

# Changes in Live Weight and the Reproductive Tract of Farmed Red Deer Stags from 6 to 27 Months of Age

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## Abstract

Groups of farmed red deer stags ( $n = 49$ ) were weighed and slaughtered, and the reproductive tracts dissected, at 2- or 3-month intervals from age 6 to 27 months. The penis, testes, epididymides, seminal vesicles, ampullae, and prostate gland were weighed separately, and testes sections were examined using light microscopy. At 6 months of age reproductive tracts were immature. The seminiferous tubules were mostly solid and contained spermatogonia only. At 9 months the testes had doubled in size, and spermatocytes were seen indicating that spermatogenesis had begun; at 12 months, elongated spermatids were present. A dramatic increase in the weight of the reproductive tract occurred between 12 and 15 months of age at which time the seminiferous tubules were mature and fully active. This was coincident with the timing of the seasonal rut in older stags. Over winter, from 15 to 21 months of age, weight of the reproductive tracts decreased, and live weights fell slightly. Live weights began to increase again at 24 months of age, and this was associated with the resumption of reproductive tract development. At the time of the second rut in March (27 months of age), the testes and accessory glands attained their greatest weights recorded. Live weights at slaughter increased during spring and summer and fell in autumn. We conclude that reproductive development of farmed red deer stags from 6 to 27 months of age consists of two phases of growth which occur during spring and early summer each year. The first phase includes the onset of spermatogenesis indicating that puberty occurs between 9 and 15 months of age. After puberty is attained, the stags exhibit a decline in reproductive state over winter followed by recrudescence in spring, similar to the reproductive cycle of adult stags.

*Key words:* Growth, male, puberty, red deer, reproduction, season

## Introduction

The physical development of the male reproductive tract during puberty has been studied in wild Scottish red deer (*Cervus elaphus*). Lincoln (1971a) found that spermatogenesis began at about 10 and was complete at 15 months of age. Testicular and accessory gland (seminal vesicles, ampullary gland, and prostate) weight increased slowly from when the testes descended into the scrotum at around 3 months until about 14 months of age, reaching a peak during the breeding season (rut) at 15 months. After the rut

the testes and accessory glands decreased in weight, and thereafter an annual rhythm of seasonal development and regression ensued, such as was apparent in adult stags (Lincoln 1971b).

The stags studied by Lincoln (1971a, b) were very small and at 15 months were 55 to 60 kg or only about half the weight of typical well-grown farmed red deer stags of similar age and genotype in New Zealand (Suttie 1981). As nutrition and growth are known to play a role in pubertal development (Foster et al. 1988) we have studied the temporal reproductive development in well-

grown New Zealand red deer stags from 6 to 27 months of age.

## Materials and Methods

Farmed red deer stag calves ( $n = 49$ ) born in December 1984 (southern hemisphere) were randomly allocated to one of nine groups ( $n = 5$  or 6 per group) which were slaughtered at 2- to 3-month intervals from 6 to 27 months of age. The animals were held indoors under natural day length and fed a pelleted barley/soya meal based concentrate ration ad libitum throughout the study.

After a 24-h fast the animals were weighed and slaughtered in a research abattoir. The reproductive tracts were recovered then they were dissected, and the testes, epididymides, seminal vesicles, ampullary glands, prostate body, and the bulbourethral glands were weighed. Dissection followed Lincoln (1971b) and Wallace and Birtles (1985). Sections of testis from each animal were fixed in Bouin's solution and stained with hematoxylin and eosin. They were examined at a magnification of X450. Antler status was recorded for each animal.

## Results

The mean weight of each group increased to 17 months of age then fell. The last group to be slaughtered (at 27 months of age) was the heaviest (Fig. 71.1). Testis weight increased from June to March with a marked increase from December to March (Fig. 71.2). The testes weight of stags from groups slaughtered from March to September then progressively decreased in size. The epididymides and seminal vesicle weights followed a similar pattern to that of the testes (Fig. 71.3). Peak weights of both were found from the stags killed at 15 and 27 months.

