# LAMB GROWTH REDUCES SHEAR FORCE IN THE LONGISSIMUS MUSCLE

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**Shear force is an important component of eating quality in lamb, and is influenced by lamb growth. Growth rates vary during different phases of growth, and a differential effect of growth rate has been demonstrated for intramuscular fat in lamb. As intramuscular fat and shear force have a negative phenotypic correlation, it was hypothesized that the association between shear force and growth would also vary between different phases of growth. Weight data totaling 164, 797 observations was collected from 17, 525 lambs across eight sites and five years of the Sheep Cooperative Research Centre Information Nucleus Flock experiment. A Bayesian random regression model was fitted to the live weight data to estimate live weight at 100 and 150 days for each lamb. Shear force was measured in the loin of 8, 433 lambs. Shear force was analysed in a linear mixed model to determine the association with birth weight and estimated weight at 100 and 150 days. As hypothesized, the association between shear force and growth varied with the phase of growth being negative 100 and 150 days and not present at birth. The effect was stronger at 100 days than 150 days. Thus the key period for shear force modulation is between birth and weaning.**

**Key Words – consumer, eating quality**

## I. INTRODUCTION

Lamb eating quality has become increasingly important to consumers [1]. Eating quality is strongly influenced by intramuscular fat due to the association between intramuscular fat and consumer sensory scores [2]. As shear force has a strong phenotypic correlation with intramuscular fat [3] changes in shear force will also impact lamb eating quality. Shear force can also be influenced by production factors including lamb growth, although this has not been thoroughly investigated. Previously hot carcass weight has been used as a measure of growth however as growth is not linear, and hot carcass weight is influenced by age, it is not a good substitute for growth at different ages. As growth varies with age the association between shear force and growth may vary with time. The change in association between growth and shear force between different phases of growth has not previously been explored in lamb, however the association has been shown to vary for intramuscular fat [4]. Therefore we hypothesise that shear force will reduce with higher growth rates, and that this effect will vary between different phases of growth.

## II. MATERIALS AND METHODS

Weight data was collected from 17,525 lambs across eight sites and five years of the Sheep Cooperative Research Centre Information Nucleus Flock experiment. Lambs were weighed at birth and at monthly intervals throughout their grow-out period, resulting in 164,797 observations. A Bayesian method was used to fit a random regression linear mixed model to the live weight data with fixed effects (interacted with a cubic polynomial for age) for site, year, gender, birth type-rear type, age of dam, sire type, dam breed within sire type. Random terms included sire, dam by year and animal identification, which were each interacted with a cubic polynomial for age. This model was used to estimate lamb weights at weaning (100 days) and post weaning (150 days).

At slaughter, a 65g sample of loin muscle was excised from 8, 254 lambs. Samples were cooked at 71ºC in plastic bags in water baths for 35 minutes before being cooled in running water for 30 minutes. Shear force was measured on six cores from each loin sample using a Lloyd texture analyser (Model LRX, Lloyd Instruments Hampshire UK) with a Warner-Bratzler shear blade fitted [5]. Data was analysed using a linear mixed effects model in SAS with

fixed effects for site, year of birth, sex, birth type-rear type, age of dam, sire type, dam breed within sire type and kill group within site, with actual weight at birth and estimated weight at 100 and 150 days included separately as covariates. Sire identification and dam identification by year were included as random terms.

## III. RESULTS AND DISCUSSION

The average shear force was 27.69N with a standard deviation of 9.85N. Weight at 100 days and 150 days each had an influence on shear force although there was no association at birth. Increasing weight at 100 days was associated with a reduction in shear force. The magnitude of the reduction in shear force was 10.43N across the 57 kg weight range. This was almost double the association at 150 days which demonstrated a reduction in shear force of 6.32N across the 57 kg weight range (Table 1).

Table 1 The magnitude of effect (difference between lowest and highest shear force measurement across the range of lamb weights) of lamb weight (Kg) on shear force (N)

| Weight | Magnitude (N) | Range (Kg) |
|---|---|---|
| Birth | - | 8 |
| 100 days | -10.43 | 57 |
| 150 days | -6.32 | 57 |

The differential nature of the association between shear force and weight, with a larger effect at 100 days compared to 150 days, aligned with our hypothesis. The lack of relationship between lamb birth weight and shear force is consistent with findings in pigs [6] and cattle [7]. The change of the association between birth, where there was no association, and 100 days, where there was a strong association, highlights the pre- weaning phase of growth as a key period in which growth modulates the development of shear force. Given the strong association between shear force and intramuscular fat it is not surprising that these traits are impacted during the same period of growth. Furthermore the magnitude of the effect of growth at both weaning and post weaning was large, being greater than the standard deviation of the shear force trait.

The main source of lamb nutrition pre-weaning is via the ewe suggesting that there is potential to modulate lamb intramuscular fat by manipulation of ewe nutrition.

## IV. CONCLUSION

The association between lamb growth and shear force varies with the period of growth. The strongest association is at 100 days after which the association diminishes. As the association changes from no association to a strong association between birth and weaning this is the key time period during which shear force is modulated.

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