Site Effects on Energy, Phytonutrients and Anti-Nutrient Contents of Ruminant Feed-Grade Sugarcane Peels

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Feed constitutes about 80% of the total livestock production cost in Nigeria. The problem is more critical during the dry season more especially for ruminants. This study was conducted to determine the effect of location on chemical composition of sugarcane peels as animal feed in Kano State, Nigeria. The three sugarcane peel samples used for the study were from three different locations namely; Kano, Kaduna and mixed sugarcane peel (Kano and Kaduna). Known weights of the peels were sun dried and determined in the laboratory for proximate, energy, pH and phytonutrients. Results showed that ether extract, nitrogen-free extract, and dry matter were influenced by the location. Energy values (3891.34 – 4037.53 kcal/kg) were also affected ($P<0.05$) by location of the sugarcane peels meal. Crude protein (6.02 – 8.20%), crude fiber (29.99 – 30.22%) and ash were not significantly affected ($P>0.05$) by location. The cellulose, hemicelluloses, NDF, ADF, and ADL of sugarcane peels meal were all significantly ($P<0.05$) affected by the location. The pH values (6.38 – 6.67) were significantly affected ($P<0.05$) by location. The phytonutrients of all the components were not significantly affected ($P>0.05$) by the location. Based on these findings, sugarcane peels meal from all the locations can serve as an alternative feed ingredient for ruminants, since the peels contained substantial amount of energy and protein. However, the peels meal can also be safe for ruminants’ feedings because it contained small amounts of anti-nutritional factors.

Keywords: anti-nutritional factors, crude fiber fractions, proximate compositions, ruminants, sugarcane peels

INTRODUCTION

Feed constitutes about 80% of the total livestock production cost in Nigeria (Saleh, 2017). The problem of inadequate feed nutrients is more critical during the dry season especially in the northern part of Nigeria especially for ruminants. However, there are inadequate availability of conventional grazing forages and very expensive industrial byproducts (Saleh, 2015). Some of the current feed resources being used in Nigeria for ruminant feeding include wheat and maize offal, groundnut haulm, cowpea hay, wheat, and rice straws, maize and millet straws, groundnut cake and cotton seed cake. Moreover, pasture grasses and legumes that are available in Nigeria that are used for ruminants feeding include Northern and Southern gamba grasses, Buffel grass, pigeon pea, Siratro, Axillaris, centro and so on.

Thus the search for alternative feeds ingredients that are cheaper and easier to obtain as well as easier to process become of paramount importance. The use of sugarcane peels meal (SCM) as feedstuff during the dry season will help in reducing the problem of feed shortage, especially, in the northern part of the country where the sugarcane peels are available at the period and also has the highest number of ruminants. According to Ayoade, Carew, and Ameh, (2007) exploitation of cheap feed resources for animal production would lower cost of production and

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improve protein intake. Saleh and Maigandi (2014) reported the availability of sugarcane peels in Kano State but, have not yet been put to better use such as for feeding livestock. NSDC, (2003) reported that Nigeria is one of the most important producers of sugarcane with a land potential of over 500,000 hectares of suitable cane field capable of producing over 5.0 million metric tons of sugarcane. If processed, it will yield about 3.0 million metric tons of sugar.

There is little information on utilization of sugarcane peels by ruminants in Nigeria, but Kano has an abundant sugarcane peels which are largely unutilized except for the small quantity being scavenged by donkeys, cattle, sheep and goats; the remaining large quantity are either burnt or dumped as refuse and this cause environmental havoc by blocking water ways (Saleh, 2015). Sugarcane peels can provide cheap feedstuff resource with appreciable amount of nutrients dry matter 87.6%, crude protein 6.5%, crude fiber 12.7%, ether extract 2.8%, ash 12.8% and NFE 77.1% that can support modest performance in ruminants Ayoade et al. (2007). Ochepo, Ochepo, and Ayoade, (2012) observed in their studies with West African Dwarf (WAD) goats that up to 40% inclusion level of sugarcane peels in a complete diet had no adverse effect on performance. Saleh, (2010) recommended that sugarcane peels meal could be incorporated into the diet of growing Yankasa sheep up to 45% level. There is availability of sugarcane peels in different locations in the country but their chemical compositions were not known, therefore, this study was to determine the effect of location on chemical composition of sugarcane peels as ruminant feeds ingredient found in Kano State, Nigeria.

