

# INFLUENCE OF DIFFERENT FEED ON WEEKLY BODY WEIGHT AND MORPHOMETRIC TRAITS OF NIGERIAN GOATS

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## ABSTRACT

**Objective:** The objective of the experiment was to study the influence of different feed on weekly body weight (BW) and morphometric traits of Nigerian goats

**Methods:** A total of 36 weaner goats of two breeds (West African dwarf, n=18; 9 males + 9 females) and Red Sokoto goats, n=18; 9 males + 9 females) of about 3–4 months of age were used for the experiment and the treatments comprised of three diets group (100% *Digitaria smutsii* [DS], 50% DS+50% Groundnut haulm [GH], and 50% DS+50% CH). Data collected were BW, body length, withers height, chest girth (CG), chest depth (CD), rump height, cannon circumference (CC), chest width (CW), hind leg length (HL), fore leg length (FL), and ear length (EL). The data on BW and morphometric were subjected to analysis of variance to test the fixed effect of feed on BW and morphometric traits using Statistix Analytical software, file version 8.0. Significant differences among the means were separated using Duncan's Multiple Range Test.

**Results:** The results indicated that goats fed 50% DS+50% CH diet had significant ( $p<0.05$ ) higher values for all the parameters with significant differences in all 8 weeks of the experiment. At week 1, goats fed 50% DS+50% CH had significantly ( $p<0.05$ ) higher BW compared to those fed 100% DS and 50% DS+50% GH. At week 2, those fed 50% DS+50% CH had higher BW, CG, CC, CW, HL, FL, and EL compared to those fed 100% DS and 50% DS+50% GH. The results also showed that those fed 50% DS+50% CH had significantly ( $p<0.05$ ) higher BW at weeks 3, 4, and 5 and CD at weeks 6 and 7. Similarly, those fed 50% DS+50% CH had significantly ( $p<0.05$ ) higher BW and CD at week 8.

**Conclusion:** The goats fed 50% DS+50% CH feed not only gained more weight but also exhibited better morphometric traits, indicating improved feed efficiency and nutrient utilization. This implies that goat farmers in the study area should consider implementing a feed that includes 50% DS+50% CH to maximize growth performance in their herds and feeding of goats with GHs and cowpea husk are beneficial and does not negatively affect the BW and morphometric traits of Nigerian goats.

**Keywords:** Effect, Diet, Body weight, Weekly, Morphometric, Nigerian goats.

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## INTRODUCTION

The nutritional management of goats is crucial for optimizing their growth, health, and productivity, particularly in regions, such as Nigeria where livestock farming is a significant component of the agricultural economy (Abubakar *et al.*, 2021). Goats are known for their adaptability to various environmental conditions and their ability to thrive on a diverse range of feedstuffs. However, the choice of diet can significantly influence their growth performance and overall health. The potential benefits of incorporating local feed resources such as groundnut haulms (GH) and cowpea husks into goat diets, particularly as sustainable alternatives to conventional feed sources (Nuwam, 2015).

Goat farming in Nigeria faces significant challenges related to feed availability and quality, especially during the dry season when traditional pastures are scarce. This scarcity leads to inadequate nutrition, which adversely affects the growth performance and overall health of goats. The reliance on conventional feed resources is often insufficient to meet the dietary needs of goats, resulting in poor weight gain and suboptimal morphometric traits (Obe and Yusuf, 2017). Furthermore, there is limited knowledge regarding the effects of alternative feed sources, such as agro-industrial by-products and non-conventional feeds, on the performance of Nigerian goat breeds, particularly the West African Dwarf and Red Sokoto goats (Obe and Yusuf, 2017). This lack of information hinders farmers from making

informed decisions that could enhance productivity and sustainability in goat farming.

Therefore, understanding how these different diets affect body weight (BW) and morphometric traits is essential for developing effective feeding strategies that enhance the productivity of goats in Nigeria and will help identify optimal dietary formulations that can enhance weekly BW gains and morphometric traits in Nigerian goats. This could lead to improved growth rates and better overall health for livestock. Therefore, experiment was conducted to study the effect of diet (*Digitaria smutsii* [DS], GH and cowpea husks), on weekly BW and morphometric traits of Nigerian goats thereby contributing to improved livestock management practices and food security in the Nigeria.