In contrast, the weight pattern of the ampullae and prostate differed (Fig. 71.4) both from each other and from the pattern of the testes, epididymides, and seminal vesicles. The ampullae increased in weight rapidly in samples from June to March (6 to 15 months) and again from September to peak in March (21 to 27 months). The weight of the prostate also increased until March (15 months) and then showed a more

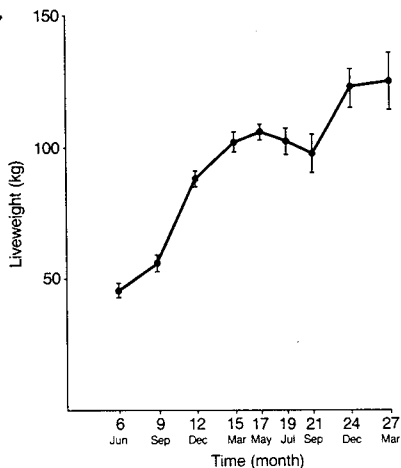


FIGURE 71.1. Live weight of slaughtered red deer stags ( $\bar{x} \pm \text{SEM}$ ).

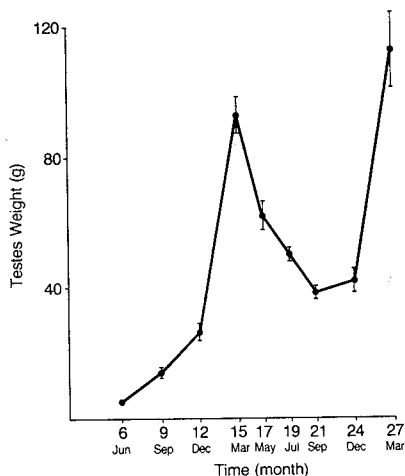


FIGURE 71.2. Mean ( $\pm \text{SEM}$ ) testes weight of slaughtered stags.

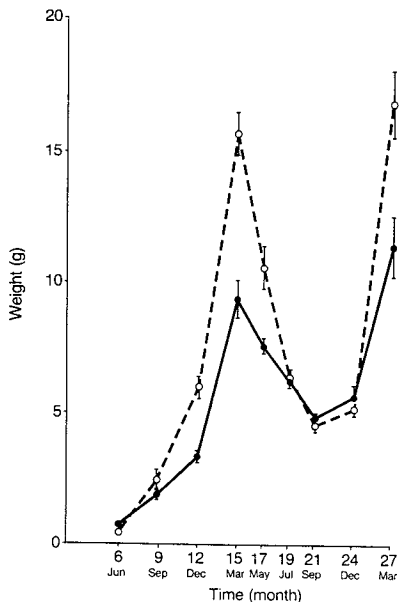


FIGURE 71.3. Mean ( $\pm$  SEM) epididymides ( $\bullet$ ) and seminal vesicle ( $\circ$ ) weight of stags.

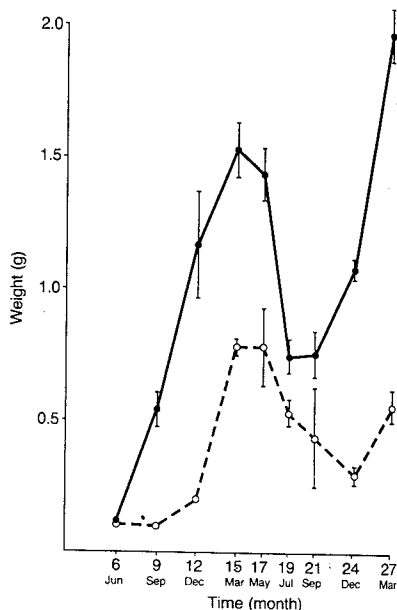


FIGURE 71.4. Mean ( $\pm$  SEM) ampullary gland ( $\bullet$ ) and prostate weight ( $\circ$ ) of stags.

prolonged decrease until December. Mean weight at 27 months was less than at 15 to 17 months. Bulbourethral glands weighed between 0.15 and 0.40 g and did not vary seasonally or during development.

The testes of 6-month-old stags were characterized by small closed seminiferous tubules with few spermatogonia (Fig. 71.5). In the 9-month-old stags the number of spermatogonia had increased, although the tubules were still closed. There were maturing spermatids in the testes of the 12-month-old stags. The testes of 15-month-old stags showed all stages of spermatogenesis with maturing spermatids in the tubules which now had a well-pronounced lumen.

