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<td>Author 1</td>
<td>AKA, L.O</td>
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<td>OBIDIKE, R.I</td>
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THE EFFECT OF INTRARUMINAL INFUSION OF IODINATED CASEIN ON THE POTENTIAL DEGRADABILITY OF *PANICUM MAXIMUM* IN WEST AFRICAN DWARF X UDA SHEEP

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SUMMARY

The quantitative (percentage) rumen degradability of *Panicum maximum* at 48hrs post rumen incubation was studied in West African (Northern) long-legged sheep using the nylon bag technique, in a 4x4 Latin square experimental design of; four sheep, four time intervals, four experimental rounds of same sample and four levels of iodinated casein. The animals had an average body weight of 9.6 ± 1.46kg. They were fitted with rumen fistula through which *Panicum maximum* were incubated. Various dose ranges of 1.5g, 2.5g, 3.5g, and 4.5g of iodinated casein were infused into the rumen 8hrs prior to the incubation. Potential rumen degradability of *Panicum maximum* was determined at time intervals of 4, 8, 12 and 48hrs post incubation. The results of the experiment showed that infusing a maximum dose of 3.5g of iodinated casein produced marked improvement in the rumen degradability of dry matter, organic matter and crude protein fractions of *Panicum maximum* and beyond this limit the effect decreased. The increase in rumen potential degradability of all the fractions of *Panicum maximum* was significantly different (p<0.05) between the treatment groups of 2.5g and 3.5g of iodinated casein and the control as well as among the extremes of the treatment groups. This increase was however found to be dose (iodinated casein) dependent. The result of this experiment will hopefully expand the possibilities of exploiting the nutritional benefits of some ruminant feeds particularly the more fibrous, rumen undergradable, non-conventional feed resources through the inclusion of appropriate levels of iodinated casein in ration containing them. In so doing, the scope of feed resources for ruminants may be expanded.

KEYWORDS: Rumen, degradability, iodinated casein, *Panicum maximum*, sheep.
INTRODUCTION

Measuring feed fraction degradability within the rumen is usually a difficult task (Hungate, 1966). For this reason in vitro studies involving cultures of rumen microbes are usually preferred (Czekowski, 1986). In such studies numerous factors are known to modulate the events studied (Katho et al., 1993).

Researchers in ruminant nutrition have attempted various ways of improving the utilization of both conventional and non-conventional feed resources by ruminant animals. The involvement of rumen microbes in the breakdown of feedstuffs opens many ideas towards this purpose. It sounds therefore biologically logical to state that improving the activity of the rumen microbes by whatever means, may enhance better bioavailability of contents of these substances upon which they act. Activity of rumen microbes have been modulated in various ways namely: grinding of feedstuffs improves degradability (Weston and Hogan, 1967); defaunation improves ruminal bacterial activity (Jacques et al., 1987); enzyme inclusion in feed improves digestibility (Cooper et al., 1995); temperature regulation modifies microbial synthesis (Kennedy and Miligan, 1978); season affects degradability (Arigbede et al., 2002). These methodologies/strategies are generally targeted towards developing a feeding programme that will enhance better degradability.

nutrient bioavailability and utilization. Newer methods such as rumen degradability characteristics of feeds, especially roughages, have been used to describe the nutritional value of feeds for ruminant animals (Bhagara and Orskov, 1987).

Under natural conditions, ruminants utilize forages as defined by the in vivo degradative capacities of the rumen microbes (Czekowski, 1986), rumen rate of passage (Verbie et al., 1999) and other factors. However, according to Leng (1974), the natural limitations in the digestive physiology of an animal can be readily improved by the use of both naturally occurring or synthetic agents. For instance the use of copper sulphate, at certain concentrations, to reduce protozoal population has been used to improve rumen degradability of forages (Melvin, 1993). Likewise intra-ruminal infusion of free amino acids have resulted in improved digestibility in steers (Spears and Harvey, 1984) but amino acid in peptides are incorporated by certain rumen microbes more efficiently than are free amino acids (Philposon, 1970). In order to further investigate this claim, that amino acids in peptides is beneficial in rumen microbial activity, this experiment was aimed at using iodinated casein as source of peptide amino acids and degradability characteristics of Panicum maximum, to measure the activity of rumen microbes when iodinated casein is infused into the rumen.

