00am in form of complete mixing and ensuring the voluntary consumption. Water was also provided for each animal at *ad libitum*. Subsequently, the live body weight of sheep were measured prior to feeding using a spring balance on weekly basis to determine change in body weight. The quantity of feed offered and leftovers were weighed daily in the morning prior to feeding to determine daily feed intake. Data gathered from the daily feed intake and daily weight gain was used to compute feed conversion ratio. The trial lasted for 84 days after a 14-day adjustment period of sheep to the experimental diets.

In Vitro Gas Production Study

Rumen fluid obtained from West African dwarf sheep previously fed with forages and concentrate diet were used for the *in vitro* gas production study. About 200mg of dry milled samples of treatment diets 1, 2 and 3 were used as the standard substrates. Samples were replicated three times for each treatment diets and placed into 100ml graduated gas tight plastic syringes. Incubation was carried out at 39^0C which lasted for 24 hours as described by Menke and Steingass (1988). At post incubation period, 4ml of NaOH (10M) was introduced to estimate methane production following the method described by Fievez *et al*. (2005). Thereafter, data were obtained from volume of gas and methane (CH_4) produced. Metabolisable energy (ME) and Organic Matter Degradability (OMD) were estimated according to Menke and Steingass (1988). Short Chain Fatty Acids (SCFA) was calculated as reported by Getachew *et al* (2003).

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The equation $Y = a + b\left(1 - e^{-ct}\right)$ was used to estimate gas production characteristics (Akinfemi *et al.*, 2009).

Where, Y = *volume of gas produced at time t,*

a = *intercept (gas produced from the soluble fraction)*

b = *gas production from the insoluble but degradable fraction*

c = *gas production rate constant for the insoluble fraction (b)*

t = *incubation time*

$a + b =$ potential gas production

$$ME = 2.2 + 0.136*GV + 0.0057*CP + 0.0002865*EE^2$$

$$OMD = 14.88 + 0.889*GV + 0.0448*CP + 0.0651*XA$$

$$SCFA = 0.0239*GV - 0.0601$$

Where: GV, CP, EE and XA were net gas production (ml/200mgDM), crude protein, ether extract and ash of the incubated samples respectively.

Digestibility Trial

Five (5) West African Dwarf sheep per treatment (totaling 15) were randomly allocated to the three dietary treatments in metabolic cages fitted with facilities for separate collection of faeces and urine. The quantity of feed offered and left over as well as faeces were determined by weighing daily for seven (7) days after a 7-day adjustment period. Sub- samples of faeces were stored in a deep freezer until required for analysis. Hence apparent nutrient digestibility was calculated using the formula:

$$\text{Apparent Nutrient Digestibility} = \frac{\text{Nutrient intake} - \text{Nutrient in Faeces}}{\text{Nutrient intake}} \times \frac{100}{1}$$

Chemical and Statistical Analyses

Proximate composition of feeds and faeces were determined according to AOAC (1990).

Data obtained from growth, *in vitro* gas production and nutrient digestibility were subjected to one-way analysis of variance (ANOVA). Significant differences between means were separated using Duncan Multiple Range Test (SAS, 1997).

RESULTS AND DISCUSSION

Experimental Diets

Table 1: Chemical composition (% DM basis) of napier grass, cocoa pod husk, soursop pulp and concentrate diet.

Nutrients	Napier grass	Cocoa pod husk	Soursop pulp	Concentrate
Dry matter	74.69	70.11	69.89	86.48
Crude protein	8.10	7.69	3.89	20.03
Ether extract	1.14	3.85	1.63	1.09
Crude fibre	29.57	28.97	7.85	14.01
Ash	9.95	9.81	1.99	7.99
Nitrogen free extract	51.24	49.68	84.64	56.92

Chemical composition of napier grass, cocoa pod husk, soursop pulp and concentrate diet are shown in Table 1. The dry matter (DM) values obtained in this study varied from 69.89 to 86.48%. The high DM value obtained in concentrate diet (86.48%) could be as a result of the feed that was prepared from dried ingredients which were characteristically high in DM than the napier grass (74.69%), cocoa pod husk (70.11%) and soursop pulp (69.89%). The crude protein (CP) values ranged from soursop pulp (3.89) to concentrate diet (20.03%). The CP values observed in napier grass (8.10%), cocoa pod husk (7.69%) and concentrate diet (20.03%) were above the 6–8% CP recommended by NRC (1985). Gratemby (2002) indicated 10–12% CP as moderate level required to satisfy the maintenance requirement of ruminant animals. Hence these diets could provide adequate nitrogen requirement for rumen microbes to maximally digest the components of the dietary fibre. Ether extract (EE) values that ranged from 1.09 to 3.85% were highest in cocoa pod husk and lowest in concentrate diet. The highest value of crude fibre (CF) was recorded in napier grass (29.57%) while the lowest in soursop pulp (7.85%). Ash and nitrogen free extract (NFE) values were varied from soursop pulp (1.99%) to napier grass (9.95%) and cocoa pod husk (49.68%) to soursop pulp (84.64%) respectively.

