RUMEN CONTENT CHARACTERISTICS AND HERBAGE DIGESTIBILITY OF CATTLE AND CAMEL GRAZING NATIVE PASTURE IN A SAHEL SAVANNA ECOSYSTEM

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ABSTRACT

Camels and cattle grazed in the native pasture of the Sahel savanna and presented for slaughter at the Maiduguri Municipal Abattoir were used to evaluate differences in forage selection, rumen content characteristics and forage organic matter digestibility. After evisceration, rumen contents were obtained and separated into solid digesta and twigs. The rumen fluid was examined for colour, pH and specific gravity. The faecal index method was used to determine the organic matter digestibility of the herbage eaten. The investigation showed that the camel rumen content was twiggy and greenish in colour, while that of cattle was mushy and brownish in colour. Camel rumen solid digesta contained leaves and twigs in contrast to cattle digesta which had grass remnants. Mean rumen pH values were 6.98 ± 0.03 and 7.14 ± 0.04 for camel and cattle respectively. Mean specific gravity values were 1.016 ± 0.005 and 1.005 ± 0.001 for camel and cattle respectively. Forage organic matter digestibility was significantly higher in camels than in cattle (P < 0.05).

Keywords: Rumen content characteristics, Herbage digestibility, Cattle, Camel

INTRODUCTION

In the Sahel savanna, cattle and camel are produced by an extensive system on natural rangelands. The climate of the region is characterized by a long dry season of about 9 months, from September to May. During the rainy season, some vegetation grows but they are of short duration (Satter and John, 1985). The predominant flora were *Acacia* sp, *Commiphora* sp, *Combretum* sp, *Terminalia* sp (all trees), *Cenchrus* sp and *Andropogon guyanus* (Kowal and Kassam, 1978). The animals subsist on grazing and browsing, although camels prefer browsing to grazing (Williamson and Payne, 1968; Olusanya *et al.*, 1985).

Camels are polygastric animals, but they are often referred to as 'pseudo-ruminants'. This is because some anatomical and physiological differences in digestive system have been observed between camels and 'true ruminants' (Wilson, 1984; Bhatia and Ghosal, 1992). The implication or importance of these differences is yet to be fully accessed. Attempts have been made to study their grazing habits, particularly; the time spent grazing and ruminating per day (Hafez, 1968; Williamson and Payne, 1968; Khana and Zaied, 1991). These studies suggest that on the average, cattle have a higher grazing rate and ruminating efficiency than camels.

Forage nutritive value may be evaluated by measuring either digestibility or efficiency with which forage is converted to animal product. Of these methods, digestibility is the most commonly used measure of value. It is easily measured and its reproducibility is better

than consumption and efficiency (Van Soest, 1973; Mott, 1973). The study reported herein was carried out to assess; (i) The forage consumed and the resulting effect on rumen content characteristics and (ii) the extent of forage digestion by camels and cattle grazed in native pasture of the Sahel savanna of Borno State, Nigeria.

MATERIALS AND METHODS

Indirect methods were used to access the type of forage eaten and the overall organic matter digestibility in camels and cattle grazed in the natural range. The animals were presented for slaughter at the Maiduguri city abattoir during the months of November and December, 1993. The animals sampled underwent antemortem and postmortem examinations, and were certified healthy. After evisceration, the rumen was opened and the contents obtained and filtered through four layers of cheese cloth to separate solid digesta from rumen liquor. The rumen fluid was examined for colour, pH and specific gravity. The pH was determined with a pH meter (Denver Instrument Company Model 20), while specific gravity was determined by means of a hydrometer. The solid digesta was examined for presence of browse leaves, grasses and twigs.