## METHODS

### The study area

The research was conducted at the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture Shabu-Lafia Campus, Nasarawa State University, Keffi. The study area is located in the Guinea savanna zone of North Central Nigeria and found on latitude 08° 33' N and longitude 08° 32' E.

### Experimental feed

The grass (DS) was sourced from the National Animal Production Research Institute/Ahmadu Bello University, Shika, Zaria, Nigeria

while the two legumes (GH and cowpea husk) were sourced from farms after harvest in Lafia, Nasarawa State. After collection, the haulms were brought to the Faculty Livestock Farm, where they were shade-dried and debris was removed before being fed to the experimental goats. The DS, GHs, and cowpea husks were fed to the experimental goats.

### Experimental design

The experiment comprises of 3 feeds, 100% DS, 50% DS+50% GH and 50% DS+50% CH with 12 goats in each of the feeding groups replicated 3 times with 4 goats in each of the replicates in a Completely Randomized Design (CRD). The goats were tagged and distributed into 18 pens with 2 goats (male and female) in each pen and they were balanced on the basis of weight to avoid bias at the beginning of the experiment.

### Experimental goats and management

Physically sound goats were randomly sourced from reputable local farms in Lafia, Nasarawa State. A total of 36 weaner goats of two breeds (West African dwarf, n=18; 9 males + 9 females) and Red Sokoto goats, n=18; 9 males + 9 females) of about 3–4 months of age were sourced for the experiment. On arrival, the goats were allowed to acclimatize for a period of 2 weeks during which they were dewormed against endoparasites and ectoparasites and vaccinated against *Peste des petits ruminants*. The experimental diets and water were given *ad libitum*.

### The BW and morphometric traits

BW was taken using an industrial hook hanging weight Crane scale to the nearest 0.1 kg. The goats were turned on their back in a Hessian Jute bag/sack and the weight was taken as the difference between the weight and the weight of the bag/sack. Data on BW were taken on a weekly basis.

The morphometric traits were taken from animals in a standing position with a raised head. The morphometric traits were carried out using a measuring tape. The morphometric traits taken include, body length (BL), withers height (WH), chest girth (CG), chest depth (CD); rump height (RH), cannon circumference (CC), chest width (CW), rump width (RW); hind leg length (HL), fore leg length (FL) and ear length (EL) were measured.

### The below morphometric traits were measured as

- BL: It was measured from the point of the shoulder to the pin bone (cm)
- WH or height at withers (WH): This measured from the surface of the platform on which the animal stood to the withers of the animal (cm)
- CG: It was measured as the body circumference just behind the forelegs (cm)
- CD: This was measured from the most dorsal point of the withers to the ventral surface of the sternum (cm)
- RH: This was measured from the surface of a platform to the rump
- CC was measured from the left mid metacarpus (region between wrist and the toes) (cm)
- CW or shoulder width (CW): This was measured as the distance from the left to right shoulder blade (cm)
- RW: This was measured as the distance between two tuber coxae (hip bone or hip joint) (cm)
- HL: This was measured from the hip joint down to the base of the hoof (cm)
- FL: This measurement was taken from the shoulder down to the hoof (cm)
- EL: This was taken as the length of the external ear from its root to the tip (cm).

### Statistical analysis

Data collected were subjected to analysis of variance to test the fixed effect of diet on BW and morphometric traits. Significant differences between treatment means were separated using the Duncan's Multiple Range Test option of the Statistix Analytical software, file version 8.0.

The mathematical model employed was:

$$Y_{ij} = \mu + F_i + e_{ij}$$

Where;

$Y_{ij}$  = individual observation,

$\mu$  = general or overall mean,

$F_i$  = effect of feed type ( $i=100\%$  DS, 50% DS+50% GH, 50% DS+50% CH)

$e_{ij}$  = experimental error.

### RESULTS AND DISCUSSION

Table 1 shows the effect of diet on BW and morphometric traits of goats at week 1. The results showed that the diet had significant ( $p<0.05$ ) effect on BW but no significant ( $p>0.05$ ) effect in all the morphometric traits measured. The goats fed 50% DS+50 CH had significantly ( $p<0.05$ ) higher BW ( $7.51\pm0.50$  kg) followed by those fed 100% DS ( $6.86\pm0.39$  kg) though similar with 50% DS+50 GH ( $5.99\pm0.30$  kg).

