Growth Performance, Carcass Characteristics and Histological Indices of White Fulani (Bunaji) Bull Yearling Calves Fed Graded Levels of Urea and Molasses Ensiled Rice Straw Supplemented with Maize Offal and Cowpea Husk

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Abstract

The study was carried out at Duware farm along Yola-Fufure Road Adamawa state. ix yearling white Fulani (Bunaji) bull calves weighed 80kg-100kg were fed graded levels of urea and molasses ensiled rice straw supplemented with maize offal and cowpea husk to investigate the growth performance, carcass characteristics and histological indices. The treatments diets consist of graded levels of urea and molasses ensiled rice straw supplemented with maize offal for T1, graded levels of urea and molasses ensiled rice straw supplemented with cowpea husk in T2, and graded levels of urea and molasses ensiled rice straw only in T3 (control group). The feeds were offered at 8; 00 am in the morning and 6:00 pm in the evening, remnants were weight before fresh feeds were offered, mineral lick and water was provided ad-libitum, and animals were weight weekly to determine their growth performance. Two weeks adaptation period was carried out, the experiment last for three months including the adaptation period, statistical package for data analysis was completely randomize design (CRD) and the values were subjected to analysis of variance (ANOVA) means were separated using least significant difference (LSD).

Keywords: white Fulani (Bunaji) bull, treatments diets, feed, growth performance.

Introduction

In Nigeria, the populace is predominantly marked by inadequate protein intake both in quality and quantity Niania et al (2021). Low level of protein intake in Nigeria is due to low level of livestock productivity and high cost of animal protein Saidu et al (2021). The most populous and widely distributed breeds of cattle in Nigeria have been found to be the white Fulani cattle pastoralist controlling more than 95% of the national herd and has been the major source of domestic meat and milk supply; many of which are reared under the transhumance farming system while a few belongs to institution and private farms (Dim et al 2012). The contribution of livestock to the livelihoods of the developing communities and the entire world requires enhanced understanding of livestock numerous and compound roles played, as their contribution to the dietary status of the world population is well recognized in term of food (protein) from animal origin, products and byproducts. Saidu et al (2021). The performance of animal fed crop residues is limited by poor intake, low nitrogen contents and poor digestibility Amudu and Okunlola (2020). Feed scarcity has been the major limiting factor in improving livestock productivity (Naik et al., 2013).

Material and Methods

Study Area

The research was carried out at Duware farm along Yola-Fufure Road Adamawa state. Nigeria, situated within the savannah region and lies between latitude 9°, 14' N and longitude 12° 21' with an altitude of about 152m above sea level. The state has tropical climate with distinct dry and wet seasons. The rainfall begins in April and ends in late October, while the dry season commence in late October or November and ends in April. It has an average minimum and maximum temperature of 18 & 40°C and relative humidity of 20 and 80%. Adamawa state has an international boundary with the Cameroon Republic along its eastern boarder (Adebayo and Tukur 1999). Adamawa shares boundaries with Taraba State to the south and west, Gombe State to the North-west and Borno State to the north.

Experimental Animals

Six calves aged between 12-15 months were used, weighing 80kg -100kg. The calves were weighed to obtain their initial weight at arrival and treated for both internal and external parasites and subjected to pre-experimental adaptation for two weeks, with three dietary treatments. The feeds were mixed and fed as complete ration daily at 8:00 am and 6:00 pm, housed under a simple shed made of a woods and thatches to prevent harsh weather conditions.

Experimental Design

A completely randomize design (CRD) was used to carried out the research, and the values was subjected to analysis of variance (ANOVA) and means were separated using least significant difference (LSD).

Procurement and Processing of Experimental Diets

The rice straw was procured from local farmers in Jimeta-Yola in Adamawa state; dried, cut into 10 cm particle size and stored in bags for easy packaging in the silos for ensiling.

