THE QUALITY OF DIET SELECTED BY ELAND IN NORTHERN NAMIBIA: CALCIUM AND PHOSPHOROUS CONCENTRATIONS

P. T. JESSEN, R.F. LAUBSCHER and H. KÖLLING

Private Bag 13184, Windhoek, Namibia

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ABSTRACT

The quality of diet of the free-ranging eland (*Taurotragus oryx*) was determined in a series of trials over a three-year period from May 1991 until April 1994. This project was carried out in northern Namibia, making use of esophageally fistulated animals and creating a near-to-natural situation. The study was undertaken to assess the quality of diet that eland were selecting, taking into consideration that the botanical composition of the diet had been assessed already. The study field was in the semi-arid part of southern Africa, where vegetation cover is low but woody species tend to encroach. Research data showed that eland select their diet very carefully and that the quality of the diet, utilising browse most of the year, tends to be extremely good compared to that of cattle in the same area. The percentage of calcium in the diet varied from 0,22 to 1,18% during the three-year period under review and that of phosphorous from 0,14 to 0, 62% over the same period.

INTRODUCTION

Little is known about the quality of diets of free-ranging wild ungulates in Namibia. The fact is that many ranchers are farming wildlife in Namibia and are importing wildlife to their ranches without knowing whether the animals will adapt, diet-wise, on these ranches. Many ranchers are also feeding wild animals in times of drought, without knowing the requirements of the animals for maintenance or reproduction. It then happens that animals die because they have been fed only the ration ordinarily given to cattle for maintenance purposes, which differs from the diet quality requirements of wildlife in its natural state.

The nutrient levels of hand-picked forages are usually an unreliable method of assessing the quality of diet selected by wild herbivores (Howery and Pfister 1990). The wild herbivores are in the favourable position of being able to select the parts of the plants that are most nutritious, making hand-picked samples obsolete (Howery and Pfister 1990).

This research forms part of a larger programme of research into the integration of eland into a mixed wildlife-beef cattle production system in north-east Namibia. The objective of the research was to establish the dietary composition as well as the quality of the diet that free-ranging eland were utilizing. This could be of significance for the management objectives of many ranches in northern Namibia.

Some studies performed in the Republic of South Africa reveal that wildlife tends to select very actively when it comes to diet (Meissner, H.H., Pieterse, Elsje and Potgieter, J.H.J. 1996). This varies over seasons and it appears that wildlife is adapted to selecting diet according to the animals' physiological status at different times of the year. Specific diet quality data, obtained by methods involving esophageally fistulated animals in free-ranging environments are rare or non-existent in Namibia.

The acceptability and palatability of herbage is determined by the plant species, its age or growth stage, digestibility and chemical composition, physical characteristics such as hairiness, thorniness, etc., its content of repugnant chemicals such as tannin, and the climate and soils (Meissner, H.H., Zacharias, P.J.K. and O'Reagain, P.J. 1999).

MATERIALS AND METHODS

The study was performed at the Sonop Research Station of the Ministry of Agriculture, Water and Rural Development in Namibia. The station is located at approximately 18° 55' S and 19° 25' E, 120 kilometers north-east of Grootfontein, the nearest major town, and 600 kilometers north of Windhoek, the capital of Namibia. It lies in the semi-arid part of southern Africa, with a mean annual precipitation of 532 mm (20 inches) per year. The rainy season is mainly concentrated during January to April. Rainfall is patchy and irregular, with great variations within and between years. From May to October there is no precipitation, and vegetation has to survive on reserves accumulated during the rainy season.

The station covers an area of 11 000 hectare and is enclosed by a three meter high game-proof fence. The farm is divided into two halves by a district road running west to east. The research station is part of the Kalahari sand savanna vegetation area of northern Namibia (Giess, 1971). The topography is dominated by stabilised dunes with an elevation of three to five meters, separated by inter-dune valleys. Dunes and valleys run in a west-east direction

The vegetation of the research station consists of 82 identified woody species, 152 species of herbaceous plants and 85 species of the family *Poaceae* (Strohbach and Müller, 1990). The woody vegetation most prevalent on the dunes is *Bauhinia petersiana* subsp. *macrantha*, *Baphia massaiensis* subsp. *obovata*, *Grewia flavescens*, *Commiphora angolensis*, *Croton gratissimus* subsp. *gratissimus*, *Ochna pulchra*, *Combretum collinum*, *Lonchocarpus nelsii* and *Terminalia sericia*.