The results are in agreement with the work of Yashim *et al.* (2016) who stated that Red Sokoto goats fed 40% cowpea had higher BW (13.50 kg) than 10.77 kg of those fed 40% GH. The possible reasons according to the authors could be due the high feed intake observed on goats fed 40% level of cowpea haulms and could be an indication of increased palatability of cowpea haulm to goats. This agrees with the report of Nuwam (2015) that supplementation with legume forage significantly enhanced ( $p<0.05$ ) feed intake in Red Sokoto does thereby leading to better BW than those fed DS.

The implication of the observed findings suggests that legume forages enhance feed intake and subsequently improve BW in goats in Nigeria.

Table 2 shows the effect of diet on BW and morphometric traits of goats at week 2. The results revealed that diet had significant ( $p<0.05$ ) effect on BW and some morphometric traits (CG, CC, CW, HL, FL and EL) at week 2. The goats fed 50% DS+50 CH had significantly ( $p<0.05$ ) higher BW ( $8.74\pm0.54$  kg) than those fed 100% DS ( $7.19\pm0.49$  kg) and 50% DS+50 GH ( $6.76\pm0.32$  kg). Similar trend was found for morphometric traits such as CG, CC, CW, HL, FL and EL with goats fed 50% DS+50 CH having significantly ( $p<0.05$ ) higher values than those fed 100%DS and 50% DS+50 GH.

The results of this study agreed with the work of Yashim *et al.* (2016) that BW of Red Sokoto and West African Dwarf goats fed a diet containing 40% Cowpea husk performed better than those fed 40% GH and solely forage grass. This could be due to goats fed cowpea husk had better feed intake because of the palatability, crude protein digestibility, and nitrogen retention values, leading to improved growth compared to goats on groundnut and DS diets (Adamu *et al.*, 2016). Similarly, Dido *et al.* (2020) reported that goats fed Cowpea had higher BW and morphometric traits than those fed groundnut husks and the authors attributed it to the efficient utilization of cowpea husk which resulted to high BW gain. Olafadehan *et al.* (2017) shown that goats fed diets containing cowpea husk experienced improvements in BW, body morphology, and testicular characteristics compared to those on other diets containing GH and forage grass. This indicating that cowpea husk in the diet led to changes in body morphology highlighting the positive impact of cowpea husk supplementation on the overall development and performance of goats. The authors further stated that inclusion of cowpea husk up to 70% in goat ration could enhance voluntary intake, BW, morphological and testicular characteristics, and economic returns.

The implications of the results indicating that diet significantly affects BW and various morphometric traits (including CG, chest circumference [CC], CW, HL, FL, and EL) at week 2 suggest that feeding strategies play a crucial role in optimizing goat growth and development and indicating that the inclusion of cowpea in the diet enhances both weight gain and morphometric measurements, thereby underscoring the importance of diet composition in improving livestock productivity and health outcomes in goat farming.

**Table 1: Effect of different feed on body weight and morphometric traits of goats at week 1**

Traits	Feed type			p-value	LOS
	100%DS	50%DS+50%GH	50%DS+50%CH		
BW (kg)	6.86±0.39 <sup>ab</sup>	5.99±0.30 <sup>b</sup>	7.51±0.50 <sup>a</sup>	0.0385	*
BL (cm)	42.93±0.96	44.34±0.92	44.33±0.86	0.476	NS
WH (cm)	39.53±1.38	40.68±1.49	39.78±1.11	0.681	NS
CG (cm)	44.58±1.20	43.92±0.91	46.32±0.87	0.1727	NS
CD (cm)	15.29±0.20	15.93±0.40	16.28±0.64	0.2533	NS
RH (cm)	43.40±0.99	44.14±0.91	45.27±1.25	0.3007	NS
CC (cm)	7.04±0.11	7.13±0.07	7.24±0.19	0.5728	NS
CW (cm)	18.75±0.73	17.72±0.53	19.15±0.46	0.2348	NS
RW (cm)	19.72±0.62	19.00±0.76	19.77±0.48	0.6357	NS
HL (cm)	43.13±1.24	41.69±0.87	44.77±1.47	0.106	NS
FL (cm)	35.42±1.11	35.62±0.67	36.13±1.03	0.8644	NS
EL (cm)	11.32±0.33	11.22±0.32	11.66±0.40	0.6543	NS

