Response of Growing Calves Fed graded Levels of Farm Kernel Meal as Nitrogen

Source

By:

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Abstract

Feeding experiment was conducted to determine the nutritive value of Palm Kernel Meal (PKM) in growing rations of cattle lasting 59 days. Twenty-four animals (24) were used in the study made up of 12 female Zebu (6 each of Bunaji and Sokoto Gudali) and 12 Friesian cross with Bunaji. The study has demonstrated the potentialities of the feedstuff in cattle growing rations “among” other locally produced feedstuffs of the same status in Nigeria. Feed intake and feed conversion ratio were found to be influenced by the level of PKM ingested (P<0.05) however, the influence was insignificant (P>0.05) for daily weight gain. Forty-five percent (45%) PKM was found optimum level for use in cattle growing rations. Feeding higher or lower level than that will not bring fast growth as wanted in calves.

Introduction:

Palm kernel meal (PKM) is a commercial by-product of palm oil extraction from palm tree *Elaeis guineensis* (Jacq.). The possible uses of PKM in livestock rations have been known for some time. However, limited work has been done relative to nature of its protein and no significant attempts have been made to estimate the availability of nutrients in the meal following digestion.

PKM production from tropical countries especially Nigeria has shown an upward trend in recent years FAO (1990). However, despite this, limited amount of the meal produced go into ruminants’ diets.

Generally, protein taken by ruminants is subjected to proteolitic activities of rumen micro-organisms to produce amino acids. El-Shazly et al (1993) have revealed the amino acids deamination to produce ammonia, which is the chief end product of protein
hydrolysis in the rumen. In separate experiments Annison (1985) and Lewis (1990) have shown the rate of protein breakdown in rumen to vary with the nature of food ingested. Thus, MacDonald (1994) found out concentration of ammonia produced in the rumen to be related to the solubility of the protein and the efficiency of protein utilization by ruminants therefore depends partly on the quality of the feeds and the ammonia produced, which in turn affects the concentration of blood urea. The quality of dietary protein is relatively of little importance to ruminants because all nitrogen sources are converted to microbial protein in the rumen and the host animal is presented with protein of more or less standard quality regardless of the diet, Chalmers and Synge (1984). However, in assessing the value of proteins to ruminants Pilgrim et al (1989) said two factors are taken into consideration these are, the way the nitrogen compounds are modified in the rumen and the extent to which the ingested nitrogen source is absorbed thus, the loss of rumen ammonia is accounted by the proportional concentration of ammonia in the rumen. Also in separate experiments Blackburn (1985) and McDonald (1994) have determined high carbohydrate content of feed to lower the rumen pH, which decreases with the ammonia absorption.

PKM appear to vary little in composition. Malakar and Rombout (1988) have shown the kernel to contain 52% oil, 8.8% protein, 23% non-protein extracts, 5.2% cellulose and 2% ash. On removal of the oil, the composition of PKM will vary with the method of processing for example, in screw pressed meal, protein will rise to about 18-20%, water 11% and NFE 50%, cellulose and ash will be 11% and 4% respectively. On the nature of the PKM protein Christensen et al (1990) had reported lysine to be the limiting amino acid, but its value of 3.8g/16g N is comparable to the level in groundnut meal (GNM) and close to that of cotton seed cake (CSC). Its methionine content (2.3g/16g N) is comparable to that of CSC and higher than in African Locust bean (1.0g/16g N) and coconut meal (0.9g/16g N). Similarly, its tryptophan content is fairly high (0.8g/16g N). Thus Fetuga et al (1984) concluded that the PKM protein appears to be fairly balanced with respect to its essential amino acids and its digestibility of 73.9% makes the individual amino acids fairly available to the animal.

Umunna (1979) compared PKM with other protein based meals in tables 1, 2 and 3 that showed the meal to be as high as GNM and CSC in dry matter (DM), crude protein (CP),
ether extracts (EE), crude fibre (CF), nitrogen free extracts (NFE) and ash. Likewise the nutritive value of the meal in terms of digestible crude protein (DCP), digestible ether extracts (DEE), digestible crude fibre (DCF) and digestible nitrogen free extract (DNFE) is comparable to GNM and CSC. Although DCP is low in PKM, its price and availability have compensated the deficiency and encouraged it usage as feedstuff.

In view of the foregoing, the feeding experiment was aimed at evaluating the nutritive value of PKM in cattle growing rations and accumulates the information for incorporation of the feedstuff in to balanced rations for optimal growth in calves.