The interdune valleys are more open and the more prevalent woody vegetation includes *Acacia mellifera*, *Rhigosum brevispinosum*, *Bauhinia petersiana* subsp. *macrantha*, *Combretum engleri*, *Ozoroa paniculosa*, *Baphia massaiensis* subsp. *obovata* and *Acacia erioloba*.

Three eland were tamed from two weeks of age, and at 18 months of age were esophageally fistulated. Two heifers and a bull underwent the operation and subsequent treatment using the method described by Chapman and Hamilton (1962). The animals were given two months to recuperate from the operation before data sampling commenced. From May 1991 until May 1994 the animals were subjected to diet sampling. This was performed by placing them in predescribed paddocks of 200–250 hectare in size.

The sampling was performed once a month, for one hour during the early morning and one hour during the late afternoon, and samples taken during that day were compared, and mixed if contents were similar. This was performed by removing the esophageal plugs and hanging a bag around the neck of each animal, the method described by Cook, C.W., Thorne, J.L., Blake, J.T., and Edelfsen, J. (1958). In the pre-trial period of the project, during which the animals were habituated to the sampling procedure, they had learnt to accept the bags. The diet was then sampled, using the method described by Bath, D.L., Weir, W.C, and Torell, D.T. (1956).

The animals were not subjected to starvation before the sampling, but were taken from the paddocks for the application of the sampling apparatus, and then set free to roam the paddock at will. Assistants followed them and made use of the subjective sampling method to determine the correlation between the subjective procedure and the esophageal fistula procedure.

Samples were mixed thoroughly, frozen and sent to the laboratory for analysis. The calcium concentration in the sample was determined by atomic absorption spectrophotometry, using a nitrous oxide-acetylene flame. The concentrations in samples were read from a linear plot of standards. The phosphorus concentration was determined spectrophotometrically, using a phosphovanado-molybdate complex.

Statistical analysis of the data was performed by making use of a One Way Analysis of variance, a Kruskal-Wallis One Way Analysis of variance in ranks, and an All Pairwise Multiple Comparison Procedures through the Tukey Test and Dunn's Method (Steel and Torrie, 1980).

RESULTS

It can be observed from Figure 1 that calcium concentrations in the diet fluctuated throughout the year. Peaks, however, occured during the months of December, January and February of each year. This is the period of highest precipitation in the northern regions of Namibia. Distinct peaks also occured during the month of June, which is during the dry winter season, and during the period when browse tends to lose its leaves and leaves are consumed from the ground. It is also during this period that eland consume mostly *Baphia massaiensis*, a browse species that is plentiful and still green at this time of the year. Other browse tends to dry out and lose quality during this time of the year.

It seems from these data that eland are very selective as to the quality of diet they consume during and within various seasons. Calcium concentrations also tended to fluctuate during consecutive years, indicating that, depending on the quality of the rainy season, eland are able to select browse of a higher calcium concentration when and where it is available in the browse.

A One Way Analysis of the data on the calcium concentrations was performed to determine variance, and the normality test failed. A Kruskal-Wallis One Way Analysis of variance in ranks revealed that there was a statistically significant difference for calcium over the various months ($P \leq 0.001$).