<sup>ab</sup>Means in the same row bearing different superscripts differ significantly (p<0.05). DS: *Digitaria smutsii*, GH: Groundnut haulm, CH: Cowpea husk, BW: Body weight, BL: Body length, WH: Withers height, CG: Chest girth, CD: Chest depth, RH: Rump height, CC: Cannon circumference, CW: Chest width, HL: Hind leg length, FL: Fore leg length, EL: Ear length, LOS: Level of significant, \*: Significant at 0.05, NS: No significant, kg: Kilogram, cm: Centimeter

**Table 2: The effect of different feed on body weight and morphometric traits of goats at week 2**

Traits	Feed type			p-value	LOS
	100% DS	50% DS+50%GH	50%DS+50%CH		
BW (kg)	7.19±0.49 <sup>b</sup>	6.76±0.32 <sup>b</sup>	8.74±0.54 <sup>a</sup>	0.0187	*
BL (cm)	45.74±1.02	46.10±0.86	48.44±1.22	0.1668	NS
WH (cm)	42.92±1.27	44.41±1.24	44.99±1.50	0.5307	NS
CG (cm)	45.39±1.79 <sup>ab</sup>	44.65±0.87 <sup>b</sup>	48.80±1.01 <sup>a</sup>	0.0438	*
CD (cm)	18.22±0.70	17.66±0.60	19.29±0.51	0.206	NS
RH (cm)	45.72±1.29	45.56±0.98	48.88±1.42	0.1378	NS
CC (cm)	8.29±0.32 <sup>ab</sup>	7.95±0.11 <sup>b</sup>	8.68±0.22 <sup>a</sup>	0.0473	*
CW (cm)	24.03±1.01 <sup>b</sup>	24.14±1.11 <sup>b</sup>	27.80±1.21 <sup>a</sup>	0.0421	*
RW (cm)	25.40±1.22	25.31±0.164	29.35±1.45	0.1026	NS
HL (cm)	44.81±1.36 <sup>ab</sup>	42.98±0.79 <sup>b</sup>	48.21±1.35 <sup>a</sup>	0.0214	*
FL (cm)	37.72±1.04 <sup>ab</sup>	36.71±0.68 <sup>b</sup>	40.15±0.83 <sup>a</sup>	0.0371	*
EL (cm)	12.56±0.26 <sup>b</sup>	12.43±0.35 <sup>b</sup>	13.86±0.56 <sup>a</sup>	0.0364	*

<sup>ab</sup>Means in the same row bearing different superscripts differ significantly (p<0.05). DS: *Digitaria smutsii*, GH: Groundnut haulm, CH: Cowpea husk, BW: Body weight, BL: Body length, WH: Withers height, CG: Chest girth, CD: Chest depth, RH: Rump height, CC: Cannon circumference, CW: Chest width, HL: Hind leg length, FL: Fore leg length, EL: Ear length, LOS: Level of significant, \*: Significant at 0.05, NS: No significant, kg: Kilogram, cm: Centimeter

The effect of diet on BW and morphometric traits of goats at week 3 is presented in Table 3. The results showed that diet had significant (p<0.05) effect on BW at week 3. The diet (50% DS+50 CH) had significantly (p<0.05) higher BW (8.38±0.53 kg) than 100% DS and 50% DS+50 GH who had 6.78±0.45 kg and 6.69±0.36 kg, respectively. The results obtained for the morphometric traits indicates that diet has no significant (p>0.05) effect on all the morphometric traits measured at week 3.

The differences observed in the BW of goats agreed with the report of Nuwam (2015) that supplementation with legume forage particularly cowpea significantly enhanced (p<0.05) feed intake in Red Sokoto goats and this could be one of the reasons for better BW than those fed 100% DS and 50% DS+50 GH. The result is also in agreement with the report of Yashim *et al.* (2016) who stated that Red Sokoto and WAD goats fed 40 40% cowpea had higher BW gain than those fed GH and forage grass and the reason could be due to higher nutrient digestibility in those fed 40% cowpea as reported by authors.