**T1.** 4kg of urea, 5 kg of molasses ensiled rice straw supplemented with maize offal

**T2.** 4kg of urea, 5 kg of molasses ensiled rice straw supplemented with cowpea husk

**T3.** 4kg of urea, 5 kg of molasses ensiled rice straw only (control group)

4kg of urea and 5 kg of molasses was dissolved in 100 liters of water and 100kg of rice straw was submerged into the solution, pressed and tied in an air tight polythene silos bag for air exclusion, knotted
to achieve anaerobic condition for 21 days for better urea hydrolysis as documented by Adamu et al. (2016) who opined that once the oxygen is exhausted, only anaerobic organism can survive, this allowed the growth of acid forming and photolytic bacteria which convert carbohydrate into lactic acid, protein into ammonia, amines and amino acid which caused decreased pH in the ensiled materials which kills both yeast and mould, acidity continue to increase to a level where the acid producing organisms themselves are killed, at this pH and time ensiling is completed.

**Chemical Analysis**

The chemical composition of the feed sample was determined in the laboratory; the analysis was conducted to determine Nitrogen (N) for crude protein (CP), crude fibre, ether extract, nitrogen free extract (NFE) and ash content using the proximate analysis (AOAC, 2004) procedure. Acid and neutral detergent fibre were determined according to the procedure described by (Van Soest et al., 1991).

**Data Collection**

**Dry matter intake (DMI)**

Feed intake was determined by collecting and weighing the amount of remnant (leftover) every morning before feeding fresh feeds and subtracting the leftover from the total amount of feed offered. Feed intake was determined using the formula below:

\[
\text{Feed intake} = \text{feed given} - \text{left over}
\]  

(1)

**Live weight gain**

Live weight was measured according to Nyako et al., (2015) procedure. The animals were weighed on arrival (at the beginning) for initial weight and subsequently on weekly intervals individually using weighing tape/band which were recorded. The differences between the previous weeks and the current week gave changes in live weight. Daily weight gain was obtained by dividing the total weight gain by the number of days of the feeding trial as described by (Gabdo et al., 2016).

**Feed conversion ratio (FCR)**

Feed conversion ratio was obtained by dividing daily dry matter intake (DMI) by average daily live weight gain, feed conversion ratio was determined using the formula:

\[
\text{Feed conversion ratio} = \frac{\text{Total dry mater intake (kg)}}{\text{Total weight gain (kg)}}
\]  

(2)

**Digestibility study**

Digestibility study commenced after the end of the feeding trial, the animals were randomly selected and confined in an improvised local metabolic cages/crate for 14 days adjustment period to get used to the new environment (metabolic crate), prior to (7) days faecal collection period. They were fitted with collection bags to facilitate faecal collection using a polythene bags, one calf from each treatment, the animals were fed their respective treatment diets. Total faecal outputs were collected daily, weighed and 10% sub-samples were taken and oven dried at 60 to 65°C for 24 hours as described by (Nyako et al., 2015). The faeces were dried, weight and then ground using pestle and mortar and stored before chemical analysis as described by (Abdullahi et al., 2016).
Nutrients digestibility (ND) was determined by the formula as described by Adamu et al. (2015).

\[ ND = \frac{\text{Nutrient intake} - \text{Nutrients in faeces}}{\text{Nutrient intake}} \times 100\% \] (3)

**Dry matter (DM)**

The dry matter content was determined by oven drying at 105°C for 3 hours until constant weight was obtained (AOAC, 2004).

**Crude protein, nitrogen free extracts and ether extract**

Crude protein (CP), Nitrogen free extract (NFE) and Ether extract (EE) were determined using the official method of Analysis of the Association of Official Analytical Chemist. (AOAC 2004) crude fibre was determined using the trichloro acetic acid digestion method.

**Acid detergent fibre (ADF) and neutral detergent Fibre (NDF)**

Van Soest et al. (1991) methods as reported by (DeBoever et al., 2002) was used to determined acid detergent fiber (ADF) and neutral detergent fibre (NDF)

**Total Ash (TA) and Mineral (Ca, P and K)**

Total Ash (AS) was determined by muffle furnace at 500°C to 600°C for four hours while mineral content were determined using Microwave accelerated reaction system (MARS) emission spectrographic procedure.

