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Short communication

Feed consumption, nutrient utilization, faecal pellet characteristics and serum metabolite profile of captive spotted deer (*Axis axis*) fed diets containing different roughages

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ABSTRACT

This study was undertaken to asses the feed consumption and nutrient utilization of captive spotted deer (*Axis axis*) fed different roughage sources containing oat (*Avena sativa*), berseem (*Alexandrium trifolium*) or combination of both the fodder. Fifteen spotted deer (66.93 ± 2.73 kg) were randomly distributed into 3 equal groups. All the animals were fed 400 g of wheat bran. The roughage source was 10 kg oat in group I, 5 kg each of oat and berseem in group II, and 10 kg berseem in group III. After a 30-day adaptation period a digestion trial of 5-day collection period was conducted to estimate feed intake, nutrient digestibility and faecal pellet characteristics. Blood samples were collected on day 40, 45, 50, 55 and 60 of the experimental period. Dry matter and fibre contents were lower in berseem than in oat. Nitrogen content of berseem fodder was twice of oat fodder. Fibre and DM intakes were lower in berseem fed groups. Significant increase ($P < 0.05$) in digestibility of organic matter, crude protein and NDF was observed when a combination of oat and berseem was distributed, feeding berseem as a sole roughage source improved these parameters. Even though gross energy intake was lower in berseem group, it was compensated by improved ($P < 0.05$) energy utilization resulting into similar digestible and metabolizable energy intake in all the groups. Number of faecal pellets/defecation increased ($P < 0.05$) with increased level of berseem in diet. Serum level of glutamate oxaloacetate transaminase, glutamate pyruvate transaminase and cholesterol was lower ($P < 0.05$) in group fed combination of oat and berseem. It was concluded that feeding oat and berseem in combination as roughage source could be a better strategy to feed cervids (spotted deer) rather than sole feeding of fodders.

1. Introduction

Spotted deer (*Axis axis*) is the most common deer species of wooded forest in India, Sri Lanka, Nepal and Bangladesh (Schaller, 1967). They are primarily a grazer (Mishra, 1982) and graze mostly on tender grasses (Schaller, 1967). Hofmann (1988) classified spotted deer as an intermediate/mixed feeder, while, Rodgers (1988) had categorised them as a generalist feeder, consuming grasses, forbs, and leaves of woody plants. Their grazing behaviour is also influenced by season and food availability. At Sariska National Park, spotted deer is a grazer as long as green grasses are available (monsoon and post-monsoon seasons), but switches over to fallen leaves, flowers and fruits in winter (Sankar, 1994). In a day, peak feeding times are around dawn and dusk. They usually have two major resting periods – before dawn and mid-day. Chital usually drink water once a day and more frequently in summer.

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Few information regarding the nutrition of this species in captivity is available, which mostly pertains to nutritive value of some cultivated pasture (Arora, 2001) In most of the captive facilities, the animals are fed either empirically from the experience of the zoo keepers or nutrient requirement is calculated on the basis of requirements of goat. Consequently, there is large variation in feeding schedule of spotted deer in different zoos across India. They are fed on different type of green fodders and tree leaves. Oat (*Avena sativa*) is an annual winter fodder from gramineae family and has high energy value (Burgess et al., 1972), but lower in protein content (Osti et al., 2006). Considering the higher (10–12% CP) protein requirement (Ramirez et al., 1996), it would be desirable to incorporate leguminous fodder in the diet of captive spotted deer fed on grass-based diet. Berseem (*Alexandrium trifolium*), a leguminous fodder grown in India during winters is a protein and minerals source (Osti et al., 2006) and could compliment grass-based diet of captive spotted deer. However, excessive feeding of berseem may cause reduction in feed consumption gastric disturbance and even bloat (Vasilakogloua and Dhima, 2008). As the roughages form the bulk of captive spotted deer diet, selection of a proper roughage source is of paramount importance for ensuring optimum nutrition in most economic manner. Therefore, this study was undertaken to determine the feed consumption and nutrient utilization of captive spotted deer (*A. axis*) fed different roughage sources containing either oat (*A. sativa*), berseem (*A. trifolium*) or combination of both the fodder.

2. Materials and methods

The experiment was conducted at Vanya Prani Udyan (a mini zoo), Indian Veterinary Research Institute, Izatnagar 243122, UP from 1st December, 2006 to 29th January, 2007, situated at 169 m msl The average temperature during the experimental period was 22.7 °C; during the period the area received just 1.4 mm of total rainfall. The general topography of the area was plain.

