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GDF8 C.1232 *G>A* FREQUENCY IN COMMERCIALLY SLAUGHTERED LAMBS

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SUMMARY

The GDF8 c.1232 *G>A* mutation, derived from Texel sheep is known to be associated with increased lean meat yield. Data was available, on 1150 lambs from 343 mobs randomly sampled, to observe the frequency of the GDF8 c.1232 *G>A* mutation in lambs from the Southland region of New Zealand. The lambs were slaughtered through Alliance Group Ltd, a company using VIAscan imaging technology to identify and reward high lean meat yielding carcasses. Of the 1150 lambs 4% were homozygous for the GDF8 c.1232 *G>A* mutation (AA), 21% were heterozygous (AG) and 75% were non-carriers (GG). At the mob level, 52.8% of mobs included lambs that were carrying at least one copy of the mutation. Using results from the Illumina OvineSNP50 BeadChip, lambs homozygous for the mutation tended to cluster to one corner of the plot of the 3rd versus the 1st principal components plot, whilst those heterozygous, although trending towards the "Texel" corner are diffuse across the plot. Combined, these results demonstrate that sires carrying the GDF8 c.1232 *G>A* mutation, Texel or composite, are being used at a moderate frequency in flocks supplying a company rewarding for lean meat yield and are being used across varied maternal genetics.

INTRODUCTION

The Texel was imported in to New Zealand and commercially released in 1990, and is considered to have both desirable terminal sire and maternal attributes. Their most acknowledged attribute is their increased carcass lean meat yield, which has been shown, in part, to be the result of a mutation in the Growth Differentiation Factor 8 Gene (GDF8) (Johnson *et al*. 2009). A genomic test, MyoMAX, based on the GDF8 c.1232 *G>A* mutation was commercialized by Catapult Genetics (now Pfizer Animal Genetics) in 2003. Initial users of the test were Texel breeders seeking to exclusively use sires carrying two copies of the mutation (MyoMAX Gold) within their breeding programme as the mutation was not fixed in New Zealand Texels. Subsequently, terminal sire composite breeders who have used Texels as part of their breed mix have also used the MyoMAX test to identify MyoMAX Gold sires for use within their breeding programmes. In addition, given their maternal attributes, many maternal composite breeders are also using Texels as part of their breed mix (SIL-ACE 2011) and therefore the GDF8 c.1232 *G>A* mutation will also be indirectly present in the industry through the use of Texels in maternal composites.

A research resource was available to investigate the frequency of the GDF8 c.1232 *G>A* mutation within commercial lambs slaughtered through Alliance Group Ltd plants in the Southland region of New Zealand. Alliance Group Ltd are using VIAscan® technology to offer producers financial premiums for lambs with increased carcass lean meat yield.

MATERIALS AND METHODS

The animals used in this study are part of a DNA/phenotype resource generated to use for Genome Wide Selection for carcass lean meat yield. Data collection was carried out between January and April over two consecutive years (2008 and 2009). Mobs of lambs were observed at Alliance Group Ltd Mataura and Lorneville meat processing plants in the two years respectively, as they passed through the VIAscan® (Hopkins *et al.* 2004) imaging system. Lambs were selected from large mobs >100 lambs, with carcass weights between 15.5 and 19kg. One to three of the

most extreme yielding pairs (high and low, matched for carcass weight) were identified from the selected mobs, thus equal numbers of high and low yielding lambs were collected. No information about breed, age or origin was available on the lambs.

The lambs were genotyped using the Illumina OvineSNP50 BeadChip (Dalrymple 2009). The lambs were also genotyped in the research environment (not commercially) for the GDF8 c.1232 *G>A* mutation using the method described by Johnson *et al.* (2011), as this SNP is not present on the Illumina OvineSNP50 BeadChip.

To investigate the breed composition of the lambs, principal components were calculated from the genomic relationship matrix which in turn was calculated using the first method of VanRaden (2008). The 3rd versus the 1st principal components were plotted against each other for animals with GDF8 c.1232 *G>A* genotypes (AA, AG, or GG). This combination of principal components was plotted as it most clearly distinguished the AA animals.

RESULTS AND DISCUSSION

The data used within this study is a snapshot across two seasons of lambs slaughtered in Southland through two Alliance Group Ltd plants. Given the method of selection there is no bias towards top high yielding mobs, as each mob was chosen based on number of lambs and carcass weight and then the top and bottom lean meat yielding lambs selected within that mob.

Data and Illumina OvineSNP50 BeadChip genotype information was available on 1434 lambs, although only 1150 also had GDF8 c.1232 *G>A* genotypes. The 1150 lambs with GDF8 c.1232 *G>A* genotypes represented 343 mobs. Of the 1150 lambs 4% were homozygous for the GDF8 c.1232 *G>A* mutation (AA), 21% were heterozygous (AG) and 75% were non-carriers (GG). The proportions of carriers and homozygotes for the mutation could be over represented given only the tails were observed, however, it still provides an indication of the frequency. The results at the mob level are given in Table 1, 52.8% of all mobs included lambs that were carrying at least one copy of the mutation.