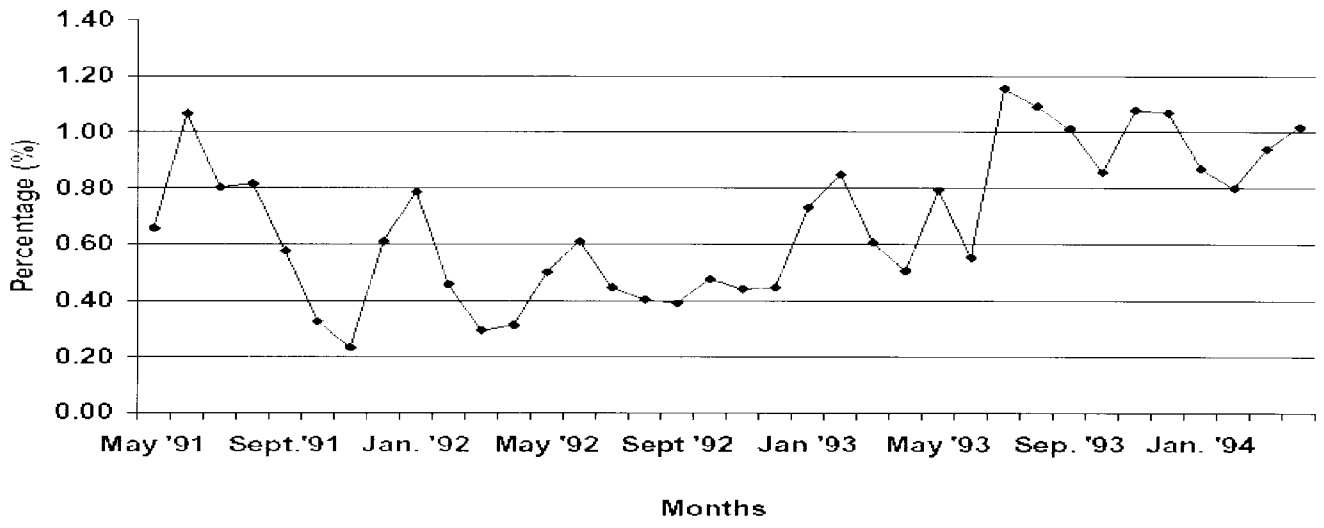

Figure 1. The percentage of calcium in the diets of the eland at Sonop Research Station (1991–1994).

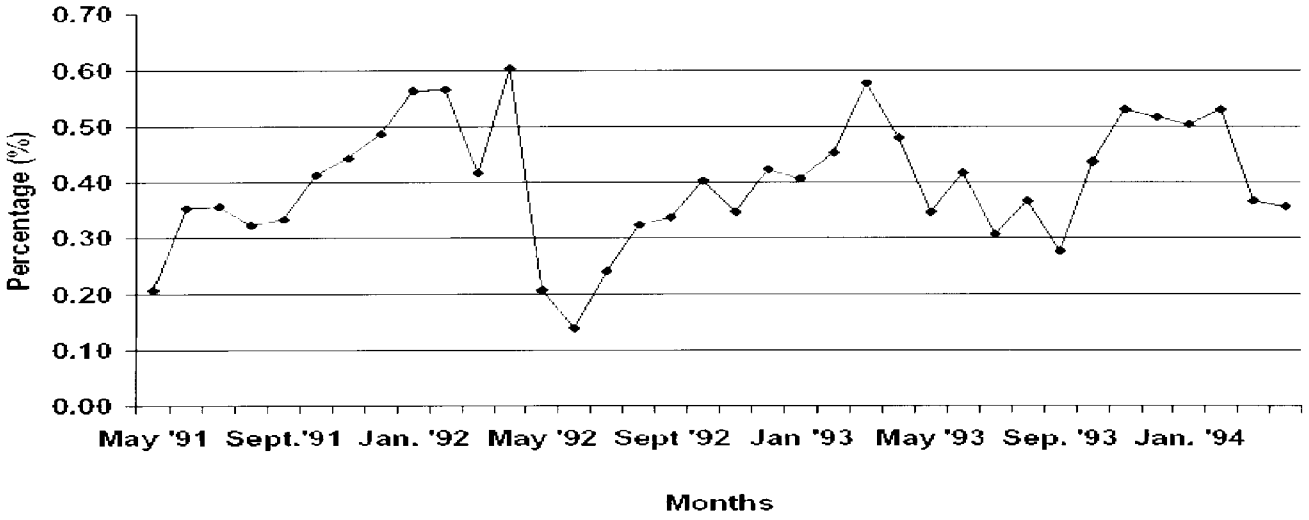

Figure 2. The percentage of Phosphorus in the diets of the eland at Sonop Research Station (1991–1994).

