# Observations on the mineral status of springbok (Antidorcas marsupialis Zimmerman) in South West Africa

by

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## ABSTRACT

The mineral status of 43 springbok was determined by liver analyses for phosphorus, calcium, magnesium, manganese, zinc, iron and copper. The animals were shot within a period of 14 months on a farm bordering the Kalahari. Mean values of the element concentrations were plotted according to season, and the probable causes of fluctuations are discussed.

## 1 INTRODUCTION

Little is known about the influence of specific minerals on the production of grazing animals, and much research work has to be carried out in this respect. Boyazoglu *et al.* (1972) have demonstrated that the mineral status of animals can be estimated by the analysis of the elements in the liver. It is planned to carry out, by liver analysis, a systematic survey of mineral imbalances of the economically important animals of South West Africa.

Little is known about the multiple factors influencing the mineral status of animals, and it is planned to determine the influences of pasture, and season, on the springbok, kept on several farms in South West Africa. Springbok are kept with a minimum of human influence. Factors applicable to domestic livestock but not applicable to them are rotational grazing, dosing and vaccinations. At most sea-salt is made available as a lick.

## 2 MATERIALS AND METHODS

Forty-three adult springbok (41♂, 2♀) were shot between April 1973 and June 1974 on the farm Gomnab (E 18°15′, S 23°36′), Rehoboth District, South West Africa. Within one hour after death a post mortem examination was carried out, and only animals in good state of health were used for this study. A wedge-shaped sample of about 30 grams of the thickest part of the edge of the liver, was taken from each animal, and was immediately preserved in 3% formaldehyde for later analysis. In the laboratory a one gram core sample was taken from the preserved liver, digested in acids, and the solution was analysed through a laminar flow burner on a "Beckman 979" atomic absorption spectrophotometer for copper, zinc, iron, magnesium, manganese and calcium (Boyazoglu *et al.*, 1972). Phosphorus was evaluated using a Technicon Autoanalyser. For the evaluation of the concentrations in each element group means of 8 observations were calculated. A mean date was also calculated for each group. By plotting the mean concentrations relative to the mean dates, the trends of the concentrations in each element are demonstrated. The means are shown in the relevant graph.

## 3 ENVIRONMENT AND FEEDING BEHAVIOUR

The farm studied lies on the border of the southern Kalahari Savannah, and can be characterized as

Table 1. Means and Standard Deviations of Mineral Concentrations in Livers from Springbok and other Livestock.

| Species, origin | Month of collection | No. of animals | CU (PPM) | MN (PPM) | ZN (PPM) | MG (PPM) | CA (PPM) | FE (PPM) | P (%) |
|---|---|---|---|---|---|---|---|---|---|
| Springbok — Study Farm, Gomnab. | April '73 — July '73 | 43 | 15,4 ±6,5 | 3,6 ±0,5 | 56,9 ±18,23 | 188,7 35,5 | 109,0 29,5 | 99,9 27,2 | 0,23 ±0,02 |
| Springbok — Farm Dabib. | August '73 | 5 | 31,4 ±3,1 | 3,5 ±0,1 | 53,6 ±3,9 | 199,2 ±8,7 | 90,2 ±6,9 | 111,4 ±6,4 | 0,25 ±0,1 |
| Springbok — Farm Campbellsdraai. | August '73 | 6 | 28,1 ±9,8 | 3,4 ±0,2 | 50,3 ±4,1 | 171,7 ±19,9 | 115,7 ±9,9 | 85,8 ±8,0 | 0,24 ±0,1 |
| Springbok — Farm Galenbeck. | July '73 | 5 | 24,6 ±3,1 | 3,7 ±0,1 | 50,6 ±2,8 | 212,6 ±7,1 | 101,6 ±19,0 | 108,0 ±11,1 | 0,26 ±0,1 |
| Republic of South Africa. Cattle (Means) Sheep (Means) | All year. 1973 — 1974 | 8000 | 39 75 | 4,2 4,2 | 75 75 | 191 191 | 129 129 | 71 71 | 0,23 0,23 |

grass, mixed tree and shrub savannah (Giess, 1971). The area substrate is limestone, which appears in several flat ridges on the surface, covered mainly by red Kalahari sand, with a few "vleis" (wet areas) and salt pans interspaced. The rainfall of the 1972/73 season was 130 millimetres, which is only about 50% of the average annual precipitation. The last abundant rain fell in April 1973. As a result the pasture was poorly grown. In 1973 early October-rains did not bring any response to the grass, but flowers, fresh green leaves and green pods developed on the shrubs. The growth of the annual grasses started in December after a series of good rains, which lasted throughout January, February, March and April 1974 (Table 1).