MATERIALS AND METHODS

Animals

Four West African Dwarf X Udara rams were bought from Ibega market in Nsukka local government area of Enugu state. They were quarantined for 21 days in a pen measuring 10ft x 8ft in the farm unit of the Faculty of Veterinary Medicine, University of Nigeria, Nsukka. During this period they were examined for helminth ova using the flotation technique. They were dewormed using a combined prophylactic dose of ivermectin and piperazine at dose rates of 220mg/kg, subcutaneously and 44mg/kg, IM respectively (Merck Vet Manual, 1993). They were fed with fresh green forages and occasional grain supplementation. Feed and water were offered ad libitum. After the 21 days quarantine period they were weighed using a weighing beam. They were later prepared for surgical rumen fistulation as described by Dougherty (1955), Oladosu and Akpokodje (1992) and Akpa and Kanalu (2004, 2005). Iodinated casein was prepared as described by Krausz et al. (2005), using potassium iodide as the iodine source.

Rumen incubation procedure

The nylon bag technique as developed and described by Mehrez and Orskov (1977) was adopted. Different measures of iodinated casein: 1.5g, 2.5g, 3.5g and 4.5g were introduced into the rumen of each sheep 12 hours before the incubation of the nylon
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bags that contained 1g each of the *Panicum maximum* into the rumen. Prior to incubation the chemical composition of *Panicum maximum* was determined by a proximate analysis procedure. (Aka and Kamalu, 2004)

Degradability studies

The immediate water soluble fractions 'a' and the slowly rumen degradable fraction 'b' of dry matter, organic matter and crude protein for *Panicum maximum* were determined as described by Arighede et al (2002), Aka and Kamalu (2004). The degradability characteristics of *Panicum maximum* at different doses of iodinated casein were monitored between 4-48hrs post rumen incubation.

RESULTS

Table 1 shows the normal chemical composition of *Panicum maximum*. The degradability of dry matter, organic matter and crude protein fraction of *Panicum maximum* in sheep on various intraruminal doses of iodinated casein at 48hrs is given in Table II. Table III: shows the potential degradability ('a': 'b') of all the feed fractions expressed in percentages.

<table>
<thead>
<tr>
<th>TABLE I: Chemical composition of <em>Panicum maximum</em> (% of dry matter)</th>
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<tr>
<td>Feed sample</td>
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<tr>
<td><em>Panicum maximum</em></td>
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TABLE II: Dry matter, organic matter and crude protein degradability of *Panicum maximum* in sheep with intraruminal iodinated casein at 48hrs post incubation

<table>
<thead>
<tr>
<th>Iodinated Casein levels (gms)</th>
<th>Feed fraction</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td>'a'</td>
<td>'b'</td>
<td>'a'</td>
<td>'b'</td>
<td>'a'</td>
</tr>
<tr>
<td>1.5</td>
<td>6.01</td>
<td>462.73</td>
<td>1.46</td>
<td>522.06</td>
<td>1.36</td>
</tr>
<tr>
<td>2.5</td>
<td>5.20</td>
<td>501.82</td>
<td>1.30</td>
<td>562.42</td>
<td>1.28</td>
</tr>
<tr>
<td>3.5</td>
<td>6.40</td>
<td>631.64</td>
<td>1.09</td>
<td>731.84</td>
<td>1.93</td>
</tr>
<tr>
<td>4.5</td>
<td>6.30</td>
<td>462.07</td>
<td>0.98</td>
<td>542.54</td>
<td>1.26</td>
</tr>
<tr>
<td>Control</td>
<td>8.80</td>
<td>421.36</td>
<td>10.01</td>
<td>391.46</td>
<td>1.20</td>
</tr>
</tbody>
</table>

*a* immediate soluble fraction.  
*b* slowly rumen degradable fraction.

Values with 'a' superscript are significantly (P< 0.05) different from the control.

TABLE III: Potential degradability of *Panicum maximum* at 48hrs post incubation in sheep with intraruminal addition of iodinated casein.

<table>
<thead>
<tr>
<th>Iodinated Casein Levels (gms)</th>
<th>Potential degradability (%) at 48hrs post incubation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM(%)</td>
</tr>
<tr>
<td>1.5</td>
<td>520.64</td>
</tr>
<tr>
<td>2.5</td>
<td>55.20</td>
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<tr>
<td>3.5</td>
<td>69.40</td>
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<tr>
<td>4.5</td>
<td>52.30</td>
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</table>
DISCUSSION

The result of the experiment showed a significant (p<0.05) increase in the degradability of *Panicum maximum* with addition of graded levels of inoculated casein into the rumen. It was also observed that degradability improved with increasing levels of inoculated casein up till the 1.5 g mark. Levels above 3.5 g (e.g., 4.5 g) yielded a poor degradability when compared with the 1.5 g to 3.5 g levels of inoculated casein. As shown in Tables II and III, inoculated casein produce improved degradability of all the feed fractions (dry matter, organic matter and crude protein).