**Table 3: Effect of different feed on body weight and morphometric traits of goats at week 3**

Traits	Feed type			p-value	LOS
	100%DS	50%DS+50%GH	50%DS+50%CH		
BW (kg)	6.78±0.45 <sup>b</sup>	6.69±0.36 <sup>b</sup>	8.38±0.53 <sup>a</sup>	0.0244	*
BL (cm)	47.56±1.65	46.34±1.15	47.75±1.53	0.7617	NS
WH (cm)	45.71±1.09	44.10±1.19	47.13±1.22	0.2126	NS
CG (cm)	47.25±1.86	46.24±1.21	50.13±1.09	0.1604	NS
CD (cm)	20.85±0.84	21.13±0.44	21.71±0.74	0.6755	NS
RH (cm)	48.13±0.61	46.74±0.94	49.24±1.45	0.2693	NS
CC (cm)	8.24±0.17	8.49±0.22	8.24±1.45	0.1129	NS
CW (cm)	24.21±0.69	23.88±0.61	24.38±1.05	0.9059	NS
RW (cm)	24.19±0.56	25.35±0.99	25.88±1.17	0.4462	NS
HL (cm)	47.76±1.02	46.13±0.95	49.14±1.52	0.2239	NS
FL (cm)	39.28±0.68	38.48±0.65	40.05±0.50	0.2172	NS
EL (cm)	13.09±0.29	13.04±0.43	13.88±0.56	0.3431	NS

<sup>ab</sup>Means in the same row bearing different superscripts differ significantly (p<0.05). DS: *Digitaria smutsii*, GH: Groundnut haulm, CH: Cowpea husk, BW: Body weight, BL: Body length, WH: Withers height, CG: Chest girth, CD: Chest depth, RH: Rump height, CC: Cannon circumference, CW: Chest width, HL: Hind leg length, FL: Fore leg length, EL: Ear length, LOS: Level of significant, \*: Significant at 0.05, NS: No significant, kg: Kilogram, cm: Centimeter

Table 4 represents the effect of diet on BW and morphometric traits of goats at week 4. The observed results showed that diet had significant (p<0.05) effect on the BW of goats at week 4 but no significant effect in all the morphometric traits measured. The 50% DS+50 CH diet had significantly (p<0.05) higher BW (9.17±0.67 kg) than 100% DS (7.82±0.47 kg) and 50% DS+50 GH (7.54±0.47 kg).

The result is also in consonant with the report of Adamu *et al.* (2016) who reported higher BW on Red Sokoto and Sahelian goats supplemented with cowpea husk. The observed differences in BW across the diet in this study is contrary to work of Babale *et al.* (2018) who reported no significant difference in BW among WAD goats fed Cowpea husk, GH, and Brewer's dried grains. The variation could be due to use of single breed, geographical location, variation in the season where the research was conducted, inclusion levels among other environmental factors. Cowpea haulms and GH have been found to be valuable supplements due to their high crude protein content, which can help in augmenting protein deficiencies in animal diets (Tekle and Gebru, 2018).

Table 5 represents the effect of diet on BW and morphometric traits of goats at week 5. The diet shows no significant (p>0.05) effect on the BW and all the morphometric traits measured. Meanwhile, diet 50%DS+50 CH had higher numerical values than 100% DS and 50% DS+50 GH for all the traits measured except for CC where 50% DS+50 GH had the highest numerical values (9.10±0.21 cm).

The no significant differences observed across all the diets in week 5 in almost all the traits in this present study is similar to the work conducted by Hossain *et al.* (2003) that goats supplemented with high protein, low protein, or no protein diet showed no significant difference between the diets in dry matter intake and general growth performance. The authors stated that when ruminants, such as goats are offered supplemented low-quality roughage, their performance will probably drop. However, the quality of protein is less important than the quantity for ruminant livestock, as the microorganisms in the rumen manufacture their own body protein (Schoenian, 2003). Therefore, the no differences across the three diets could be as the results of the aforementioned. The results observed is similar with that of Yusuf *et al.* (2014) who reported that Boer goats fed or supplemented with 1.5% *Andrographis paniculata* whole plant (APWP) diet had similar weight with those fed without *Andrographis paniculata* whole plant (APWP).



The effect of diet on BW and morphometric traits of goats at week 6 is shown in Table 6. From the results obtained, it shows that diet had no significant ( $p>0.05$ ) effect in the BW and all the morphometric traits of goats at week 6 except on CD where goats fed 50% DS+50 CH had significantly ( $p<0.05$ ) higher CD ( $22.68\pm0.54$  cm) than those fed 100% DS ( $21.49\pm0.38$  cm) and 50% DS+50 GH ( $20.60\pm0.51$  cm), respectively. Although no significant, the goats fed 50% DS+50 CH had the highest numerical values than those 100% DS and 50% DS+50 GH except on CC, CW and RW.