The scattered shrubs (*Acacia mellifera* ssp. *detinens, Acacia karroo, Catophractes alexandri, Monechma australe)* were browsed by the springbok. During the dry season, flat herbs *(Helichrysum argyrosphaerum* — "sewejaartjies" and *Lotononis platycarpis)* grew on sandy areas, where the annual grass

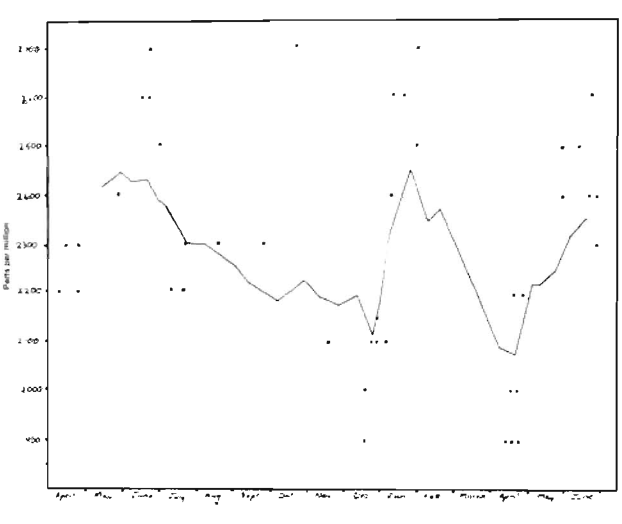

Figure 1. Correlation between Phosphorus concentration and season in springbok livers.

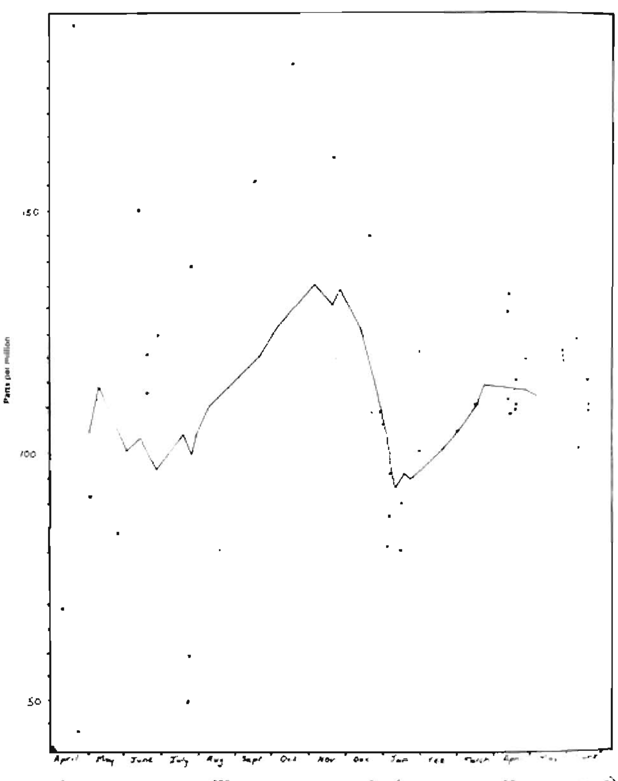


Figure 2. Correlation between Calcium concentration and season in springbok livers.

*(Schmidtia kalahariensis)* was scarce, and were grazed. In some areas of certain camps, where *Helichrysum argyrosphaerum* and *Lotononis platycarpis* were absent, green leaves of a grass (*Aristida congesta)* were grazed by the springbok. Water and rock salt blocks were available to the animals.