**Materials and methods:**

The objective of the feeding study was to determine the protein value of PKM in cattle growing rations. A total of twenty-four (24) female Zebus (six each of Bunaji and Sokoto Gudali) and twelve (12) Friesian cross with Bunaji were used in the experiment lasting fifty-nine (59) days. Animals were randomized to the treatments according to shrunk initial weight (without water and feed for 16 hours). The treatments are:

1. Cotton Seed Cake (CSC) – Control
2. 30% Palm Kernel Meal
3. 45% Palm Kernel Meal
4. 60% Palm Kernel Meal

The rations were isonitogenous and composed of 60% corn silage and 40% supplements on dry matter basis. The animals were dewormed before they were individually housed and fed their experimental diets once daily (in the morning). Bi-weekly weights of the animals were taken throughout the trial period.

Results were analysed by calculating F-values to determine the level of significance between the differences of the various treatments and their relationships with the following performance parameters:

1. Average Daily Feed Intake (DFI)
2. Average Daily Gain (ADG)
3. Average Daily Feed Conversion Ratio (FCR)
Results and Discussions:
The result of the feeding study (table 4) shows highest ADG and best FCR in animals on treatment four (60% PKM). High DFI value was however, shown in treatment one, the control treatment (cotton seed cake). Although DFI was low for PKM attributable to its gritty/dry nature Collinwood (1984) said it can be improved by addition of more palatable feedstuffs like molasses to take the advantage of its low cost and availability in the market.

Statistical analysis of results (tables 5, 6 and 7) has revealed differences in the three performance parameters as follows:
1. For ADG the difference between treatments is not significant (P>0.05) although, the mean of the treatments shows slight differences. The animals on treatment 3 and 4 were slightly better animals on the other treatments.
2. For DFI the control diet seemed to be readily consumed than the other diets. The difference between treatments was significant (P<0.05). Also the mean of the treatments shows DFI for control diet to be higher than for other diets.
3. For FCR differences between the treatments was significant (P<0.05). Mean of the treatments also shows animals on treatment four to have best feed utilization efficiency.

Summary and Conclusion:
Feed intake and feed conversion efficiency were significantly influenced by level of PKM in the diets (P<0.05). The result of the experiment has therefore revealed that potentiality of PKM among other feedstuffs to be of equal status.
Forty-five percent (45%) PKM level was found optimum for growing diets of calves. Breed effects on the performance parameters were not checked for lack of adequate number of animals.
References:

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   the Ruminants. *Journal of Biochemical Society, 64: 705*

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   Protein Quality of Some Nigerian Feedstuffs, *Nigerian Journal of
   Animal Production, 3:2*


# Tables:

## Table 1: Average Chemical Composition of PKM (%DM)

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Dry Matter DM</th>
<th>Crude Protein CP</th>
<th>Ether Extract EE</th>
<th>Crude Fibre CF</th>
<th>Nitrogen Free Extract NFE</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut Meal (GNM)</td>
<td>90.40</td>
<td>51.41</td>
<td>10.16</td>
<td>4.16</td>
<td>4.64</td>
<td>5.51</td>
</tr>
<tr>
<td>Cotton Seed Cake (CSC)</td>
<td>94.60</td>
<td>28.40</td>
<td>14.05</td>
<td>21.61</td>
<td>31.10</td>
<td>1.75</td>
</tr>
<tr>
<td>Palm Kernel Meal (PKM)</td>
<td>91.60</td>
<td>20.40</td>
<td>8.32</td>
<td>9.02</td>
<td>56.60</td>
<td>5.67</td>
</tr>
</tbody>
</table>

Source: Oyenuga (1983)

## Table 2: Calculated Nutritive Values of PKM (%Digestibility)

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Digestibility CP %</th>
<th>Digestibility EE %</th>
<th>Digestibility CF %</th>
<th>Digestibility NFE %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut Meal (GNM)</td>
<td>46.75</td>
<td>9.25</td>
<td>2.32</td>
<td>24.90</td>
</tr>
<tr>
<td>Cotton Seed Cake (CSC)</td>
<td>21.07</td>
<td>12.93</td>
<td>13.83</td>
<td>18.40</td>
</tr>
<tr>
<td>Palm Kernel Meal (PKM)</td>
<td>16.48</td>
<td>6.32</td>
<td>4.81</td>
<td>49.20</td>
</tr>
</tbody>
</table>