The significance of the results indicating that diet had no significant effect on BW and most morphometric traits of goats at week 6, except for CD, underscores several key points in goat nutrition and management practices. The observed no significant difference in BW across all the diet groups at week 6 is in agreement with the report of Babale *et al.* (2018) who reported no significant difference in BW and other morpho-structural traits in WAD goats fed cowpea husk, GH, forage, and brewer's dried grains. The reason for no observed differences may be that the animals fed cowpea husks, GH, and DS had similar feed intake, crude protein digestibility, and nitrogen retention values (Adamu *et al.*, 2016).

**Table 4: Effect of different feed on body weight and morphometric traits of goats at week 4**

Traits	Feed type			p-value	LOS
	100%DS	50%DS+50%GH	50%DS+50%CH		
BW (kg)	7.82±0.47 <sup>ab</sup>	7.54±0.47 <sup>b</sup>	9.17±0.67 <sup>a</sup>	0.0159	*
BL (cm)	47.89±1.61	46.53±1.15	48.98±1.43	0.5069	NS
WH (cm)	46.55±1.23	44.86±1.25	47.73±1.25	0.2989	NS
CG (cm)	48.29±1.66	47.59±0.94	51.09±1.13	0.1796	NS
CD (cm)	22.10±0.55	21.60±0.57	23.10±0.49	0.1737	NS
RH (cm)	48.68±0.69	48.41±1.43	49.44±1.61	0.8432	NS
CC (cm)	8.88±0.16	9.09±0.21	8.96±0.19	0.7217	NS
CW (cm)	26.25±1.10	25.96±0.48	26.30±1.19	0.967	NS
RW (cm)	26.45±1.08	27.80±0.74	27.29±1.15	0.6367	NS
HL (cm)	48.31±1.03	47.51±1.06	49.76±1.71	0.4864	NS
FL (cm)	39.91±0.55	41.33±1.18	41.89±1.20	0.3553	NS
EL (cm)	13.48±0.35	13.60±0.62	13.87±0.59	0.8599	NS

<sup>ab</sup>Means in the same row bearing different superscripts differ significantly ( $p<0.05$ ). DS: *Digitaria smutsii*, GH: Groundnut haulm, CH: Cowpea husk, BW: Body weight, BL: Body length, WH: Withers height, CG: Chest girth, CD: Chest depth, RH: Rump height, CC: Cannon circumference, CW: Chest width, HL: Hind leg length, FL: Fore leg length, EL: Ear length, LOS: Level of significant, \*: Significant at 0.05, NS: No significant, kg: Kilogram, cm: Centimeter

**Table 5: Effect of different feed on body weight and morphometric traits of goats at week 5**

Traits	Feed type			p-value	LOS
	100%DS	50%DS+50%GH	50%DS+50%CH		
BW (kg)	7.83±00.56	7.72±00.34	9.14±0.61	0.0369	NS
BL (cm)	48.03±01.61	47.06±01.10	49.27±1.38	0.5624	NS
WH (cm)	46.63±01.23	45.50±0.94	48.07±1.19	0.3189	NS
CG (cm)	48.41±1.76	47.80±0.88	50.39±1.02	0.3928	NS
CD (cm)	22.14±0.46	21.64±0.61	23.04±0.37	0.1576	NS
RH (cm)	48.71±0.64	48.64±1.32	49.26±1.25	0.9104	NS
CC (cm)	8.90±0.18	9.10±0.21	8.93±0.18	0.7347	NS
CW (cm)	26.84±1.09	26.20±0.54	26.63±1.11	0.8936	NS
RW (cm)	27.50±01.01	27.66±0.80	27.47±1.12	0.9902	NS
HL (cm)	48.68±01.06	47.89±0.99	50.00±1.69	0.5109	NS
FL (cm)	40.10±0.55	41.61±1.21	42.10±1.14	0.3298	NS
EL (cm)	13.50±0.37	13.69±0.63	13.97±0.54	0.8066	NS

DS: *Digitaria smutsii*, GH: Groundnut haulm, CH: Cowpea husk, BW: Body weight, BL: Body length, WH: Withers height, CG: Chest girth, CD: Chest depth, RH: Rump height, CC: Cannon circumference, CW: Chest width, HL: Hind leg length, FL: Fore leg length, EL: Ear length, LOS: Level of significant, NS: No significant, kg: Kilogram, cm: Centimeter

Table 7 represents the effect of diet on BW and morphometric traits of goats at week 7. The obtained results revealed that the diet had no significant ( $p>0.05$ ) effect on the BW and all the morphometric traits except CD. The diet (50% DS+50 CH) had significantly ( $p<0.05$ ) higher CD ( $22.68\pm0.55$  cm) than diets 100% DS and 50%DS+50 GH with CD  $21.49\pm0.38$  cm and  $20.60\pm0.51$  cm, respectively.