## 4 RESULTS AND DISCUSSION

Table 1 shows mean and standard deviations of the concentrations of the elements in the liver of

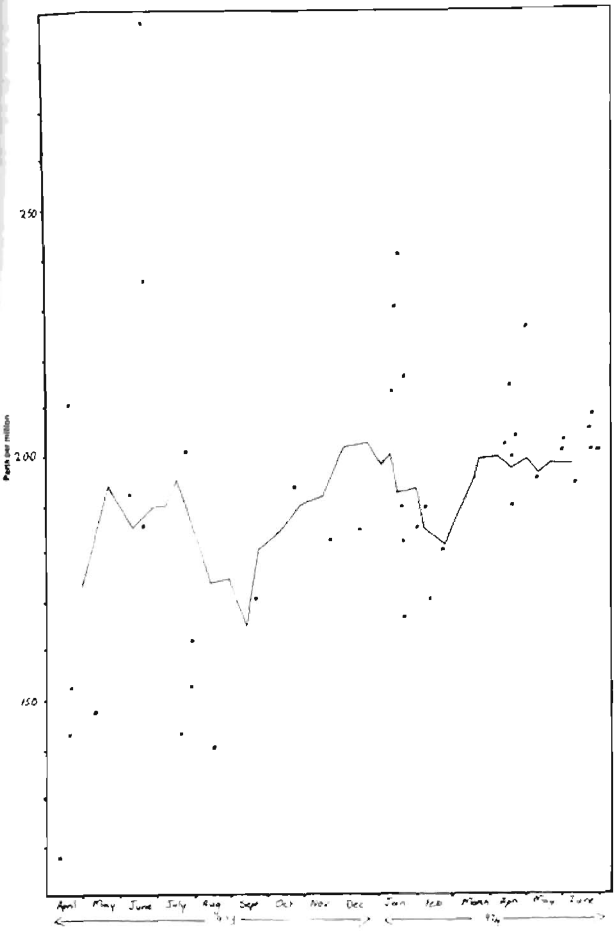

Figure 3. Correlation between Magnesium concentration and season in springbok livers.

springbok used in this study. Values are included from springbok of three other farms, 50 and 80 kilometres apart, partly comparable in soil and plant communities. Compared with the figures from the other farms, the animals studied at Gomnab had lower copper concentrations. The other elements did not differ. The lower copper concentration may be due to a less favourable state of the pasture and a lower copper concentration of the soil. In comparison to the "normal values" (table 2) determined in approximately 8 000 cattle and sheep in the Republic of South Africa by the same method (Boyazoglu, 1974), copper, manganese and zinc are lower in the springbok; the iron concentration however, is higher.

### 4.1 Seasonal influences

Figures 1 to 7 show concentrations of various elements in the livers collected over several months, indicating certain trends. The results were compared with those of mineral analyses by Freyer (1967) in 10 "palatable" grass and 4 shrub species collected on the Experimental Farm Uitkoms near Grootfontein, South West Africa. This area has a higher rainfall than the study farm, nearly all of the grasses and all the shrubs analysed were different from the pasture plants of the study farm. Nevertheless the seasonal influences on the mineral concentration of the plants are expected to be the same.

#### 4.1.1 Phosphorus and Calcium (Figures 1 and 2)

The average concentration of phosphorus in the livers decreased during the dry season, rising after the rainy season had started.

This observation confirms Freyer's findings of a slight decrease of phosphorus in the palatable shrubs in winter, and a remarkable fall to traces in grasses during the dry winter season. The calcium concentration in the livers on the other hand, rose during the dry season and made the calcium/phosphorus balance unfavourable. This increase seems to be influenced by the increase of calcium in the pasture plants during the dry season, (Freyer 1967). Phosphorus fell during January, February and April 1974; calcium, however rose during the same time, and thereafter there were contrary trends in both these minerals. The antagonistic effect of high calcium intakes on phosphorus absorption, was also noted.

After the initial green, growth of the plants is completed, the fall of phosphorus, and slow rise of calcium in December/January, is suspected to be caused by a rise in calcium in the summer pasture plants and by a decrease of phosphorus (Freyer 1967) The second rise of phosphorus is obviously due to the first occurrance of the typical winter plants such as *Helichrysum argyrosphaerum* ("sewejaartjies") and *Lotononis platycarpis* in April/May, which were grazed by springbok during the dry season.

