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Body Size: Dominance Relationships in Red Deer Stag Calves

Red deer stags spend much of the year in groups separate from hinds (Darling 1937). These groups have a well marked social dominance hierarchy (Lincoln et al. 1970; Lincoln 1972; Suttie 1980). It has been shown by Suttie (1980) that live-weight is positively correlated with dominance rank, although whether high rank is due to large body size or vice versa was not established. The present study offered the opportunity to test this. Twenty stag calves born at Glensaugh Deer Farm (Blaxter et al. 1974) were weaned from their dams in late September. After weaning they were run in several large paddocks with other stag calves, hind calves and adult hinds. Undoubtedly some of the experimental stag calves encountered each other prior to the study. However it was not considered that a fixed or complete dominance hierarchy existed among them because they were kept in separate paddocks. On the 1st of December 1977 they were assigned randomly to two groups (of 9 and 11) as part of a feeding trial designed to study the influence of plane of winter nutrition on body size at 15 months (Suttie 1981). Each stag was weighed, the hind-foot length measured and the groups were penned separately indoors. The weighing and measuring was repeated on the 7th of February 1978 and during the following two days the dominance hierarchy was determined for each group. This was achieved by observing the stags from a vantage point above floor level and scoring the winners of natural interactions until all had interacted with each other. One was said to be dominant over another if he won the majority of the observed interactions. There were remarkably few triangular relationships of dominance. The Landau's Indices were 0.97 and 0.85 respectively for the high plane and low plane of nutrition groups. These indicate strong relationships of dominance (Landau 1951). This contrasts with the dominance hierarchy studied by Suttie (1980) where many triangular relationships of dominance were shown, but agrees well with Espmark (1964) who studied dominance relations in a herd of reindeer. There is a significant positive correlation between live-weight and dominance rank of the 7th of February for both groups. If the formation of dominance hierarchies is independent of weight then a correlation between dominance rank and pre-experimental weight would not be expected. However, there is a strong positive correlation between weight on the 1st of December when the groups were first formed, and dominance rank two months later. Significant positive correlations for hind-foot length and dominance rank were shown for the group on the low plane of winter nutrition on both the 1st of December and the 7th of February and for the group on the high plane on nutrition on the 7th of February (Table I). The high plane of nutrition group were almost equal in hind-foot length, making significant correlations less likely, but within-group differences in hind-foot length existed in the low plane group. Since the weight of the stag calves, measured before they had the opportunity to interact fully with each other, correlates with dominance rank as established nine weeks later, it is concluded that weight plays a large part in determining dominance rank in young red deer stags. Male red deer reach puberty between 9 and 15 months of age (Lincoln 1971; Suttie 1981) although their chances of access to oestrus hinds is likely to be limited until they have reached adult size. As superior weight leads to some stags being more successful than others in competing physically and aggressively for access to females by fighting (Clutton-Brock et al. 1979; Gibson and Guinness 1980a, b), there is a selection pressure for growth to as large a size as possible. Further, this growth must be as fast as possible so that although young stags have little chance of mating, large size at an early age will enhance these chances. Dittus (1977) considered that dominance rank and weight were related in toque monkeys (*Macaca sinica*) as males who had lost dominant status also lost weight and condition. Appleby (1980) demonstrated clearly that high rank in red deer stags leads to greater access to high quality grazing and less feeding interference. Both these studies on wild populations confirm, in essence, the suggestion that body size is related to dominance rank and vice versa. High rank at an early age must be an advantage, particularly after weaning, if it gives access to higher quality food; differences in size and dominance rank would then be perpetuated.

J. M. SUTTIE*

Physiology Department,
Rowett Research Institute,
Bucksburn,
Aberdeen.

*Present Address: Invermay Agricultural Research Centre, Private Bag, Mosgiel, New Zealand.

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Table I. One-tailed Spearman Rank Correlation Coefficients (r_s) and Levels of Significance (Sig) of Dominance Rank (Number of Stags Dominated) with Live-weight (kg) and Hind-foot Length (cm)

		*FWH group			**FWL group		
		N	r_s	Sig	*N*	r_s	Sig.
Live-weight (kg)	1 Dec 1977	9	0.82	$P < 0.01$	11	0.80	$P < 0.01$
Live-weight (kg)	7 Feb 1978	9	0.75	$P < 0.05$	11	0.81	$P < 0.01$
Hind-foot length (cm)	1 Dec 1977	9	0.53	NS	11	0.68	$P < 0.05$
Hind-foot length (cm)	7 Feb 1978	9	0.71	$P < 0.05$	11	0.69	$P < 0.05$

*First winter high plane of nutrition, **First winter low plane of nutrition, NS not significant.

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