The faecal index method was used to determine digestibility. The method consisted of determining the concentration of nitrogen in faeces and applying the value in a known regression equation to calculate digestibility as: $Y = 3.43X + 64.63$, where Y = organic matter (OM) digestibility and X = faecal organic matter content (Greenhalgh *et al*., 1966). Faecal samples were collected per rectum from 17 camels (*Camelus dromedarius*) and 16 *Zebu cattle* (Wadara). The samples were collected in plastic bags between 6.00 and 7.00 am. They were immediately transported to the laboratory in an insulated box containing ice. In the laboratory, few drops of undiluted formaldehyde were added to each sample as preservative. The bags were tied off to exclude air. They were stored frozen at -10^{o}C until analyzed for proximate fractions according to the AOAC methods (AOAC, 1993).

Statistical Analysis: Comparisons between camel and cattle were carried out using the student t' test (Steel and Torrie, 1982).

RESULTS

The characteristics of the rumen contents are shown in Table 1. The camel rumen content was twiggy and greenish in colour. Examination of the solid digesta for forage residues revealed the presence of leaves and twigs in the camel rumen content. Two different *Acacia* species and other shrubs were identifiable. Cattle digesta on the other hand revealed presence of grass remnants. Mean values for rumen pH were 6.98 ± 0.03 and 7.14 ± 0.04 for camel and cattle respectively. This difference was statistically significant ($P < 0.05$). Specific gravity values of 1.016 ± 0.005 and 1.005 ± 0.001 were obtained for camel and cattle respectively. The difference in specific gravity was not statistically significant ($P > 0.05$).

The differences in the proximate fractions obtained from camel and cattle faeces are shown in Table 2. Camel faeces were higher in crude protein, ether extract, crude fibre and ash, while cattle faeces were higher in nitrogen-free extract (NFE). The differences in crude protein, nitrogen-free extract and crude fibre were statistically significant ($P < 0.05$). Also shown in Table 2 is the organic matter digestibility of 66.35 ± 0.25 and 65.49 ± 0.21 for camel and cattle respectively. The difference was statistically significant ($P < 0.05$).

DISCUSSION

In this study, differences in the colour, forage type and pH of rumen content were observed. These observations indicated that camels ate browse plants while cattle ate grasses. It confirms other reports in the literature on the eating habits of camels and cattle (Williamson and Payne, 1968; Olusanya *et al*., 1985). Normally, the pH and specific gravity of rumen contents are influenced by the nature and amount of food present in the rumen (Barnett and Reid, 1961). The normal pH range is usually between 5 and 7.5 (Barnett and Reid, 1961; Dukes, 1955), although grain engorgement can

Table 1: Characteristics of the rumen contents of cattle and camels

Species	Rumen content characteristics				
	pH	Specific gravity	Colour	Digesta	Forage type
Camel (n = 17)	6.98±0.03[a]	1.016±0.005 [a]	Greenish	Twiggy	Mostly browse
Cattle (n = 16)	7.14±0.04[b]	1.005±0.001 [a]	Brownish	Mushy	Mostly grass

Values are presented as means ± standard errors. Different superscripts in the same column represent statistical significance (P < 0.05)

Tables 2: Proximate composition of camel and cattle faeces, and pasture organic matter digestibility

Parameters	Species	
	Camel (n = 17)	Cattle (n = 16)
Crude protein (%)	2.76 ± 0.33[a]	1.44 ± 0.33[b]
Ether extract (%)	2.70 ± 0.58 [a]	1.90 ± 0.61 [b]
Nitrogen-free extract (%)	68.17 ± 3.30 [a]	85.96 ± 1.84 [b]
Crude fibre (%)	15.29 ± 3.75 [a]	4.20 ± 0.96 [b]
Ash (%)	11.10 ± 0.25 [a]	8.10 ± 2.38 [b]
Organic matter digestibility (%)	66.35 ± 0.25 [a]	65.49 ± 0.21 [b]

Values are presented as means ± standard errors. Different superscripts in the same row represent statistical significance (P < 0.05).

produce pH values below 5 (Dirkson, 1970; Argenzo, 1993). The pH values in this study were within normal range, although the value for cattle was slightly but significantly (P < 0.05) higher than that for camel. The higher rumen pH for cattle may be due to the dryness of the grass which at this time of the year had become standing hay. Dryness of feed increases the rate of salivary secretion and hence, the pH (Barnett and Reid, 1961; Blair-West *et al.,* 1965).