Figure 2 depicts the phosphorus concentrations on a monthly basis over the three-year period. It can be observed from the figure that phosphorus concentrations, as in the case of calcium concentrations, also tended to fluctuate during the year. This was due to selection by the animals during certain periods of the year and the concentrations of phosphorus in the plant species. The percentage of phosphorus dropped to 0,14% during the month of June 1992, the dry part of the season, when vegetation tends to be stagnant, i.e. little growth and browse loose leaves. The percentage increased from the winter months (June/July) towards the summer, which also culminates in the rainy season. Concentrations were at their highest during the rainy season (January to April).

A One Way Analysis of the data on the phosphorus concentrations was performed to determine variance, and the normality test failed. A Kruskal-Wallis One Way Analysis of variance in ranks revealed that there was a statistically significant difference for phosphorus over the various months ($P \leq 0.001$).

DISCUSSION

African savannas show distinct seasonal variation in their nutritive value, which implies that their chemical composition varies from season to season (Meissner *et al.* 1999). This is also the case in Namibia (Joubert 1974) and nutritive value would therefore have to be determined separately during each of the seasons.

From the results presented it can be seen that eland select browse very specifically for calcium and phosphorus intake within and between years. Soil phosphorus concentrations in the north-eastern regions of Namibia are very low and ranchers usually have to supplement phosphorus, in the form of mineral licks, to counteract this deficiency. The phosphorus concentrations in hand-picked browse of the species selected by eland were also analyzed. This revealed that the browse species most utilized during the months of May to September, i.e. *Baphia massaiensis*, had phosphorus concentrations of 0,069 to 0,103%. Phosphorus concentrations in the species *Bauhinia petersiana*, which was the species that was the next most utilized by eland, were 0,157 to 0,159%. *Acacia erioloba* pods utilized from time to time, however, had phosphorus concentrations of 0,457% (MAWRD reports, 1997). This shows that eland are able to select very specifically a diet that contains a higher phosphorus concentration than that obtained from hand-picked samples of all the species known to be consumed by eland.

Els (2000) did research into diet selection of various small stock types, including Angora goats, Dorper sheep, Karakul sheep and Merino sheep in southern Namibia. He found that the phosphorus concentrations in diets of livestock species were 0,230; 0,195; 0,160 and 0,170% for Angora goats, Dorper sheep, Karakul sheep and Merino sheep respectively.

The values for eland were higher during most of the months in which samples were taken.

Concerning the need to supplement phosphorus in animal feed during the winter period, de Waal (1990) and Meissner (1999), taking into account the economic implications of the exercise, sounded a cautionary note. This caution is pertinent in the case of eland too, considering that their phosphorus concentrations during winter months (May–August) are lower than during the wetter summer months.

Calcium concentrations in hand-picked *Baphia massaiensis* varied from 0,744 to 0,821%; in *Bauhinia petersiana* from 0,905 to 1,250% and in *Acacia erioloba* pods from 0,303 to 0,415% (MAWRD reports, 1997). Calcium concentrations in the diet selected by eland varied greatly from month to month but tended to increase during the rainy season, as was the case with phosphorus concentrations.

Data from the Republic of South Africa, published by Dörgeloh *et al.* (1998), puts faecal calcium concentrations in roan antelope diets at between 0,7556 and 2,4480% at

various locations in the Republic of South Africa. Roan antelope are, however, selective grazers and not browsers, unlike eland.

With domestication of wildlife species in Africa gaining momentum, it becomes increasingly important to know what the mineral intake of wild animals is, in order to develop feedstuffs that comply with the concentrations required by the animals. Feedstuff developers and producers are asking researchers more and more questions about the diet quality of our indigenous wild animals. In Namibia there are no available data to enable comparison of the diet of eland of north-eastern Namibia with that of eland anywhere else in the country. With regard to the diet quality of any other wildlife, there are no data whatsoever available in this country.

From the data presented it can be observed that eland are very selective in their diet, which the chemical composition shows very clearly. With the development of feeds for use in feeding domesticated eland, this should be taken into consideration, so that they are fed according to their dietary requirements.

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