**Results**

**Table 1. Gross and Calculated Chemical Composition of Experimental Treated (Ensiled) and Untreated Rice Straw (%DM basis)**

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>DM</th>
<th>CP</th>
<th>CF</th>
<th>EE</th>
<th>Ash</th>
<th>NFE</th>
<th>NDF</th>
<th>ADF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice straw</td>
<td>92.40</td>
<td>9.0</td>
<td>10.0</td>
<td>2.1</td>
<td>1.2</td>
<td>68.70</td>
<td>11.38</td>
<td>3.47</td>
</tr>
<tr>
<td>Ensiled rice straw</td>
<td>98.5</td>
<td>12.2</td>
<td>4.0</td>
<td>2.4</td>
<td>10.0</td>
<td>80.4</td>
<td>29.11</td>
<td>13.33</td>
</tr>
<tr>
<td><strong>Nutrients</strong></td>
<td>MO</td>
<td>OM</td>
<td>Cel</td>
<td>Hem</td>
<td>Lig</td>
<td>Ca</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Rice straw</td>
<td>4.93</td>
<td>93.50</td>
<td>3.33</td>
<td>7.91</td>
<td>0.14</td>
<td>0.45</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>Ensiled rice straw</td>
<td>18.20</td>
<td>79.36</td>
<td>12.98</td>
<td>15.58</td>
<td>0.55</td>
<td>0.51</td>
<td>0.47</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Dry mater (DM); Crude protein (CP); Crude fibre (CF); Ether extract (EE); Ash; Nitrogen free extract (NFE); Neutral Detergent Fibre (NDF); Acid Detergent Fibre (ADF); Moisture (MO); Organic Matter (OM); Cellulose (Cel); Hemi cellulose (Hem); Lignin (Lig); Metabolizable Energy = ME (Kcal/kg) = (37 x %CP + 81.1 x %EE + 35.5 x %N.F.E NFE = 100 – (%MO + %EE + % CP + % CF%+ ASH). Organic Matter (OM) = Dry mater (DM) – Total Ash (TA). Metabolizable energy (Kcal/kg) 2,998.37
Table 2. Gross and Calculated Chemical Composition of Experimental Maize Offal (% DM basis)

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>MO</th>
<th>DM</th>
<th>CP</th>
<th>EE</th>
<th>CF</th>
<th>Ash</th>
<th>OM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize offal</td>
<td>3.50</td>
<td>86.10</td>
<td>10.52</td>
<td>1.30</td>
<td>10.85</td>
<td>4.00</td>
<td>81.00</td>
</tr>
<tr>
<td>NFE</td>
<td>55.51</td>
<td>20.45</td>
<td>20.35</td>
<td>5.12</td>
<td>2.5</td>
<td>1.85</td>
<td></td>
</tr>
</tbody>
</table>

Note: Moisture (MO); Dry mater (DM); Crude protein (CP); Ether extract (EE); Crude fibre (CF); Ash; Organic Matter (OM); Nitrogen free extract (NFE); Acid Detergent Fibre (ADF); Neutral Detergent Fibre (NDF); Cellulose (Cel); Hemi cellulose (Hem); Lignin (Lig); Metabolizable Energy = ME (Kcal/kg) = (37 x %CP + 81.1 x %EE + 35.5 x %N.F.E NFE = 100 – (%MO + %EE + % CP + % CF%+ ASH). Organic Matter (OM) = Dry mater (DM) – Total Ash (TA). Metabolizable energy (Kcal/kg) 2,998.37

Table 3. Gross and Calculated Chemical Composition of Experimental Cowpea Husks (% DM basis)

<table>
<thead>
<tr>
<th>Nutrients (%)</th>
<th>DM</th>
<th>CP</th>
<th>CF</th>
<th>EE</th>
<th>Ash</th>
<th>NFE</th>
<th>NDF</th>
<th>ADF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cowpea Husk</td>
<td>88.50</td>
<td>3.5</td>
<td>9.0</td>
<td>1.0</td>
<td>1.1</td>
<td>76.0</td>
<td>66.1</td>
<td>39.3</td>
</tr>
</tbody>
</table>

Note: Dry mater (DM); Crude protein (CP); Crude fibre (CF); Ether Extract (EE); Ash; Nitrogen Free Extract (NFE); Neutral Detergent fiber (NDF); Acid detergent fiber (ADF).