Growth Performance

Table 2: Growth performance of West African dwarf sheep fed cocoa pod husk with soursop pulp meals as replacement for napier grass.

	Treatments			
Parameters	T_1	T_2	T_3	SEM $\pm$
Initial body weight (kg)	7.83	7.57	7.36	2.16
Final body weight (kg)	9.98^b	10.63^a	11.02^a	1.23
Total body weight gain (kg)	2.15^b	3.06^a	3.66^a	0.25
Average daily weight gain (g)	25.60^c	36.43^b	43.57^a	0.35
Total feed intake (kg)	18.63^a	17.42^b	17.03^b	0.99
Average daily feed intake (g)	221.79^a	207.38^b	202.74^c	1.98
Feed conversion ratio	8.68^a	5.69^b	4.65^c	0.65

$^{a\,b\,c}$ Means on the same row with different superscript are significantly different (P<0.05).

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Table 2, shows the growth performance of West African dwarf sheep fed experimental diets. Initial body weight values that ranged between 7.36 and 7.83 kg were not significantly (P>0.05) affected by treatment diets. Final body weight values (9.98-11.02kg) were numerically different among sheep on treatment diets. The highest significant (P<0.05) value that was obtained in sheep on T_3 could probably be a good indication of well utilized diets which then interfered with the final body weight of the sheep. The total body weight followed a particular trend as observed in final body weight. It increases progressively from T_1 (2.15kg) to T_3 (3.66kg) in the treatment diets. However, the higher significant (P<0.05) values recorded in T_2 and T_3 might be due to the ability of the sheep to properly utilized the nutrient in the diets for total body weight. This observation for further buttressed the fact that sheep on T_2 and T_3 were in advantages over T1. Average daily weight gain was significantly (P<0.05) better in sheep on T_3(43.57g) compared with T_2 (36.43g) and T_1(25.60g). This implies that sheep on T_3 provide more sufficient and efficient nutrient in the treatment diets to meet the daily weight gain of the growing sheep. The recorded values in this study were within the average daily weight gain value (43.33g) for sheep as reported by Okoruwa *et al.* (2015).

Moreover, several reports indicated that feed intake is an important factor in the utilization of feed by ruminant livestock and a critical determinant of energy intake and performance in small ruminants (Ososanya, 2010; Garba *et al*., 2010). Total feed intake (TFI) decreased significantly (P<0.05) as the inclusion levels of cocoa pod husk increases with decreased in soursop pulp levels in the diets. Animal on T_1 (18.63kg) had the highest TFI, followed by T_2 (17.42kg) and then T_3 (17.03kg) was the least. This decreasing trend in the corresponding diets (T_1, T_2 and T_3) could be attributed to the decrease in acceptability and the physical nature of the diets which could probably interfered with the efficient stimulation of feed intake. This agrees with the report of Aderolu *et al*., 2007) who reported that decreased in feed intake by ruminant livestock have been found to depend on acceptability and physical characteristics of the feed. Average daily feed intake (ADFI) values were significantly (P<0.05) highest in T_1 (221.79g/day), followed by T_2 (207.38g/day) before T_3 (202.74g/day). The ADFI values observed in this study were lower than the range values of 424.30–575.90g/day obtained for growing ewe-lambs fed raw, cooked or fermented cassava-urea meals as established by Olorunnisomo (2010). This difference in ADFI could be as a result of difference in nature of the feeds which could partly contribute to the variation observed. This is in consonance with the report of Jokthan *et al.* (2010) who observed that the nature of feeds play an important role in determining the average daily feed intake in ruminant livestock.

However, feed conversion ratio (FCR) that is measured by feed intake per unit weight gain was significantly (P<0.05) highest in sheep on T_1 (8.66), followed by T_2 (5.69) before T_{3} (4.65). This means that, the efficiency at which sheep converted feeds for their body weight gain in T_3 was lowest and indicated better feed conversion ratio of the diets. However, the positive response between the daily weight gain and better FCR obtained on T_3 could be probably used to further attest the superiority of sheep on T_3 in term of nutrient availability and utilization over others.

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In Vitro Gas Production

Table 3: *In vitro* gas production characteristics of standard substrates (experimental diets ml/200mgDM) in rumen fluid of sheep fed forages and concentrate diet (24 hours).