The observed result is similar to the report of Babale *et al.* (2018) who reported no significant difference in BW among WAD goats fed Cowpea husk, GH, and Brewer's dried grains.

Table 8 shows the effect of diet on BW and morphometric traits of goats at week 8. The results showed that diet has no significant ( $p>0.05$ ) effect in all the parameters except on BW and CD. The 50% DS+50 CH had significantly ( $p<0.05$ ) higher BW and CD ( $9.22\pm0.87$  kg,  $22.72\pm0.54$  cm), respectively, than 100% DS for BW and CD ( $8.25\pm0.46$  kg,  $21.78\pm0.37$  cm), respectively, and 50% DS+50 GH for BW and CD ( $7.94\pm0.44$  kg,  $20.72\pm0.49$  cm), respectively. The 50% DS+50 CH had higher numerical values than 100% DS and 50% DS+50 GH for BL, WH, RH, CC, CW, RW, HL, FL and EL though no significant difference.

**Table 6: Effect of different feed on body weight and morphometric traits of goats at week 6**

Traits	Feed type			p-value	LOS
	100%DS	50%DS+50%GH	50%DS+50%CH		
BW (kg)	7.74±051	7.61±0.38	8.75±0.83	0.3917	NS
BL (cm)	48.84±1.82	49.64±0.67	50.65±2.08	0.7568	NS
WH (cm)	47.19±1.27	45.58±1.28	47.58±1.28	0.5593	NS
CG (cm)	48.29±1.85	46.98±1.00	48.83±1.06	0.6928	NS
CD (cm)	21.49±0.38 <sup>ab</sup>	20.60±0.51 <sup>b</sup>	22.68±0.54 <sup>a</sup>	0.0297	*
RH (cm)	48.96±0.68	49.26±1.65	49.95±1.15	0.809	NS
CC (cm)	8.76±0.21	9.04±0.35	8.80±0.19	0.7062	NS
CW (cm)	27.67±1.04	27.02±0.32	26.22±1.18	0.577	NS
RW (cm)	28.47±0.95	28.38±0.94	27.67±1.06	0.8223	NS
HL (cm)	49.43±0.92	49.56±1.43	51.17±1.78	0.6168	NS
FL (cm)	40.34±0.69	41.66±0.80	42.37±1.32	0.3234	NS
EL (cm)	13.57±0.42	13.78±0.78	13.80±0.61	0.9503	NS

DS: *Digitaria smutsii*, GH: Groundnut haulm, CH: Cowpea husk, BW: Body weight, BL: Body length, WH: Withers height, CG: Chest girth, CD: Chest depth, RH: Rump height, CC: Cannon circumference, CW: Chest width, HL: Hind leg length, FL: Fore leg length, EL: Ear length, LOS: Level of significant, \*: Significant at 0.05, NS: No significant, kg: Kilogram, cm: Centimeter

**Table 7: Effect of different feed on body weight and morphometric traits of goats at week 7**

Traits	Feed type			p-value	LOS
	100%DS	50%DS+50%GH	50%DS+50%CH		
BW (kg)	7.71±0.49	7.69±0.39	8.95±0.89	0.3192	NS
BL (cm)	48.86±1.82	49.64±0.67	50.67±2.07	0.7552	NS
WH (cm)	47.19±1.27	45.98±1.29	47.58±1.28	0.6954	NS
CG (cm)	48.34±1.87	47.22±0.86	48.78±1.35	0.7878	NS
CD (cm)	21.49±0.38 <sup>ab</sup>	20.60±0.51 <sup>b</sup>	22.68±0.55 <sup>a</sup>	0.0297	*
RH (cm)	49.01±0.72	49.28±1.66	50.43±1.19	0.6518	NS
CC (cm)	8.76±0.21	9.02±0.34	8.77±0.19	0.7113	NS
CW (cm)	27.71±1.05	27.02±0.32	26.20±1.21	0.5609	NS
RW (cm)	28.49±0.96	28.38±0.94	27.68±1.07	0.8262	NS
HL (cm)	52.15±0.97	49.96±1.51	51.20±1.78	0.7393	NS
FL (cm)	40.53±0.68	41.48±0.81	42.55±1.23	0.3055	NS
EL (cm)	13.57±0.41	13.78±0.78	13.80±0.61	0.9503	NS

