SEASONAL VARIATION IN VOLUNTARY FOOD INTAKE IN GROWING LAMBS: A COMPARISON OF GENOTYPES

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Introduction

In both sheep and deer, a seasonal depression in voluntary food intake (VFI) has been observed, such that the nadir of the annual cycle occurs in winter (Kay, 1979). This possibly represents an adaptation among some temperate and high latitude species to a predictable seasonal decline in food availability or quality (Kay and Staines, 1981). The annual cycle of VFI is thought to be entrained by photoperiod and one study has shown a difference between two breeds of sheep in its amplitude (Kay, 1979). This decline in VFI may be accompanied by a concomitant depression in fasting metabolic rate in winter (Blaxter and Boyne, 1982).

The estimation of feed requirements of sheep on similar diets is normally considered to be a function of live weight or metabolic body weight. If different genotypes have different propensities for a depression in VFI in winter, then this should also be considered as a determinant of their requirement for nutrients.

This study describes and compares the pattern of VFI in winter by growing lambs of six different British hill and upland genotypes.

Material and Methods

Between 1983 and 1988 experiments with castrated male lambs, born in April and weaned in August, were conducted from late summer through to the following spring. Lambs of six commercial British genotypes were used; 1983: pure-bred Scottish Blackface (BF, n=10); 1985: Suffolk x (Border Leicester x Blackface) (BLxBF, n=6), Suffolk x (East Friesland x North Country Cheviot) (EFxNCC, n=5) and Suffolk x (East Friesland x Blackface) (EFxBF, n=5); 1987: pure-bred Welsh Mountain (WM, n=4) and pure-bred Beulah (BH, n=6). The data reported derive from control groups of lambs offered chopped straw-based complete pelleted diet (DM 870 $g \cdot kg^{-1}$, CP 122-150 $g \cdot kg^{-1}$ DM, ME 10.0-11.0 $MJ \cdot kg^{-1}$ DM) ad libitum. All lambs were individually penned under natural light and temperature regimes at Bush Estate, Penicuik, Midlothian, Scotland. Voluntary intakes were measured daily and liveweights (LW) weekly. Measurements began two weeks after first penning. Data were restricted to the period from mid-November to the end of May for which measurements were available for all six breeds and liveweight gains were linear. Preliminary statistical analysis showed that the major effects explaining variation in VFI were (i) a linear increase with time and (ii) differences between genotypes associated with liveweight. Linear regressions were fitted to intake versus week for each individual lamb. Analysis of variance of the parameters of the regression lines eliminated the statistical problem of non-independence of successive intake measurements from the same individual (Rowell and Walters, 1976). Variation in the seasonal pattern of intake between genotypes was investigated by analysis of the deviations about each individuals' fitted regression line, in different time periods. Deviations for each individual were averaged over ten, 3-week periods.

Results and Discussion

There was no significant difference between the genotypes in initial VFI in mid-November, however the rates at which VFI increased with time did vary between genotypes ($P < 0.05$) and in early February, the mid point of the experiments, there was significant heterogeneity between them both on an absolute basis ($P < 0.05$) and when expressed per kg LW ($P < 0.001$) (see table 1).

TABLE 1. THE MEANS OF VOLUNTARY FOOD INTAKE (VFI) PARAMETERS FOR LAMBS OF SIX UNITED KINGDOM HILL AND UPLAND GENOTYPES

Genotype N	BF 10	BLxBF 6	EFxNCC 5	EFxBF 5	WM 4	BH 6	SED
Rate of increase in VFI ($g \cdot d^{-1}$)	31.9	25.7	21.6	19.0	16.6	11.1	7.2
Mid-Nov-Late May							
VFI in Mid-Nov. ($g \cdot d^{-1}$)	1352	1449	1427	1555	1111	1402	174
VFI in Late-Feb. ($g \cdot d^{-1}$)	1829	1834	1757	1839	1359	1569	145
VFI in Mid-Nov. ($g \cdot kg^{-1} \cdot d^{-1}$)	42.5	36.6	37.4	39.9	38.8	45.7	3.2
VFI in Late-Feb. ($g \cdot kg^{-1} \cdot d^{-1}$)	35.5	29.1	29.3	29.8	32.8	35.7	1.3

Analysis of variance of the deviations about individual regression lines showed differences between the genotypes in the first and the third of the ten 3-week periods, thus demonstrating different seasonal patterns of VFI (figure 1). The seasonality was greatest in Scottish Blackface lambs and both BLxBF and EFxBF lambs also had low amplitude cycles. The EFxNCC, BH and WM lambs showed no consistent seasonal patterns (figure 1). Examination of local weather station

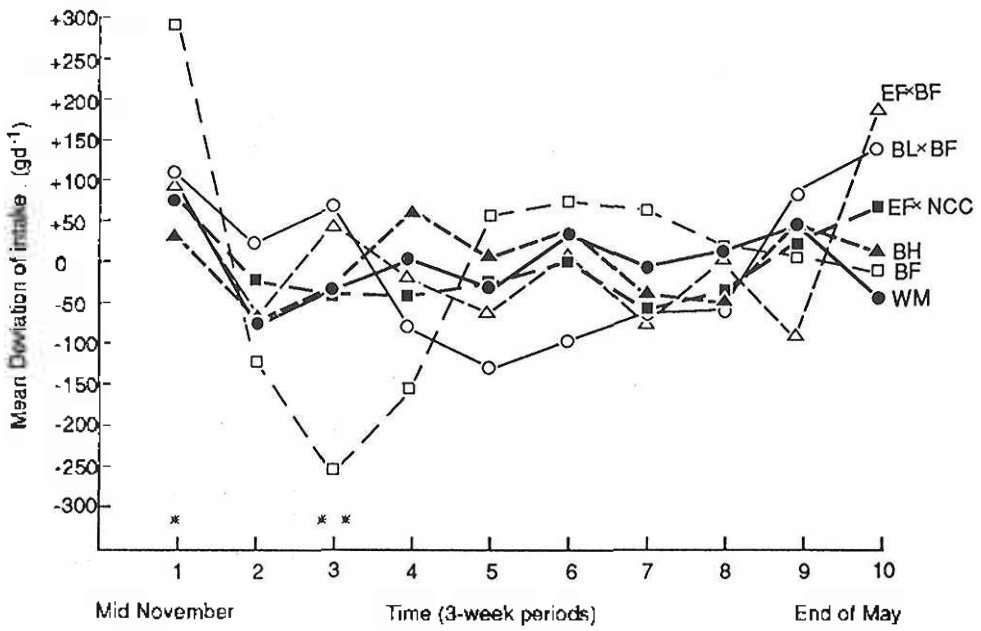

Figure 1. The mean deviation from regression lines for each lamb of VFI against week, for each of six genotypes. Deviations were averaged across 3-week periods. Significant differences between breeds within 3-week periods indicated by * $p < 0.05$ and ** $p < 0.01$.

data showed that patterns of variation in VFI were not driven by year to year variation in mean daily temperatures. Furthermore the three genotypes in the 1985 experiment, two showed a cyclic pattern whilst another did not. The results emphasise the seasonality of VFI associated with the Scottish Blackface genotype.

Lambs in the U.K. are usually slaughtered during their first year at a relatively low proportion of mature body weight and it is during this first year of life that the amplitude of the annual cycle of VFI is greatest (Blaxter et al., 1982). Seasonal variation in VFI must be considered when seeking accurate predictions of the growth responses of lambs to nutrients.

(Key Words: Seasonality, Voluntary Food Intake, Lambs)

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