MATERIALS AND METHODS

There are three sugarcane peels samples that are found in Kano State viz; sample of sugarcane peels obtained from Kano (KN) State; Kaduna (KD), and mixed sample (KN and KD) which were all obtained from the noble cane (S. officinarum). Known weights of the peels were sun dried on a concrete slab for 3 – 4 days and thereafter the dry matter(DM) of the samples was determined in the laboratory. The dried sugarcane peels were milled to produce sugarcane peels meal. The dried samples were then analyzed for crude protein (CP), crude fiber (CF), ether extract (EE) and ash according to AOAC, (2006). Energy was determined using Bomb Calorimeter (Cal2k Isothermal), neutral detergent fiber (NDF) and acid detergent lignin (ADL) was determined according to procedures described by Van Soest and Robertson (1991). The effects of chemical and energy compositions of sugarcane peels meal value were reported as indicated in table (1). All proximate values were reported in percentages (AOCS, 2000).

The pH values of the three prepared samples of sugarcane peels were determined in the laboratory using a pH meter. Also, tannin, oxalate, and hydrogen cyanide contents were analyzed according to standard procedures (AOAC, 2006), while saponin and phytate were done according to the procedure of El-Olemey, Al-Muhtad and Affi (1994). Three treatment samples using three replicate per each samples were used. The data generated were subjected to analysis of variance (ANOVA) according to (SAS, 2000). Where differences in means manifest, the Fisher’s least significance difference test (FLSD) was used to separate them at (P< 0.05) level of probability.

RESULTS

The effect of location on chemical and energy composition of sugarcane peels meal is presented in table (1). The chemical composition of, ether extract and nitrogen free extract were significant (P<0.05), also, dry matter of the sugarcane peels was highly significant (P<0.01) by the location. Meanwhile, energy was significantly affected (P<0.05) by the location of the sugarcane peels. Crude protein, crude fiber and ash were not significantly affected (P>0.05) by the sugarcane location. Values for dry matter ranged from 96.06 – 96.82%; ether extract ranged from 1.26 – 1.61%; nitrogen free extract from 53.04 – 55.82%. Also, crude protein ranged from 6.02 – 8.20%; crude fiber ranged from 29.99 – 30.22%; ash ranged from 6.95 – 6.97% and energy ranged from 3891.34 – 4037.5 kcal/kg.

The effect of location on cellulose, hemicellulose, NDF, ADF, and ADL of sugarcane peels meal is presented also in table (2). All the parameters were significant (P<0.05). The values for cellulose ranged from 34.05 – 37.00%; hemicelloses ranged from 14.05 - 15.56%; neutral detergent fibre ranged from 46.92 - 49.54%; acid detergent fibre ranged from 61.02 - 65.28% and acid detergent lignin ranged from 11.37 – 13.61%.

The anti-Nutritional factors or phytonutrients (quantitative and qualitative) in sugarcane peels meal as affected by the location is presented in table (2). The phytonutrients of all the components were not significantly affected (P>0.05) by the location. Values of tannin ranged from 0.10 - 0.11%; phytate ranged from 2.44 - 2.57%; Oxalate 4.11 - 4.18%; saponin 3.87 - 5.87% and hydrogen cyanide 0.29 -- 0.33%.

DISCUSSION

The effect of proximate compositions of sugarcane peels meal value were reported in percentage as indicated in table( 1). The dry matter is higher than the values reported by Alu, Kaankuka, Bello and Salau (2013) for SCM. Crude protein contents recorded are within the values reported by (Ochepo et al., 2012). The crude fiber observed in the study is higher than the 12% reported by Ayoade et al. (2007) for SCM. The ether extract contents recorded are lower than 2.8% reported by Ayoade et al. (2007).
Table 1: Effect of location on chemical, pH and energy composition of sugarcane peels meal

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Locations of Sugarcane Peels</th>
<th>LSD*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kano (KN)</td>
<td>Kaduna (KD)</td>
</tr>
<tr>
<td>Dry Matter (DM%)</td>
<td>96.71&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>96.82&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Crude protein (CP%)</td>
<td>8.2</td>
<td>6.06</td>
</tr>
<tr>
<td>Crude Fiber (CF%)</td>
<td>30.19</td>
<td>29.99</td>
</tr>
<tr>
<td>Ether extract (EE%)</td>
<td>1.61&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.18&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Nitrogen free extract (NFE%)</td>
<td>53.04&lt;sup&gt;b&lt;/sup&gt;</td>
<td>55.82&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cellulose%</td>
<td>34.64&lt;sup&gt;b&lt;/sup&gt;</td>
<td>34.05&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hemicellulose%</td>
<td>15.31&lt;sup&gt;b&lt;/sup&gt;</td>
<td>14.05&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Neutral detergent fiber%</td>
<td>49.54&lt;sup&gt;a&lt;/sup&gt;</td>
<td>46.92&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Acid detergent fiber%</td>
<td>65.28&lt;sup&gt;a&lt;/sup&gt;</td>
<td>61.02&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Acid detergent lignin%</td>
<td>13.61&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.82&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>pH</td>
<td>6.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.42&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Energy (Kcal/g)</td>
<td>3891.34&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4037.53&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a,b</sup> Means in the same row with different superscripts are significantly different (P < 0.05)

<sup>LSD</sup> = Least Significant Difference.