Source: Oyenuga (1977)

## Table 3: Related Average Price per Ton (N) of PKM

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>1990-1993</th>
<th>1994/95</th>
<th>% Increase</th>
<th>1999</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut Meal (GNM)</td>
<td>6500</td>
<td>12000</td>
<td>65</td>
<td>27000</td>
<td>55.6</td>
</tr>
<tr>
<td>Cotton Seed Cake (CSC)</td>
<td>-</td>
<td>6000</td>
<td>-</td>
<td>9000</td>
<td>6.66</td>
</tr>
<tr>
<td>Palm Kernel Meal (PKM)</td>
<td>5700</td>
<td>5700</td>
<td>-</td>
<td>6000</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Source: FAO (1990)
### Table 4: Results of the Feeding Experiment

<table>
<thead>
<tr>
<th>Treatment No</th>
<th>T R E A T M E N T S</th>
<th>% PKM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>SE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of calves</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Initial Weight, Kg</td>
<td>115</td>
<td>108</td>
<td>114</td>
<td>112</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Daily Gain, Kg</td>
<td>0.23</td>
<td>0.24</td>
<td>0.32</td>
<td>0.34</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Feed Intake, Kg</td>
<td>3.91</td>
<td>2.16</td>
<td>2.88</td>
<td>2.67</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed Conversion Ratio</td>
<td>10.66</td>
<td>9.79</td>
<td>9.96</td>
<td>5.84</td>
<td>2.23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Study Data  
* Standard Error  
  1 One animal died at the beginning of the experiment

### Table 5: Analysis of Variance – Feed Intake

<table>
<thead>
<tr>
<th>Sources</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>F-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment (t – 1)</td>
<td>3</td>
<td>211754.62</td>
<td>70584.87</td>
<td></td>
</tr>
<tr>
<td>Error [n – (t – 1)]</td>
<td>19</td>
<td>2605464.60</td>
<td>137121.70</td>
<td>0.515*</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>2817463.10</td>
<td>207706.57</td>
<td></td>
</tr>
</tbody>
</table>

* This value is smaller than the table F-Value of 3.15 at 5% level of probability. Thus, the feed intake variance between the treatments is not statistically significant.

### Table 6: Analysis of Variance – Average Daily Gain

<table>
<thead>
<tr>
<th>Sources</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>F-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment (t – 1)</td>
<td>3</td>
<td>0.77</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>Error [n – (t – 1)]</td>
<td>19</td>
<td>0.58</td>
<td>0.03</td>
<td>8.66*</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>1.35</td>
<td>0.06</td>
<td></td>
</tr>
</tbody>
</table>

* This value is greater than the table F-Value of 3.15 at 5% level of probability. Hence, the average daily gain variance between the treatments is statistically significant.
Table 7: Analysis of Variance – Feed Conversion Ratio

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>F – Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>3</td>
<td>1767.43</td>
<td>589.14</td>
<td></td>
</tr>
<tr>
<td>(n – 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>19</td>
<td>589.14</td>
<td>31.00</td>
<td>19*</td>
</tr>
<tr>
<td>[n – (t – 1)]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>1968.89</td>
<td>89.49</td>
<td></td>
</tr>
<tr>
<td>(n – 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* This figure is greater than the table F – Value of 3.15 at 5% level of probability. Hence, the feed conversion ratio variance between the treatments is statistically highly significant.

Formulae/Models:
1. DFI is calculated by taking the difference between kg feed allowed and the kg remnants per day per animal as follows:
   
   Kg feed allowed – F
   Kg feed left over – f
   Number of animals/treatment – n
   Number of days the experiment lasted - d
   
   DFI (kg) = \(\frac{n (F-f)}{d}\)

2. ADG is calculated by taking the difference of daily weight of animal with the preceding day's weight of the animal as follows:
   
   Today’s weight, kg – W
   Yesterdays weight, kg – w
   Number of animals per treatment - n
   Number of days experiment lasted – d
   
   ADG (kg) = \(\frac{n (W-w)}{d}\)

3. FCR is calculated by dividing daily feed consumption by daily weight gain as follows:
   
   Kg feed consumed per day – f
   Kg weight gain per day – w
   Number of animals per treatment – n
   Number of days experiment lasted – d
   
   FCR = \(\frac{n (f-w)}{d}\)