Table 4. Growth Performance of White Fulani (Bunaji) Bull Yearling Calves Fed Treated (ensiled) and Untreated Rice Straw Supplemented with Energy Sources (maize offal and cowpea husk)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>T1 ERS/MO</th>
<th>T2 ERS/CH</th>
<th>T3 ERS</th>
<th>SEM</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final body weight (kg)</td>
<td>107.99a</td>
<td>104.90b</td>
<td>99.80c</td>
<td>0.03</td>
<td>0.13*</td>
</tr>
<tr>
<td>Total weight gain (kg)</td>
<td>37.54a</td>
<td>34.47b</td>
<td>29.39c</td>
<td>0.01</td>
<td>0.03*</td>
</tr>
<tr>
<td>ADWG (g/a/day)</td>
<td>425.98a</td>
<td>388.95b</td>
<td>329.78c</td>
<td>0.01</td>
<td>0.03*</td>
</tr>
<tr>
<td>Dry matter intake (kg/a/day)</td>
<td>419.98a</td>
<td>417.90b</td>
<td>401.89a</td>
<td>0.03</td>
<td>0.13*</td>
</tr>
<tr>
<td>Ensiled rice straw (kg)</td>
<td>318.99a</td>
<td>313.89b</td>
<td>305.98a</td>
<td>0.03</td>
<td>0.11*</td>
</tr>
<tr>
<td>Energy supplements (kg)</td>
<td>104.87a</td>
<td>102.59b</td>
<td>101.98a</td>
<td>0.03</td>
<td>0.11*</td>
</tr>
<tr>
<td>ADFI (kg/a/day)</td>
<td>4.68a</td>
<td>4.59b</td>
<td>4.44b</td>
<td>0.03</td>
<td>0.12*</td>
</tr>
<tr>
<td>Feed conversion ratio</td>
<td>11.19a</td>
<td>12.12b</td>
<td>13.67b</td>
<td>0.03</td>
<td>0.08*</td>
</tr>
</tbody>
</table>

Note: Mean on the same row bearing different superscript differ significantly (P<0.05), SEM=Standard Error Mean, LSD=Least significant different, NS=No significant different, ADFI=Average daily feed intake, ADWG=Average daily weight gain, Energy supplements, Treated (Ensiled) rice straw and maize offal.

Growth Performance of White Fulani (Bunaji) Bull Yearling Calves Fed Treated (ensiled) and Untreated Rice Straw Supplemented with Energy Sources (maize offal and cowpea husk)

The result is presented in Table 4. The final body weight (FBW kg), total weight gain (TWG kg) and average daily weight gain (ADWG g/day) indicated significant (P<0.05) difference across the treatments, the final body weight ranged from 99.80 to 107.99kg. The highest value 107.99kg was recorded in T1, followed by 104.90kg in T2 and the least value 99.80kg was recorded in T3. The Total weight gain (TWG kg) ranged from 29.39 to 37.54kg. The highest values was recorded in T1 with 37.54kg followed by 34.47kg.
in T2 29.39 kg in T1 as the least recorded values. The average daily weight gain ranged from 329.78 to 425.98 g/a/day, the highest values was recorded in T1 with 425.98 kg/a/day followed by T2 with 388.95 kg/a/day, T3 with 329.78 kg/a/day as the least values was recorded.

The total dry matter intake (DMI), ensiled rice (kg), energy supplement (kg) and average daily feed intake (kg/a/day) showed significant (P<0.05) different across the treatments. The total dry matter intake (DMI) ranged from 401.89 to 419.98 kg recorded. The highest dry matter intake recorded in T1 with 419.98 kg followed by T2 with 417.90 kg and the least was recorded in T3 with 401.89 kg. Ensiled rice straw (kg) ranged from 305.98 to 318.99 kg recorded. The least value 305.98 kg was recorded in T3, 313.89 kg in T2 and the highest values 318.99 kg was recorded in T1. Energy supplement ranged from 101.98 to 104.87 kg recorded. The highest value 104.87 kg was recorded in T1, followed by 102.59 kg in T2 and the least value 101.98 kg was recorded in T3. The average daily feed intake (ADFI) ranged from 4.44 to 4.68 kg/a/day recorded. The highest daily feed intake was recorded in T1 with 4.68 kg/a/day, followed by T2 with 4.59 kg/a/day as the least value recorded in T1 with 4.44 kg/a/day. The feed conversion ratio (FCR) showed significant (P<0.05) different across the treatments. The FCR ranged from 11.19 to 13.67, The highest value 13.67. The highest value was recorded in T2 with 13.67 and the least value was recorded in T1 with 11.19.