The stags had pedicles only in September at 9 months of age and were in velvet antler in December at 12 months of age. They were in hard antler from March to September (15 to 21 months), in velvet in December (24 months), and in hard antler in March (27 months).

## Discussion

The weight gain pattern of the stags was normal for red deer farmed in New Zealand (Fennessey et al. 1981). The group slaughtered during March (15 months of age) achieved a maximum liveweight of  $107 \pm 2.0$  kg which is the normal liveweight for yearling stags (Fennessey et al. 1981). The stags slaughtered at 27 months weighed  $111 \pm 11$  kg which is a little smaller than the expected liveweight of 130 kg at that age. The stags began pedicel development within the weight range expected for farmed New Zealand red deer of 60 kg (Suttie and Kay 1983).

In general, the pattern of development and regression of the reproductive organs follows closely that published by Lincoln (1971a). In the present study, the testes were heavier at all stages compared with those of wild Scottish red deer (Lincoln 1971a), however, the seasonal decrease in weight from 15 months to 24 months of age

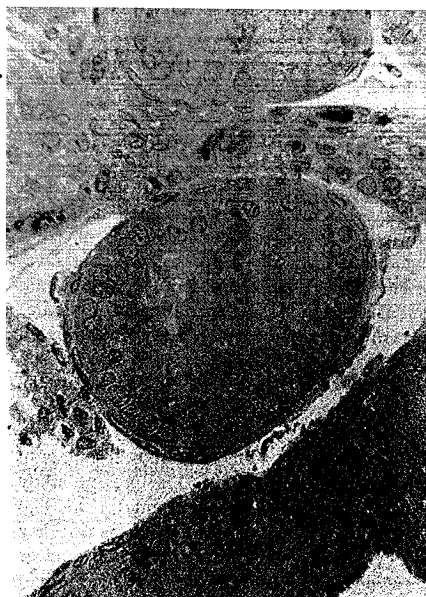
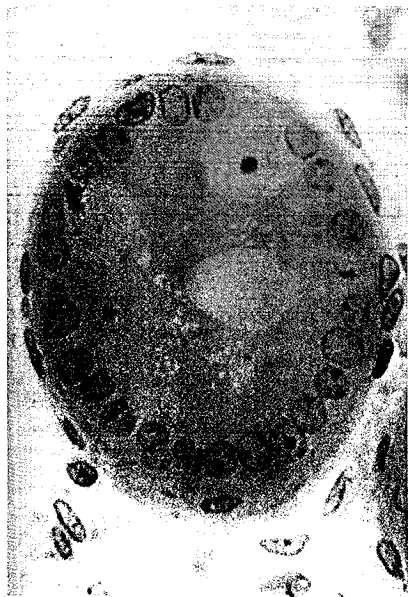


FIGURE 71.5. Histological sections of testes from typical stags at 6 (top left), 9 (top right), 12 (lower left), and 15 (lower left) months of age.

was about 50% in both studies. This indicates that the New Zealand deer proportionately were following the same seasonal pattern. The presence of sperm in the testes of the 12-month old stags in the present study was earlier than reported by Lincoln (1971a). This probably indicates that the larger New Zealand deer were advanced in reproductive development compared with their wild Scottish counterparts.

The epididymides, prostate, and ampullary glands were of similar size and had a similar pattern of development and regression compared with Lincoln (1971a). In contrast the seminal vesicles of the NZ stags were larger and showed a greater regression in size after the 15-month rut than reported by Lincoln (1971a). Lincoln (1971a) did not report bulbourethral glands in the stags from his study. The present study confirms the finding of Wallace and Birtles (1985) that they exist in red deer, but indicates that they are small and do not show a clear seasonal or developmental rhythm.

Antler cycles were in synchrony with the rhythm of testicular development and regression such that velvet antler grew when the testes were small or developing. Antlers were hard when testes were large or regressing, and antler casting occurred when the testes were completely regressed (Lincoln 1971b).

The present study confirms that farmed red deer in New Zealand have a well-defined developmental pattern of reproductive organ growth. Full physical reproductive maturity is reached at 15 months of age, although some sperm may be

present as early as 12 months of age. It is unlikely that the stags are fertile at 12 months due to the lack of development of the epididymides and accessory glands indicating successful ejaculation would be unlikely.

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