There were marked increases in the degradability of each of these fractions. As the levels of inoculated casein increased from 1.5 g to 3.5 g, the potential degradability increased from 52.5% to 69.4% for dry matter, and 53.4% to 74.09% for organic matter and 68.64% to 98.76% for crude protein. These represent an increment of 17.4% for dry matter, 20.69% for organic matter and 30.13% for crude protein, as inoculated casein is increased from 1.5 g to 3.5 g. When compared with the control, at 48 hrs after incubation, increasing inoculated casein up to 3.5 g produced an increment in degradability of 19.4% for dry matter, 13.09% for organic matter and 41% for crude protein.

Meanwhile, it was also observed that increasing the level of inoculated casein beyond 3.5 g (e.g., 4.5 g in this experiment) produced a decreased degradability effect. For instance for organic matter at 4.5 g of inoculated casein, the potential degradability decreased to 45.98% from 74.99% at 3.5 g level. These trends of events simply suggest that inoculated casein improves the degradability characteristics of feedstuffs within a given limit beyond which a decrease degradability results. Again the benefits of inoculated casein is evidenced by its ability to overcome the detrimental effects of rumen indigestible polysaccharides (e.g. NSP) such as, their ability to increase digesta viscosity (Hill and Hymaswood, 2001), their ability to interact with the microflora of the gut, (Hodgson and Apjin Labhi, 2002), and their ability to alter the physiology and morphology of the digestive tract (Spiehs et al., 2002), by degrading them and making them unattainable within the ruminant and post ruminal segment of the gut.

As an attempt to explain the probable mechanism, it is suggested that inoculated casein increases either the growth of the microbial population of the rumen after some hours upon introduction into the rumen or by initiating a processes that increase the production, of bacterial enzymes within the rumen. Numerous factors have been shown to be involved in the regulation of the growth rate of various species of rumen microorganisms (Hill, 1969). Diet and time after feeding are also such factors (Nichols, 1992). The mechanism with which would increase the growth rate of rumen bacterial which in turn increases rumen protozoa population few hours after feeding (Mohammed and Smith, 1977). This could have accounted for the improved degradability since the *Panicum maximum* with inoculated casein after introduction of inoculated casein. It is probable that inoculated casein served as a source of amino acids, which were further utilized for microbial growth.

The trend where further increase in inoculated casein beyond 3.5 g, did not yield a corresponding increase in degradability of feed fractions is however puzzling. It could be as a result of reduced bacterial population due to massive proliferation of rumen protozoa. With increased bacterial multiplication and growth, rumen protozoa feed much faster to feed on, and in so doing reduce their population and activity. The ecology of the rumen microbes seems to be regulated by interdependence of the microbes themselves. Based on this finding therefore, the effect of inoculated casein on the physiology and microbiology of the rumen can be said to be dose dependent. Studies of nutritional factors important for the growth of rumen microbes tend to emphasize the interdependence of the microbes and their fit into ecological niches (Haugtge, 1966).

CONCLUSION

In conclusion, this experiment has provided some clues to the importance of inoculated casein in ruminate nutrition particularly in the improvement of rumen degradability. This idea can be employed to enhance the utilization of non-starch polysaccharides (NSP) to enhance
energy availability from them. Just as concepts are needed to improve the digestibility of nutrients from non-conventional feed resources in poultry, radicin can play a similar role in ruminants. It is therefore possible to produce commercial fermented radicin and consequently use it for the improvement of digestibility of pectin and hemicellulose to yield ultimately usable calorie energy within the rumen, which is in turn produce acceptable health outcomes in ruminants. The challenge of enhancing the nutritive value of conventional and non-conventional feed resources for ruminants may be addressed by the incorporation of radicin in ruminant rations.

It is recommended that further investigations into the mechanism by which radicin brings about improved nutrition, digestibility of feeds, and ruminant performance, the results of this experiment may serve as a basis for adopting the benefits of incorporating radicin in ruminant rations.

REFERENCES


AKA et al: Degradability of *Panicum maximum* in sheep