Effect of Carcass Characteristics of White Fulani (Bunaji) Bull Yearling Calves Fed Treated (ensiled) and Untreated Rice Straw Supplemented with Energy Sources (maize offal and cowpea husk)

Results on the absolute weights, carcass characteristics and internal organs of experimental Yearling white (Fulani Bunaji) bull calves fed urea and molasses ensiled rice straw supplemented with energy sources is presented in Tables 5.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T1  (ERS &amp; MO)</th>
<th>T2  (ERS &amp; CH)</th>
<th>T3  (ERS Only)</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primal Cuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rump (kg)</td>
<td>2.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.26</td>
</tr>
<tr>
<td>Hind Shank (kg)</td>
<td>14.69&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.53&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>13.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>14.92</td>
</tr>
<tr>
<td>Loin (kg)</td>
<td>1.19&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.13&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>1.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.23</td>
</tr>
<tr>
<td>Organs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver (kg)</td>
<td>1.49&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.37&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>1.22&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.14</td>
</tr>
<tr>
<td>Spleen (kg)</td>
<td>1.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.98&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.79&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.03</td>
</tr>
<tr>
<td>Kidney (kg)</td>
<td>0.75&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.65&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.50&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.04</td>
</tr>
</tbody>
</table>

Note: ERS=Ensiled rice straw, MO=Maize offal, CH=Cowpea husk.

Primal Cuts

Rump weight (DW) (kg)

Rump of experimental bull calves fed urea and molasses ensiled rice straw supplemented with energy sources presented in Table 5, revealed no significant (P>0.05) difference among the experimental treatments groups, differences in values among treatment means were only numerical The SEM value for this parameter was 9.26.
Hind shank weight (kg)
Results on the hind shank weight performance of bull calves fed urea and molasses ensiled rice straw supplemented with energy sources presented in Table 5 revealed a significant (P<0.05) difference on the weight between treatments means in this experiment. SEM was 14.92 for this parameter.

Loin weight (kg)
Table 5 showed results on loin weight performance of experimental bull calves fed urea and molasses ensiled rice straw supplemented with energy sources revealed significance (P>0.05) difference between the experimental treatment means. The SEM for the parameter was 8.23.

Organs/Offal Weight
Liver weight (LW) (kg)
Results on liver weight performance of experimental bull calves administered urea and molasses ensiled rice straw supplemented with energy sources presented in Table 5 revealed that liver weight means was highest (1.49) in T1, 1.37 in T2, and 1.22 in T3 (control treatment) significance (P<0.05) difference was observed among all the treatments means. SEM value for this parameter was 0.14.

Spleen weight (kg)
Spleen weight performance of experimental bull calves administered urea and molasses ensiled rice straw supplemented with energy sources presented in Table 5 revealed spleen weight was highest in T1 1.00 with a progressive decline in spleen weight trend to 0.98 in T2 and 0.79 T3 among all the treatments means including the control. SEM value in this parameter was 0.03.

Kidney weight (kg)
Results on the Kidney weight performance of experimental bull calves administered urea and molasses ensiled rice straw supplemented with energy sources presented in Table 5. The results revealed that kidney values among all the treatments means were significantly (P>0.05) difference. The highest values were 0.75 in T1, 0.65 in T2 and 0.50 in T3 the control. SEM values for this parameter were 7.04.

Effect of Histopathology of White Fulani (Bunaji) Bull Yearling Calves Fed Treated (ensiled) and Untreated Rice Straw Supplemented with Energy Sources (maize offal and cowpea husk)
Histopathology of the Liver
Liver histological interpretations in all the treatments groups revealed significant orientation of the cells (hepatocyte) and regular sinusoidal placement with perfect cellular permeated evident inside the sinusoid, T1, and T2 while T3 Control group revealed normal orientation of hepatocyte and mitotic cells, no pathological effect on the tissue of the liver despite urea and molasses inclusion levels in all the treatments including the control (CV) H&E x200.

Histopathology of the spleen
Photomicrograph results of the spleen revealed no congestion in areas with red pulp, normal white pulp and several phagocytic cells in T1 and T2. Constricted hyperemic region of the blood vessels are seen in T1 and the results confirmed no clear regions of the red pulp, although highly scattered phagocytic cells in white pulp, no signs of unusual orientation of pathological effects between all the treatments including the control as displayed. H&E x200.