#### 4.1.2 Magnesium (Figure 3)

Freyer 1976, found the magnesium and calsium concentration highest in the palatable shrubs. Mag-

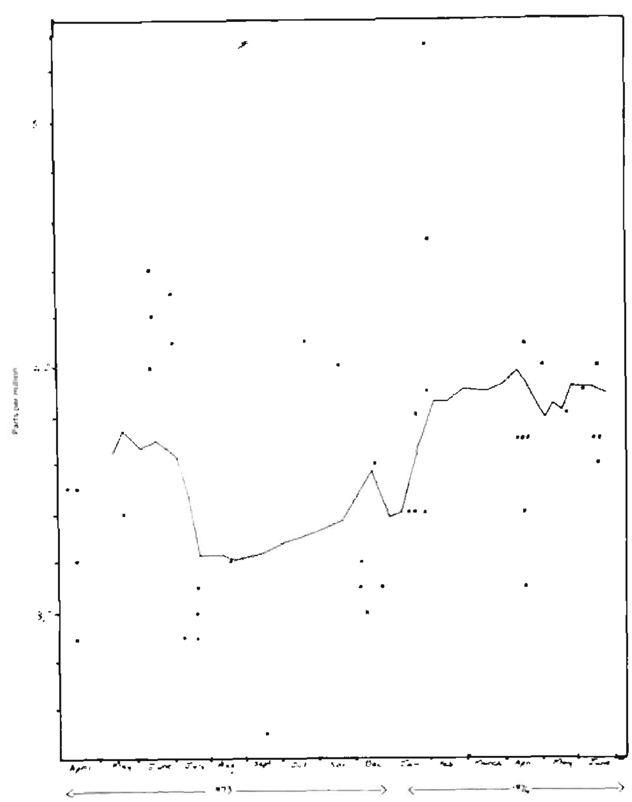

Figure 4. Correlation between Manganese concentration and season in springbok livers.

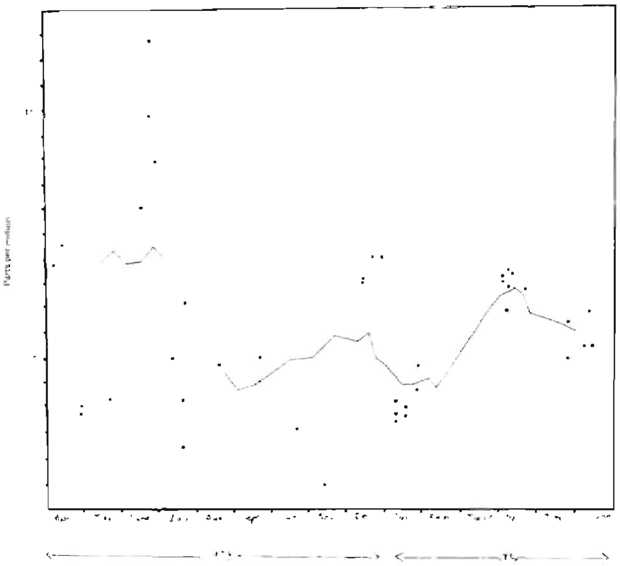

Figure 5. Correlation between Zinc concentration and season in springbok livers.

nesium hardly decreased in the pasture of the dry season, however, small variations and an antagonistic effect to phosphorus are suspected in the springbok. Except for the dry season 1973, the magnesium concentration of the livers followed a pattern similar to calcium.

### 4.1.3 Manganese (Figure 4)

In spite of the fact that Freyer *op cit* found only a slight decrease of manganese in the pasture during the dry season, there is a distinct difference between the relatively low concentration of this element in the livers collected during the dry season to those collected during the rainy season. The increase of the manganese concentration in December/January seems to be delayed long after the onset of the rainy season and the occurrance of the first green growth.

### 4.1.4 Zinc (Figure 5)

Freyer *op cit* found a slight decrease in the zinc concentration of the palatable shrubs, but a remarkable decrease in the zinc concentration of the pasture grasses during the dry season. The general trend of the graph confirms this finding. The expected rise of the zinc level at the beginning of the dry season however, seems to be delayed. There is again the question of whether the extremely high calcium concentrations at the beginning of the rainy season had a depressing effect on zinc absorption.

### 4.1.5 Iron(Figure 6)

There is an evident increase in the iron concentration of the springbok livers at the end of the dry season. Specific feeding patterns and changes in specific winter pasture plants seemed to be the cause, as Freyer *op cit* found a fairly constant level of iron in the pasture plants of different seasons.

### 4.1.6 Copper (Figure 7)

Freyer *op cit* found a decrease of copper only in the pasture grass of the dry season, but not in the palatable shrubs which contain 3 to 4 times more copper than grasses. In figure 7 there are two distinct rises in the copper concentrations of the livers.