Parameters	Treatments T_1	T_2	T_3	SEM ±
a (ml)	1.51	1.49	1.61	0.12
b (ml)	42.49^{a}	36.67^{b}	35.99^{b}	2.05
a + b (ml)	44.00^{a}	38.18^{b}	37.48^{b}	2.07
c (mlh^{-1})	0.07	0.06	0.06	0.08
CH_4 (ml)	8.01^{a}	4.49^{b}	4.58^{b}	1.02
ME (MJ/Kg/DM)	8.42^{a}	6.72^{b}	6.91^{b}	0.21
OMD (%)	37.72^{a}	34.73^{b}	35.81^{b}	0.87
SCFA (µM)	0.99	0.76	0.79	0.16

CH_4 = Methane, ME = Metabolizable energy, OMD = Organic mater, SCFA = Short Fatty Acids
$^{a\,b\,c}$ means on the same row with different superscript are significantly different (P<0.05).

Presented in Table 3, is the *in vitro* gas production characteristics of the standard substrates (dietary treatments T_1, T_2 and T_3) in rumen fluid of sheep fed forages and concentrate diet that were incubated for 24hrs. The result showed that cumulative gas volume at 24hrs after incubation, differed significantly (P<0.05) for all parameters assessed except gas production from soluble fraction (a), rate of gas production (c) and short chain fatty acids (SCFA) that were not significantly (P>0.05) affected by treatment diets. The non-significant values (1.49-1.61ml) observed for gas production from soluble fraction (a) could probably due to soluble feed ingredients added to the dietary treatments. Akinfemi *et al.* (2009) reported that mathematical description of gas production profiles allow analysis of data, evaluation of substrates and media related differences as well as fermentable component of feeds. The fermentation of the insoluble but degradable fraction (b) and potential gas production (a + b) differed significantly (P<0.05) with the highest mean value observed in T_1 (42.49 & 44.00ml) followed by T_2 (36.67 & 38.18ml) and the lowest in T_3 (35.99 & 37.48ml). The observed low (b) and (a + b) on T_3 could probably due to the fibre combination in cocoa pod husk with soursop pulp which might probably resulted to low nutrient availability for rumen microbes. This observation was further buttressed by the fact that sheep on T_1 had the highest feed intake (Table, 2) and lowest nutrient digestibility (Table, 4). Cerillo and Juarez (2004) indicated that the intake of a feed is mostly explained by the rate of gas production which affects the rate of passage of the feed through the rumen whereas the potential gas production (a + b) is associated with the degradability of the feed. The rate of gas production (c) ranged from 0.06 to 0.07mlh^{-1}. The fastest rate of gas production was observed on T_1 (0.07mlh^{-1}), possibly influenced by the soluble carbohydrate fraction readily available to the microbial population. Slower rate were observed on T_2 (0.06mlh^{-1}) and T_3 (0.06mlh^{-1}) indicating that these diets were less readily available to the microbes in the rumen. Significant variation (P<0.05) was observed for methane (CH_4) production with T_2 (4.49ml) and T_3 (4.58ml) recorded the lowest compared with T_1 (8.01ml). Hence, methanogenesis was obviously suppressed in T_2 and T_3 which translated to more efficient utilization of the diets. It was reported by Babayemi and Bamikole (2006) that methane gas is an important gas among gases produce by ruminants during fermentation which have negative correlation with energy utilization in ruminants. Akinfemi *et al* (2009) reported that, though gas production is a nutritional wasteful product but it provides useful basis from which ME, OMD and SCFA may be predicted. The metabolizable energy (ME) and organic matter digestibility (OMD) differed significantly (P<0.05) with T_1 (8.31MJ/kgDM and 37.72%) recorded the highest compared to T_3 (6.91MJ/kgDM and 35.81%) and T_2 (6.72MJ/kgDM and 36.73%). The low values observed in ME and OMD in T_2 and T_3 suggest the presence of non-methanogenic fibre degrading microbes, hence a mutual relationship exists between total methane production and ME with OMD (Babayemi, 2006). Sallam (2005) stated that the prediction of ME is more accurate when *in vitro* gas volume measurement and chemical constituents are used. The Short Chain Fatty Acids (SCFA) estimated values were 0.99, 0.76 and 0.79µM for T_1, T_2 and T_3. The low SCFA estimated for T_2 (0.76µM) and T_3 (0.79µM) were due to lower gas production which was evident in the first 24 hours of incubation while the highest estimated SCFA for T_1 (0.99µM), suggests a potential to make energy available to the rumen microbes. Akinfemi *et al* (2009) confirmed a close association between SCFA and *in vitro* gas production.

Apparent Nutrient Digestibility

Table 4: Apparent nutrient digestibility (%) of West African dwarf sheep fed experimental diets.