2.1. Plant material

Berseem (var Moscovy) and oat (Var. Kent) were cultivated at the fodder section of the Institute. Seed rate for berseem was 30 kg/ha: fertilizer doses used were N:P:K at 20:60:40 kg/ha, respectively. Seed rate for oat was 80 kg/ha: fertilizer doses used were N:P:K at 80:60:40 kg/ha, respectively. The berseem fodder used for feeding of the experimental animals were from 2rd cut.

2.2. Animals and diets

Fifteen (12 males and 3 females) spotted deer (66.9 ± 2.73 kg) were randomly distributed into 3 groups of 5 each (each group had one female) in an experiment based on randomized block design. All the animals received 400 g of wheat bran. In all times, forage offered was more than 40% in excess of animal's intake to meet their estimated ME requirement (Kirkwood, 1996). Animals were offered 10 kg of fresh oat, 5 kg each fresh oat and berseem and 10 kg of fresh berseem in groups I, II and III, respectively. Animals were offered fresh unchopped fodder without making any blend. Wheat bran was offered at 9 AM and freshly cut roughages were offered at 3 PM. This feeding schedule was adopted because freshly cut roughages were available only in the afternoon.

Animals were kept under uniform managemental condition by housing them in separate enclosure with facilities for individual feeding. Ample clean and fresh drinking water was available to the animals at all times. Prior to the experimental feeding, all animals were dewormed with oxyclozanide (19 mg/kg BW). Proper managemental and sanitary guidelines as suggested by the Central Zoo Authority (CZA, 2000) were followed during the course of experimentation.

2.3. Measurements

After an adaptation period of 30 days, a digestion trial of 5 days collection period was conducted during days 31–36 of the experimental period. The mounts of feed offered, individual refusals and faeces were weighed and sampled daily for determination of intake and digestibility of nutrients. Animals were weighed before and after the trial period.

2.4. Blood sampling

After completing the digestion trial blood samples were collected from all the animals. Only 3 (1 from each group) animals were bled on a singular day to avoid stress. To complete blood collection from all animals sampling was done on day 40, 45, 50, 55 and 60 of the experimental period. The animals were released to their open-air enclosure after the blood collection was completed. Hellbrunns mixture (ketamine:xylazine = 1:1.25) at 0.25–0.5 ml was used for tranquilization and capture of spotted deer. Blood was collected from the animal by jugular vein puncture into non-anticoagulant tubes for serum. The blood was allowed to clot. After 1 h, the blood samples were centrifuged at 2000 rpm for 10 min to harvest serum. The harvested serum samples were stored at −20 °C until further analysis.

2.5. Morphometry

Number of pellets per defecation was counted. Fresh and dry weight of 100 faecal pellets were measured daily from each animal throughout the trial period. The number of defecation was calculated as total weight of faeces (g)/(fresh weight of a faecal pellet (g) × number of pellets per defecation).

2.6. Analytical technique

Samples of feed, faeces and ort were dried at 100 °C to determine the dry matter (DM) content. Samples of feed, orts and faeces were collected daily and stored at −20 °C. At the end of trial, each individual's ort and faeces were pooled across the 5-day trial period. Feed, faeces and orts were dried in a hot-air oven at 50 °C for 4 days, ground and stored for later analysis. The milled samples of feed, ort and faeces were analysed for organic matter (OM), crude protein (CP), ether extract (EE) and gross energy (GE) according to AOAC (1990). Samples were also analysed for neutral detergent fibre (NDF), as per the method described by Van Soest et al. (1991) without using sodium sulphite or alpha amylase.

Serum samples were analysed for glucose (Hultman, 1959), total protein (Lowry et al., 1951), albumin (Doumas et al., 1971), urea (Rahamatullah and Boyde, 1980), creatinine (Bonsnes and Taussky, 1945), total cholesterol (Wybenga et al., 1970), serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) (Reitman and Frankel, 1957).

2.7. Statistical analysis

Since no data pertaining to energy requirement of spotted deer is available we estimated this requirement using standard values generally applied to mammals. As factor for conversion of DE into ME ranged between 84.5 and 87.4% of DE in a number of wild ungulates including cervids (Baker et al., 1998), we used the value of 85% to convert DE to ME. Data obtained were subjected to analysis of variance according to Snedecor and Cochran (1989). Treatment means were separated using Student's "*t*" test.

3. Results

3.1. Nutritional characteristics of feeds

Table 1 reports nutrient content of feed and fodders distributed to spotted deer. Moisture content of berseem fodder was high. Crude protein content of wheat bran and berseem was similar and was almost double than that of oat fodder. Neutral detergent soluble (NDS), as expected was highest in wheat bran followed by berseem and oat fodder, while NDF content followed the reverse trend.