The first increase, at the beginning of the rainy season, is suspected to be caused by two factors. Firstly, the grass has grown and becomes unattractive to the springbok, the animals browse more on the shrubs. Secondly, the values over the first peak, (over 24 ppm Cu) originate from animals in camps in the best condition of pasture and where *Acacia mellifera* ssp. *detinens* was abundantly available. The second rise is very much suspected to be caused by the occurrance of the winter plant *Helichrysum argyrosphaerum*, ("sewejaartjies"), one of the main feed sources of springbok during the winter season. This plant contains higher amounts of copper (Oelschläger and Schwerdtfeger, 1959) than other pasture plants, and usually occurs in larger numbers, mainly in overgrazed camps on the farm. This fact can be demonstrated by identifying the origin of the samples. From April to July 1974 (second rise of the graph), the springbok with the highest copper concentrations were shot in camps which were exceedingly overgrazed and of poorer quality, during the rainy season, whilst camps with the best pasture conditions were then found in the middel range.

In conclusion copper seems to be best supplied during the rainy season by pastures in generally good condition.

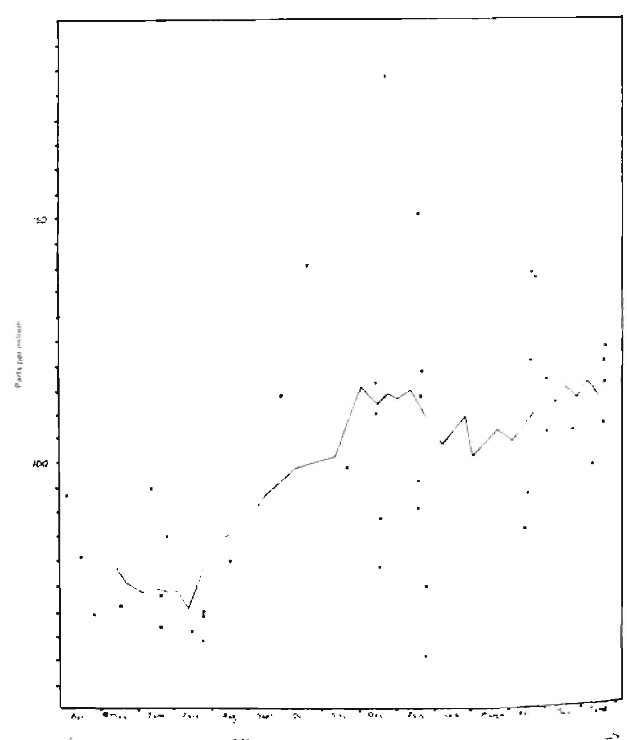

Figure 6. Correlation between Iron concentration and season in springbok livers.

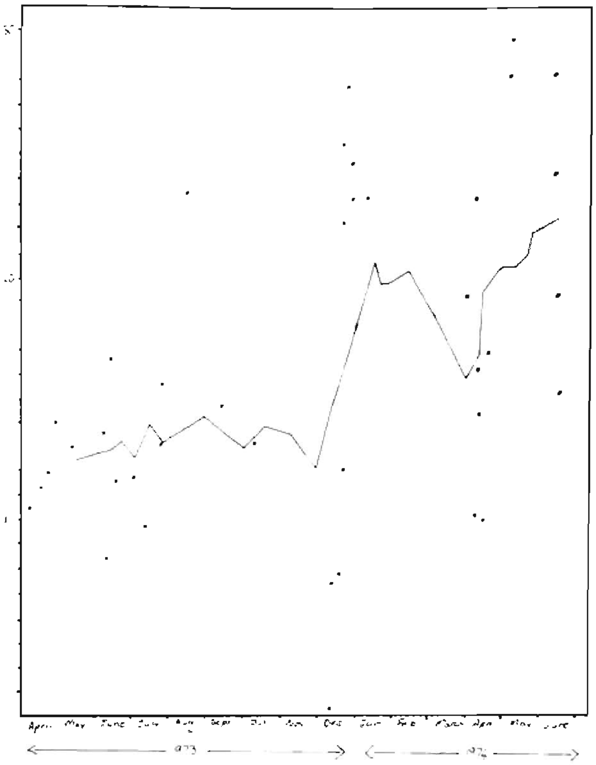

Figure 7. Correlation between Copper concentration and season in springbok livers.

During the dry season however, an overgrazed pasture is revaluated by the abundant growth of certain pioneer plants, if there is enough moisture in the soil.

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