<sup>ab</sup>Means in the same row bearing different superscripts differ significantly ( $p<0.05$ ). DS: *Digitaria smutsii*, GH: Groundnut haulm, CH: Cowpea husk, BW: Body weight, BL: Body length, WH: Withers height, CG: Chest girth, CD: Chest depth, RH: Rump height, CC: Cannon circumference, CW: Chest width, HL: Hind leg length, FL: Fore leg length, EL: Ear length, LOS: Level of significant, \*: Significant at 0.05, NS: No significant, kg: Kilogram, cm: Centimeter

**Table 8: Effect of different feed on body weight and morphometric traits of goats at week 8**

Traits	Feed type			p-value	LOS
	100%DS	50%DS+50GH	50%DS+50CH		
BW (kg)	8.25±0.46 <sup>ab</sup>	7.94±0.44 <sup>b</sup>	9.22±0.87 <sup>a</sup>	0.0497	*
BL (cm)	50.18±1.68	49.84±0.67	50.85±2.07	0.9121	NS
WH (cm)	48.33±0.88	46.10±1.30	47.67±1.27	0.4148	NS
CG (cm)	49.27±2.01	47.36±0.85	48.97±1.35	0.6733	NS
CD (cm)	21.78±0.37 <sup>ab</sup>	20.72±0.49 <sup>b</sup>	22.72±0.54 <sup>a</sup>	0.0342	*
RH (cm)	49.30±0.81	49.35±1.65	50.62±1.16	0.6849	NS
CC (cm)	8.77±0.25	9.02±0.34	8.77±0.19	0.7497	NS
CW (cm)	28.10±1.22	27.22±0.93	26.28±1.21	0.4847	NS
RW (cm)	28.83±1.07	20.42±0.93	27.72±1.06	0.7363	NS
HL (cm)	50.83±1.04	50.24±1.48	51.32±1.77	0.8461	NS
FL (cm)	40.87±0.69	41.82±0.79	42.62±1.21	0.4295	NS
EL (cm)	13.82±0.43	13.84±0.77	13.82±0.61	0.9995	NS

<sup>ab</sup>Means in the same row bearing different superscripts differ significantly (p<0.05). DS: *Digitaria smutsii*, GH: Groundnut haulm, CH: Cowpea husk, BW: Body weight, BL: Body length, WH: Withers height, CG: Chest girth, CD: Chest depth, RH: Rump height, CC: Cannon circumference, CW: Chest width, HL: Hind leg length, FL: Fore leg length, EL: Ear length, LOS: Level of significant, \*: Significant at 0.05, NS: No significant, kg: Kilogram, cm: Centimeter

The observed significant difference for BW and CW across the diet groups at week 8 is in agreement with the report of Babale *et al.* (2018) who reported no significant difference in BW in WAD goats fed cowpea husk, GH, forage and brewer's dried grains. The reason for observed differences in BW and CW may be that the animals fed cowpea husks had higher feed intake, crude protein digestibility, and nitrogen retention values than those fed GH and DS.

## CONCLUSION AND RECOMMENDATION

The study found that goats fed a diet consisting of 50% DS and 50% cowpea husk (CH) not only gained more weight but also exhibited superior morphometric characteristics, indicating enhanced feed efficiency and nutrient absorption compared to other diets.

These findings suggest that adopting a 50% DS+50% CH diet can significantly optimize growth performance in goat herds, particularly for Red Sokoto and West African dwarf goats. In addition, the use of GH and cowpea husks is beneficial, as it does not negatively affect BW or morphometric traits.

Future research could explore the long-term effects of various feed combinations on overall herd health and productivity, investigate the specific nutritional components that contribute to enhanced growth and morphometric traits, and assess the economic viability of implementing these feeding strategies in different farming contexts across Nigeria.

## AUTHORS' CONTRIBUTION

Conceptualization and design of the experiment: E.O. Negedu and I. Mallam. Material preparation: E.O. Negedu and I. Mallam. Data collection and analysis: E.O. Negedu and I. Mallam. The first draft of the manuscript

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## CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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