Histopathology of the kidney
Histopathological kidney results in T1 indicated usual glomerular structure with normal straight collecting ducts and convoluted collecting ducts T1, T2 and T3 Photomicrograph section of the kidney displayed normal morphological arrangement of medullary section.
Discussion

Proximate Composition of Maize Offal

The chemical composition of maize offal is presented in Table 1. The compositional dry matter recorded value (86.10%) of maize offal was consistent with the value of 86.01% as revealed by (Ahmed et al., 2011). The dry matter of maize offal was 86.10% lower than the value of 89.21% reported by Ashiru et al. (2013). The crude protein (CP) values 10.52% in this study falls within the values of 9-14% as reported by Aduku, (2005) as the minimum nutrient requirement for small ruminants. The crude protein values obtained were lower than the value of 11.90% reported by Abdullahi et al. (2016) who fed urea treated sorghum chaff as a basal diets supplemented with maize offal’s to Yankasa rams. The crude protein of maize offal (10.52%) reduced significant due to the time / age of maturity as reported by (Shyama et al., 2016). The recorded 10.52%) values were lower than the value of 13.6% as reported by (Naik et al., 2014) who fed hydroponic maize to lactating cows. However, increased in crude protein content in treated hydroponic maize might be attributed to the loss in dry matter (DM), particularly carbohydrate, through respiration (oxidation) during germination.

The ether extract (EE) of maize offal (1.30%) was consistent with 1.40% reported by (Abdullahi et al., 2016) who fed urea treated sorghum chaff as a basal diets supplemented with maize offal's to Yankasa rams.

The crude fibre (CF) content of maize offal was 10.85% figures values was lower than the values 11.85% reported by (Alikwe et al., 2012) who fed maize bran, wheat offal and rice bran to West African Dwarf goats. The nitrogen free extract (NFE) of maize offal recorded was 55.51lower than the value of 82.12 to 84.15% as reported by (Naik et al., 2012); this might be attributed to the increase in the number and size of cell walls for the synthesis of structural carbohydrate. Although higher than the values 32.4% as revealed by Abdullahi et al. (2016) who fed urea treated sorghum chaff as a basal diets supplemented with maize offal's to Yankasa rams, and also higher than the figure 50.75% reported by (Gabdo et al., 2016) who Offered Leptadenia Hastata as a Basal Diet.

The total Ash value 4.00 maize offal was higher than dry maize seed 1.57% as reported by (Morsy et al., 2013). However, the recorded value (4.00) was lower than the figure of 9.36% as reported by (Naik et al., 2016). The total ash content was lower than the values of 7.85% as reported by (Ashiru et al., 2013). The recorded value of maize offal 4.00% was higher than the value 3.69% as reported by (Babale et al., 2018) who fed Maize Cob Replacing Maize Bran with Cowpea Husk Basal Diet to red Sokoto Goat. The higher value might be attributed to the increase cell walls for the synthesis of structural carbohydrate.

Growth Performance of Yearling White Fulani (Bunaji) Bull Calves Fed Ensiled Rice Straw Supplemented with Energy Sources

Dry Matter Intake

The results of dry matter intake (kg) of the diets of yearling bull calves fed ensiled rice supplemented with energy sources were shown in Table 4. The figures (401.89 to 419.98 were higher than the findings of Jasmine et al. (2019) who recorded (166.26 to 169.40kg) of dry matter intake when the authors fed hydroponic maize to cross bred calves. The high values might have been attributed to the composition of the diets which were adequate to meet the protein requirements (16-20%) of calves and also effective rumen function as reported by Donna et al. (2006) who fed and managed baby calves from three month of age. ADF and NDF 25 to 28%) of the animal for proper rumen function, maintenance of normal pH 6.2 to 6.8, saliva production and maintenance of rumen mat as recommended by NRC (2000).