The importance of rumen fluid specific gravity is that it influences the rate of passage of food particles into the omasum. Lighter particles float and are retained longer in the rumen, while heavier particles (up to specific gravity of 1.2) move faster into the omasum (Hungate, 1966). According to Barnett and Reid (1961), the specific gravity of rumen contents lies between 1.02 and 1.06, and it is a function of the nature and amount of food present. In this study, we observed values of 1.016 and 1.005 for camel and cattle respectively. The two values were not statistically different (P > 0.05). The specific gravities are probably low because the animals had been subjected to overnight fast.

The differences observed in the proximate fractions of the faeces are not unexpected, since nutrients that appear in the faeces usually represent excess intake or undigested or unavailable portions. Browse and forbes generally contain higher levels of crude protein, silica and lignin (NRC, 1981). Protein in faeces was mostly NPN, in the form of microbial products or maillard products (Van Soest, 1982). Most faeces yield considerable NFE upon analysis and calculation, but do not ordinarily contain water-soluble carbohydrates. The high NFE is the result of error caused by inclusion of solubilized lignin and hemicellulose and insoluble starch into NFE (Van Soest, 1982). The higher NFE values in cattle faeces probably reflect the higher hemicellulose and lower lignin contents in grass when compared to legumes (Van Soest, 1982).

The major factors which influence digestibility of forages are fibre and protein contents. Digestibility usually decreases with increase in fibre content. It also decreases with decrease in protein content (Van Soest, 1973; NRC, 1981). In this study, a higher organic matter digestibility was observed for camel in comparison to cattle.

This difference can be explained in terms of the differences in faecal crude protein, NFE and crude fibre concentrations. Camel faeces were higher in crude protein and crude fibre, but lower in NFE. The opposite was true for cattle faeces. The general connotation is that the NFE fraction contains soluble carbohydrates and therefore should be easily digestible. The explanation for this paradox was offered by Van Soest (1982), who noted that the basic error of the NFE concept is the assumption that if constituents are soluble, they are digestible. He attributed the error to the method used in crude fibre determination, which involves successive boiling with dilute sulphuric acid and sodium hydroxide; a method that does not recover all the fibre. Large portions of fibrous constituents (lignin and hemicellulose) are extracted into the NFE. Lignin is dissolved by sodium hydroxide, and hemicellulose is dissolved by both acid and alkali. Browse plants are woody and therefore high in lignin. The effect of this is that digestibility was lowered. Grasses contain less lignin and much more hemicellulose. The lower lignin content is offset by the greater hemicellulose and consequently, high cell wall contents. The overall effect was also a lowering of digestibility with the result that the digestibility of grasses and browse plants were similar (Van Soest, 1973). Thus, the crude protein content becomes the factor that has the greatest impact on organic matter digestibility. Our observation agrees with this position. The camel faeces having the higher crude protein content produced the higher organic matter digestibility. The result is also in agreement with the findings of Englehardt *et al*. (1992).

Camels undoubtedly enjoy a greater variety of feedstuff and fare better than cattle in the native pasture of Sahel savanna. They are able to subsist on plant species and plant parts undesirable to other animals. They can exist entirely on browsing and their height allows them to browse at a level where there is little or no competition from other animals (Wardeh *et al*., 1991; Wensvoort and Wade, 1992).

In conclusion, this investigation has shown that the camels and cattle studied consumed different types of forage as found in their rumen. The types of forage eaten in turn influenced rumen content characteristics. Organic dry matter digestibility was greater for camel and was positively influenced by crude protein content of the forage.

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