Treatments				
Nutrients	T_1	T_2	T_3	SEM $\pm$
Dry matter	70.92^a	69.93^b	71.99^a	1.61
Crude protein	68.03^c	70.92^b	78.93^a	0.08
Ether extract	70.07^a	65.27^b	64.04^b	0.01
Crude fibre	53.98^c	66.22^b	70.72^a	0.02
Ash	58.65^c	66.22^b	70.72^a	0.51
Nitrogen free extract	64.59^c	75.38^a	73.99^a	1.87

$^{a\,b\,c}$ means on the same row with different superscript are significantly different (P<0.05)

The apparent nutrient digestibility coefficients of West African dwarf sheep fed experimental diets are presented in Table 4. Dry matter (DM) digestibility values for sheep varied significantly (P>0.05) between treatment groups, indicating difference in DM digestibility values among treatment diets. However, the DM digestibility ranged values (69.93–71.99%) recorded in this study were higher than the DM digestibility values (37.87–41.33%) reported for sheep fed ensiled hyacinth diets (Akinwande *et al.*, 2011). Crude protein (CP) digestibility was significantly influenced (P<0.05) by dietary treatments with sheep on T_3 (78.93%) recorded the highest, followed by T_2 (70.92%) before T_1 (68.03%). This gradual increased in the trend of CP digestibility as the inclusion levels of cocoa pod husk increases in the diets, could be associated with CP content in cocoa pod husk which probably improved the efficiency of microbial nitrogen synthesis in the diets. Thus, the higher values of CP digestibility recorded in T_2 and T_3 indicated that cocoa pod husk could serves as potential protein that would enhance the intake and utilization of low quality feeds by ruminants. However, the CP digestibility values obtained in this study were adequate to support the growth performance of sheep, since the values were above the minimum value (10-12%) necessary to provide sufficient nitrogen required by rumen micro-organism to support optimum activity (Akinwande *et al.*,2011). Ether extract (EE) digestibility values that ranged between 64.04 and 70.07% was significantly (P<0.05) highest in

T_1, indicating that EE content was useful in assessing the quality of the diet and also an idea of the amount of fat and oil present in the diet. However, the reduction in EE digestibility in T_2 and T_3 could probably be as a result of varying levels of cocoa pod husk with soursop pulp that was imbalance in fat and oil which had associative digestive effect on EE digestibility. The recorded values for EE digestibility in this study were not in agreement with ranged values (92.48 to 94.02%) of EE digestibility for sheep reported by Bolaji *et al* (2010). There were significant (P<0.05) difference in crude fiber (CF) digestibility values measured across treatment diets. Digestibility of CF increased progressively as the levels of cocoa pod husk inclusion increased with decreased in soursop pulp in the treatment diets. This might probably reflect the better utilization of cocoa pod husk than napier grass and soursop pulp. Wulandari *et al*. (2014) reported that the cellulosic from bacteria microbial inoculums growing in fermented cocoa pod is capable of degrading fiber and lowering theobromine content to improve fiber digestibility. Thus, the CF digestibility values obtained in this study might be an evidence for proper utilization of cocoa pod husk than napier grass and soursop pulp. Ash was best digested on T_3 (70.72%), followed by T_2 (66.22%) while T_1 (58.65%) was the least. The observed differences could be a true reflection of the mineral components that were absorbed and utilized in the diets by the sheep, since nutrient digestibility among other factors would depend on the nutrient composition and differential level of a ration (Ahamefule *et al*., 2001). Nitrogen free extract (NFE) digestibility varied significantly (P<0.05) among treatment diets with sheep on T_2 (75.38) and T_3 (73.99%) being optimally digested than T_1 (64.59%). The highest significant (P<0.05) values obtained T_2 and T_3 could be indication of better proportion of energy source in the treatment diets attributed by soursop pulp that was appropriate degraded by the rumen microbial activity to enhance energy. Notwithstanding, the comparative high nutrient digestibility of sheep on T_2 and T_3 suggest that cocoa pod husk with soursop pulp inclusion at these levels provide sufficient nutrient for the rumen microbes which help in achieving more efficient utilization fibre and other nutrient components that bringing about higher digestibility. Konlan *et al.* (2012) stated that better nutrient intake and digestibility may account for good performance in sheep.

CONCLUSION

It is therefore concluded that feeding cocoa pod husk with soursop pulp to sheep had the potential of meeting the nutritional needs in terms of basal component feeds without any adverse effect on the sheep. The response in growth performance, *in vitro* gas production and nutrient digestibility by sheep indicated that feeding 50% cocoa pod husk with 20% soursop pulp and 30% concentrate diet (T_3) can be recommended as a suitable feedstuff for sheep, especially during feed scarcity. This will reduce the feed stress of dry season and enhance sheep performance and productivity in the tropics.

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