Ensiled rice straw 305.98 to 318.99 obtained in the present study were lower than the values (391.13 to 431.79kg) as reported by (Sekhonyana et al., 2015) who fed urea treated maize Stover on the growth performance of cross bred heifers calves. Also, the recorded values (305.98 to 318.99kg) were higher than
the figures (167.07 to 197.17 kg) reported by Rajkumar et al. (2018) who fed hydroponic maize as a partial feed substitute in the ration of crossbred calves. The higher values in the present study could be due to the energy and protein constituents of the ensiled rice straw, tenderness, lushness and its succulent nature.

**Live Weight Gain**

The total weight gain (TWG) and average daily weight gain (ADWG) of yearling bull calves fed ensiled rice straw supplemented with energy sources showed significance (P>0.05) difference across the treatments means (Table 4). The total weight gain ranged from 29.39 to 37.54 kg in this study were lower than the value of 53.17 to 62.67 kg reported by (Sekhonyana et al., 2015) who fed maize Stover treated with urea to crossbred heifer calves. The highest total weight gain was recorded in T1 (37.54 kg) and the least value (29.39 kg) was obtained in T3. The increase intake could be as a result of supplementation of the energy and an accompanying improvement in the utilization of non-protein nitrogen in the treated straw which resulted in an improvement in the live weight gain of the animals. Similarly, the highest weight gains in T1 correspond with higher dry matter and nutrient intake as reported by (Dawit et al., 2013) who determined the growth performance of Jersey calves fed maize Stover slilage based total mixed ration compared to calves fed hay and concentrate separately. The figures (29.39 to 37.54 kg) were lower than the figures (30.39 to 40.58 kg) revealed by Rajkumar et al. (2018) who fed hydroponic maize as partial substitute in the ration of crossbred calves. The lower values recorded might be attributed to many factors including particle size, chewing frequency and effectiveness as well as rate of fermentation of the potentially digestible NDF, the lower value could be attributed to differences in the initial average body weight of the animals, and also the growth performance of animals is directly related to the protein and energy obtained from a given ration as reported by Dawit et al. (2013) who fed a basal diet of maize offal to crossbred heifer calves. Live weight gain depends on several factors such as breed characteristics, age, initial live weight, plane of nutrition and management practice as opined by Fazaeli et al. (2011).

**Feed Conversion Ratio**

Feed conversion ratio of yearling bull calves fed ensiled rice straw supplemented with energy sources showed significant (P<0.05) difference across the treatment groups as presented in Table 4. Feed conversion ratio measured the efficiency of bull calves to convert feed consumed into meat; thus, the lower the value, the better the feed conversion ratio (Adebiyi et al., 2018). Feed conversion ratio ranged from 11.19 to 13.67; the highest value of 13.67 was recorded in T3, the best and lowest figure 11.19 was recorded in T1. The figures 11.19 to 13.67 were however much higher than the values of 4.7 to 5.5 as reported by (Dawit et al., 2013). This observation might have been attributed to the presence of nutrients solution which enhanced the crude protein contents of the hydroponic leading to the uptake of nitrogenous compounds. This finding coincides with (Dung et al., 2010) who reported on nutrient contents and in-sacco digestibility of barley grain and sprouted barley.

**Carcass Characteristics and Internal Organs Indices of Yearling White Fulani (Bunaji) Bull Calves Fed Ensiled Rice Straw Supplemented with Energy Sources**

**Primal cuts (kg)**

**Rump (kg)**

Rump weight indicated no significant (P>0.05) difference across the treatments. The weight value recorded in this study was 2.02 to 2.79 and lower than 9.50 to 11.00% of shoulder as reported by (Ayandiran et al. 2019) during blood metabolites and carcass characteristics of west African dwarf goat fed bread waste and moringa oleifera leaf, 40.56 to 43.28% as submitted by (Odeomelan et al. 2014) were also higher than the figures obtained in the present study.
Hind Shank (kg)
Significant (P<0.05) different were observed on dietary treatments. The value 13.67 to 14.69 were higher than the figure 8.50 to 8.86% as reported by (Ayandiran et al 2020) submitted on carcass quality of west African dwarf goat fed shear butter nut meal. 7.76 to 8.98% of goat forelimb as reported by Ayandiran et al 2020 the authors evaluated carcass quality of west African dwarf goat fed shear butter nut meal, the cut parts values of animals depend on how adequate the animals were able to utilize nutrients in feed to synthesize body tissues (Okay et al 2014).