Table 1. Percentage of 343 mobs of lambs observed at meat processing plants carrying the different GDF8 c.1232 *G>A* genotypes[1]

GDF8 c.1232 *G>A Genotype*	% Of Mobs
AA Only	0.9
AA, AG and GG	6.7
AA and AG	1.7
AA and GG	3.5
AG Only	4.1
AG and GG	35.9
GG Only	47.2

[1]A is the allele associated with the increased muscling

The results of a genetic relationship analysis using the Illumina OvineSNP50 BeadChip data are given in Figure 1. Lambs of similar breeding are expected to cluster together (Dodds et al., 2009). From Figure 1 it can be seen that the *AA* lambs tend to cluster towards one corner of the plot, whilst lambs that are heterozygous, although trending towards the "Texel" corner are diffuse across the plot and is consistent with animals carrying the GDF8 c.1232 *G>A* mutation being used across a variety of genetic backgrounds.

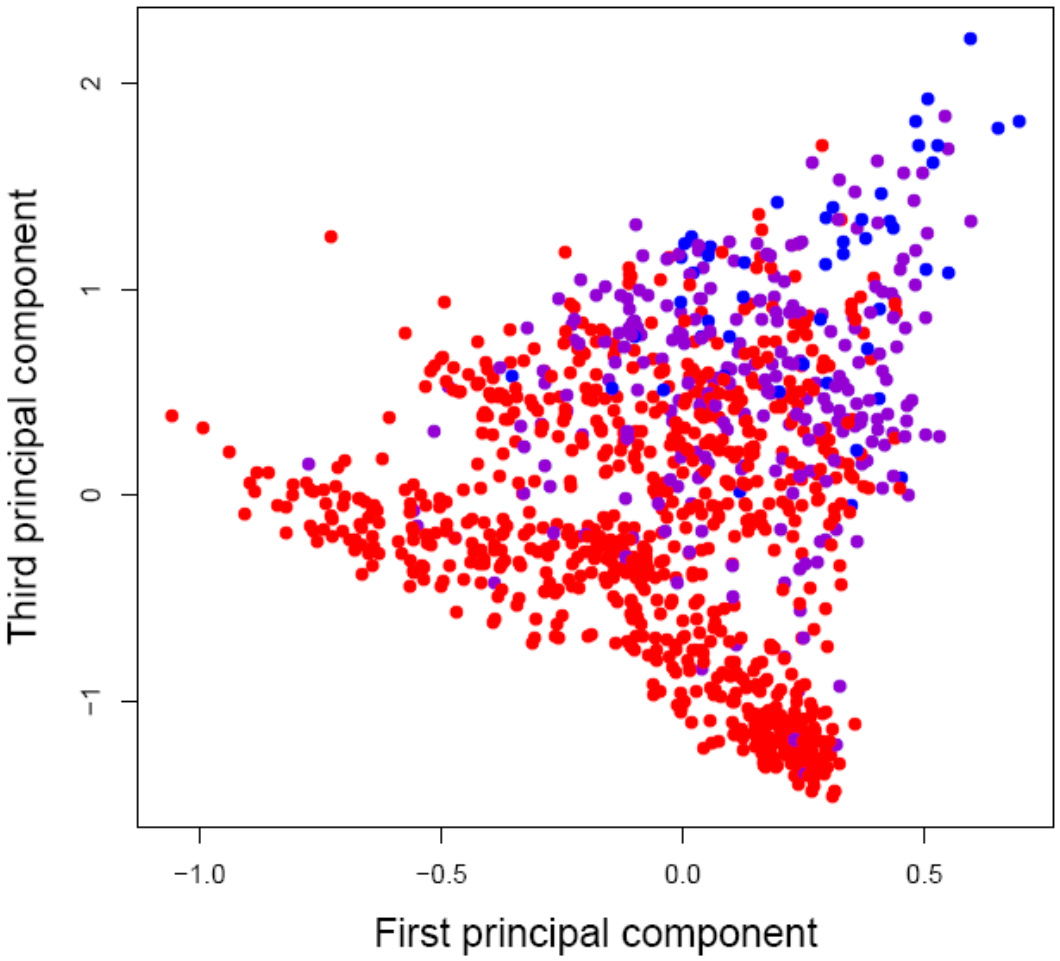

Figure 1. Plot of 3rd against 1st principal component of 1150 lambs collected from the freezing works. The different colour symbols denote their GDF8 c.1232 *G>A* genotypes (Blue=AA, Purple=AG, Red=GG). The *A* allele is derived from Texels and is associated with increased muscling.

It is unknown whether these results are representative across the entire New Zealand sheep industry, given the lambs used in this study were sourced from a plant offering financial premiums for increased meat yield. Also whether the mutation was inherited from the sire or the dam can not be determined. However, there is sufficient evidence to suggest that when tangible financial rewards are offered for increased lean meat yield, commercial producers are seeking to use genetics that will increase the likelihood of their lambs receiving the premium. However, as shown by Johnson *et al.* (2011) using the same data set, carrying just one copy of the GDF8 c.1232 *G>A* mutation is not a guarantee that the lambs will achieve premium targets, and consideration needs to be given to the residual genetic merit of the sires for lean meat yield and the maternal genetics.

CONCLUSIONS

Data from a meat processing company where financial rewards are offered for improved carcass lean meat yield, illustrates that sires carrying the GDF8 c.1232 *G>A* mutation, Texel or composite, are being used at a moderate frequency in flocks supplying the company.

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