Variation in body condition of impala and nyala in relation to social status and reproduction

A.F. van Rooyen*
Mammal Research Institute, University of Pretoria, Pretoria, 0002 Republic of South Africa

The influence of social class and reproduction on the body condition of impala Aepyceros melampus and nyala Tragelaphus angasi was investigated using the Kidney Fat Index (KFI). Territorial male impala lost condition during the rut, while the KFIs of bachelor impala remained unchanged. By the end of the dry season both territorial and bachelor impala males were in poorer condition. Male nyala had relatively low KFIs with no significant seasonal variation. Pregnant impala and nyala had higher KFIs than non-pregnant females. It is suggested that if the KFI is used to assess body condition the differences attributable to social classes and reproductive state must be considered.

Introduction

The evaluation of body condition of ungulates is important in management and providing information for potential meat production (Monro & Skinner 1979). In order to measure and quantify the physiological condition of an animal, Riney (1955) developed the Kidney Fat Index (KFI).

Body condition is not influenced by nutrition alone but also by the sexual cycle. Territorial male impala lose condition during the rut as a consequence of increased activity and decreased food intake (Murray 1982). Dunham & Murray (1982) described the seasonal variation in the condition of male and female impala at various ages.

Published data on the body condition of nyala are limited. Condition was found to be influenced by gender and age, while only limited seasonal variation was noted (Anderson 1985).

This study investigates the variation in condition relative to social class and reproduction in impala Aepyceros melampus and nyala Tragelaphus angasi in two game reserves in northern Natal, South Africa.

Study areas

Mkuzi Game Reserve (between 27°30' and 27°45'S, and 32°05' and 32°25'E) is located on the coastal plain. The annual rainfall of 631 mm falls predominantly from October to March (Goodman 1990). Acocks (1975) described three vegetation types in the reserve, namely, Coastal forest and thornveld, Lowveld, and Zulu land thornveld.

Ndumu Game Reserve falls within Acocks's (1975) Coastal forest and thornveld vegetation types.

Material and Methods

Impala were shot monthly, at night, in Mkuzi Game Reserve between April 1987 and March 1988, while nyala were shot monthly between April and December 1987 in Ndumu Game Reserve. Care was taken to ensure that all males were classified correctly as either territorial or bachelor males. A bachelor was regarded as a male associating in a cohort with at least one other male, while a territorial male was defined as a single male found in association with a cohort of females. The reproductive tract of each female was examined for the presence of an embryo. Both kidneys and the capsula adiposa were removed within two hours post mortem and weighed to the nearest gram. The KFI was calculated as the amount of fat around the kidney expressed as a percentage of the kidney mass.

Data were pooled to facilitate analysis as indicated in Tables 1 & 2. Differences between samples were determined using the Mann-Whitney U-test, which determines significant differences between sample medians. Where samples contained more than 20 sampling units the U-value was converted to a Z-score. If the Z-score exceeded 1.96 the Ho was rejected at \( p = 0.05 \).

Results

Although the mean KFI of nyala males during winter was higher than during summer, this difference is not significant (\( Z = 1.74 \)) (Table 1). The monthly KFI of nyala females did not vary significantly between seasons. When all non-pregnant nyala females were pooled and compared with pregnant females, the latter had significantly higher KFIs (\( Z = 2.80 \))
The KFI of territorial males and bachelor males did not differ significantly before the rut (Table 2). Territorial males, however, lost a significant amount of fat during the rut, and by the end of the rut they had a KFI of 123.5 which is lower (but not significantly) than that of bachelors during the same period (169.0).

As a result of the seasonal breeding pattern of impala, only non-pregnant females were collected during April. These females had a mean KFI of 144.0 (n = 11). Three pregnant impala females collected during June and July had a KFI of 154.6 which is significantly higher (U = 0; p < 0.05) than the 115.6 of the five non-pregnant females collected during the same period. During August pregnant females had an even higher KFI (208.4; n = 5), which is significantly higher (U = 5; p = 0.05) than the KFI of the non-pregnant females collected during April. Two non-pregnant females collected during August had a mean KFI of 135.7.

**Discussion**

The validity of the KFI has been questioned by Dauphiné (1975), who found that there was a significant seasonal variation in the mass of the kidneys of male caribou *Rangifer tarandus*. This has, however, not been found in impala (Brooks 1978), nor in nyala (Anderson 1985). Moreover, Smith (1970) found a significant correlation between the total body fat and KFI of impala.

Although significant changes in nutritional quality of both species’ diets occurred during the study (Van Rooyen 1992), no significant seasonal changes in body condition of nyala males were evident. The KFI remained low during the study period, as was found by Anderson (1980) in the same study area. Nyala males may be unable to obtain enough energy to store perinephric fat owing to their large body size and continuous reproductive behaviour.

The loss in condition of territorial impala males can be attributed to reduced food intake and increased activity associated with territorial tenure (Murray 1982). This does not occur in bachelors as they are prevented from taking an active part in the rut (Leuthold 1970). By the end of winter, both territorial and bachelor males had significantly less fat than before the rut. This decline after the rut, when the territorial system disintegrates, can be attributed to food quality, viz. a decreased protein intake and increased fibre content of the diet (Van Rooyen 1992).

Anderson (1980) grouped pregnant nyala females at thirty-day intervals of gestation, and by season, and found no significant trend. However, pregnant females in the present study had higher KFIs than did non-pregnant females. The condition of pregnant impala females increased during the first three months of pregnancy (to August), although food quality deteriorated over this period (Van Rooyen 1992). Dunham & Murray (1982) found that the KFI of pregnant impala females increased after the rut until June, and then declined to reach a nadir in January and February when milk production and, therefore, energy requirements were at a maximum.

Ruminants, as well as most other mammals, experience two phases of adipose tissue metabolism during pregnancy (Knopp, Saudek, Arky & O’ Sullivan 1973). During the first two trimesters of pregnancy the female will be in a positive energy balance and will store energy in the form of fat. This stored energy will be used during the last trimester of pregnancy and in early lactation when the demands of the foetus or lamb result in a period of lipid mobilization.

Continuous progesterone secretion (Hervey & Hervey 1967) and increased insulin levels (Knopp et al. 1973) during early pregnancy induce fat deposition. Furthermore, Moore & Brasel (1984a; 1984b) reported fat increases in food-restricted laboratory rats during pregnancy, at the expense of foetal growth, indicating that nutrients and energy are directed towards maternal rather than foetal needs during the first two trimesters of pregnancy (Knopp et al. 1973). Hofmann (1973) described morpho-physiological changes in the digestive tract of impala in response to changes in diet. It is, therefore, not inconceivable that the digestive tract of pregnant females could change to enhance absorption and digestion.

Body condition indices used to assess habitat suitability (Shackleton & Granger 1989) where social status, sex and reproductive state were not considered, should thus be used with care. It is suggested that these factors are taken into account, or that a non-breeding sector of the population be used for such comparisons. Bachelor males (in the case of seasonal breeders such as impala) are not affected by the rut.
and their body condition is thus not influenced by factors other than food quality and age. They are, however, excluded from optimal habitat by territorial males, and this should be taken into consideration.

Conclusions

The body condition of impala and nyala is influenced by social status, reproductive state, and nutrition. It is, therefore, suggested that if fat-based condition indices are used these influences should not be ignored, otherwise the condition of a non-breeding section of the population should be considered.

Acknowledgements

I am grateful to the Natal Parks Board for permission to work in Mkuzi and Ndumu Game Reserves. The project was funded by the Foundation for Research Development and the University of Pretoria.

References