Loin (kg)
Loin weight revealed significance (P<0.05) difference among the treatments means. However, observed means values of 1.00-1.19 in this trial was lower than the figures of 7.41-8.07% submitted by (Ayandiran et al 2020) which are comparable to 8.05-13.15 as obtained by (Okay et al 2014) although lower values were reported by (Ukpabi et al 2007) on the evaluation of muuna seed meal based diets for goat production.

Organs / Offal
Liver (kg)
Significant (P<0.05) difference was observed among the treatment groups, the liver values 1.22-1.49 fall within the values 1.98-2.19 been the submission of (Ayandiran et al 2020). 2.92-5.29% as reported by (Ayandiran et al 2019) on blood metabolites and carcass characteristics of West African goat fed bread waste and moringa oleifera leaf.

Spleen (kg)
Spleen weight of 0.79-1.00 showed no significant (P>0.05) difference, only numerical values differences were observed across the treatment means, the 0.17-0.28 was recorded by (Ayandiran et al 2020) on carcass quality of west African dwarf goat fed shear butter nut meal and 0.61-1.40 as reported by (Ayandiran et al 2019) on blood metabolites and carcass characteristics of west African goat fed bread waste and moringa oleifera leaf. Kidney weight ranged from 0.50 -0.75, significance difference (P<0.05) was reported to exist between kidney weights in the treatments means. These are within the ranged research findings of (Ayandiran et al 2020) who reported 0.49-0.50 on carcass quality of west African dwarf goat fed shear butter nut meal but contradicted the values 1.09-1.26 as reported by (Ayandiran et al 2019) on blood metabolites and carcass characteristics of west African goat fed bread waste and moringa oleifera leaf. Ensiled rice straw enhanced flesh deposition in the carcass and impacted no visible abnormalities on the visceral organs.

Histopathological Indices of Yearling White Fulani (Bunaji) Bull Calves Fed Ensiled Rice Straw Supplemented with Energy Sources

Histopathology of the Liver
Significant differences (P<0.05) exist with sinusoidal congestion, hyperplasia and widened focal area of hepatic necrosis, the liver displayed presence of hepatic necrosis in liver tissue in this study, which falls within the report of Agboola et al (2018) on the influence of sodium acetate, sodium propionate and their combination on nutrients digestibility and blood profile obtained from healthy bird at slaughter, which indirectly affected the liver when the author investigate nutrients digestibility and blood profile of broiler chicken reared under high temperature

Spleen (kg)
Significant (P<0.05) differences were observed across the dietary treatments. The histopathological investigation of Yearling white Fulani (Bunaji) bull calves fed ensiled rice straw supplemented with energy
sources in the spleen in this trial revealed dissociation of hepatic cords, widening of sinusoidal spaces and severe congestion with mild presence of neutrophils which coincide with the submission of Agboola et al (2018) when the authors evaluate growth performance and Gut histomorphology of broiler starter.

**Histopathology of the Kidney**

The distortion of the histology readily observed in kidney revealed significant differences (P<0.05) ranged from moderate to severe hepatocellular degeneration and necrosis of hepatocyte and severe inflammatory cells. as reported by Oladipo et al (2019). Kidney showed striated muscles, degeneration and multifocal coagulation necrosis of tabular epithelium as reported by Oladipo et al (2019).

**Conclusion**

The growth performance revealed highest final body weight, total weight gain, average daily weight gain and total dry matter intake was recorded in T1 fed (Ensiled rice straw supplemented with maize offal) and the lowest feed conversion ratio was recorded in the same treatment group. The effects of carcass characteristics on primal cuts (Rump, hind shank, and loin) and organs (Liver, spleen and kidney) highest values were also recorded in T1. Histopathological indices of liver revealed sinusoidal congestion, hyperplasia and widened focal area of hepatic necrosis in liver tissue, the spleen in this trial revealed dissociation of hepatic cords, widening of sinusoidal spaces and severe congestion with mild presence of neutrophils, while the kidney revealed moderate to severe hepatocellular degeneration and necrosis of hepatocyte and severe inflammatory cells. The results of this studies recommended the feeding of ensiled rice straw supplemented with maize offal due to the highest growth performance and carcass characteristics in Bunaji calves.

Other studies should be conducted to determine the deleterious effects of urea on Bunaji Yearling calves/cattle.

**References**