Table 2: Anti nutritional factors or phytonutrients of sugarcane peels meal as affected by location

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Locations of Sugarcane Peels</th>
<th>LSD*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kano (KN)</td>
<td>Kaduna (KD)</td>
</tr>
<tr>
<td>Tannin</td>
<td>0.10</td>
<td>0.11</td>
</tr>
<tr>
<td>Phytate</td>
<td>2.57</td>
<td>2.44</td>
</tr>
<tr>
<td>Oxalate</td>
<td>4.18</td>
<td>4.11</td>
</tr>
<tr>
<td>Saponin</td>
<td>4.03</td>
<td>5.87</td>
</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>0.33</td>
<td>0.29</td>
</tr>
</tbody>
</table>

<sup>LSD</sup> = Least Significant Difference.

Table 1 also shows the values for hemicelluloses which were very close to the values of 12.22 - 14.61% obtained by Adesoji, (2012) for SCM. The acid detergent fiber values were lower than the 78.75- 84.04% obtained by Adesoji (2012) but, within the values (24.95 – 54.37%) reported by Dos Anjos, Silva and Campana (2008), for matured sugarcane. The values of NDF reported in the study are within the values of 61.9% reported by Neckle (1988) for sugarcane tops. Feed products obtained from sugarcane are high in fiber and/or energy and, therefore, are primarily used in ruminant feeding, especially cattle, to meet nutritive requirements. Feed rations containing sugarcane or its by-products are usually combined with other feed products (OECD, 2011).

The pH values in Table 1 shows the mixed sugarcane peels appear to be less alkali compared to the KN and KD sugarcane peels. Energy content values (3891. 34 – 4037.53kcal/kg) were higher than 1945 kcal/kg reported by (OECD, 2011) but, within the range of 3344 – 4311 kcal/kg reported by Alu et al. (2013) for SCM. Location, method of processing, storage and other factors might have resulted in observed differences in chemical compositions since all the authors cited worked on SCM.

Tannin values in this research are very low as indicated in table (2) and also Waghorn, Avendale and Woodfield (1990). suggested that the concentration of condensed tannins above 4 per cent should be considered toxic for ruminants. The range of phytate in this study is minimal and will not result to negative performance in ruminants. Ruminants can readily use phytate because of the activities of the rumen micro-organisms, while non-ruminants cannot. The Oxalate values in this study are safe for ruminants (Abu-Zanat, et al. 2003). Ruminants can break down saponins in the rumen, while monogastrics cannot. The saponins are water soluble and feeds treatments removes saponins (Ranjhan, 2001). In non-
ruminants (chicks and pigs), retardation of growth rate, due primarily to reduction in feed intake, is probably the major concern. Such effects have also been noted (saponin 0.71%) when saponin was incorporated in a chick diet. Furthermore, because saponins may also undergo bacterial degradation in the rumen, they may not retard the growth of ruminants (Soetan and Oyewole, 2009). The values of hydrogen cyanide (HCN) reported in this study are low. An earlier study observed that extensive processing such as sun drying and milling of sugarcane will naturally, reduce levels of any(HCN) by animals consuming sugarcane and its by-products Knight and Walter (2001).

CONCLUSION

Effect of location on proximate revealed that all the sugarcane peels from different locations contained substantial amount of crude protein (6.02% – 8.20%), crude fibre (29.99% – 30.22%) and other nutrients that will be used as ruminant feeds. However, energy values (3891.34 – 4037.53kcal/kg) and moderate anti-nutritional Factors/phytonutrients (quantitative and qualitative) compositions of sugarcane peels from different locations qualified it to be used as ruminant feeds.

RECOMMENDATIONS

Based on the findings from this study, sugarcane peels meal contained substantial amounts of energy and moderate amounts of proteins for ruminants’ feedings. However, the peels meal can be safe for ruminants’ feedings since it contained small amounts of anti-nutritional factors/phytonutrients compositions. However, further studies should be carried out in order to evaluate performance, digestibility and economic incorporation of sugarcane peels to various categories of ruminants. Also the result of this experiment could be used to improve sugarcane production and job creation in Nigeria.

ACKNOWLEDGEMENT

We acknowledge Federal College of Education (Technical) Bichi, Kano State, Nigeria for providing some facilities support for this research.

REFERENCES


Accepted 18 August 2018


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