THE IMPACT OF FEED DEPRIVATION AND STRESS AT SLAUGHTER ON THE METABOLISM AND CARCASS YIELD OF LAMBS

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Abstract –The purpose of this study was to examine what proportion of circulating metabolites at slaughter due to stress and feed deprivation and if this response differs between Merino and Terminal genotypes. Jugular blood samples were collected from 88 Merino and Terminal sired lambs at rest and at slaughter following 24, 36 and 48 hours of feed deprivation. Merino sired lambs had a higher NEFA response compared to Terminal sired lambs at slaughter after 24, 36 and 48 hours of feed deprivation, with NEFA levels up to 20% higher than previously reported at rest. In addition, increasing feed deprivation from 36 hours was associated with a 3% reduction in HCWT. This study showed that there are significant differences in NEFA response to feed deprivation between Merino and Terminal genotypes under commercial slaughter conditions suggesting that adipose tissue is an important substrate mobilised during acute stress.

Key Words – feed restriction, NEFA, hot carcass weight

I. INTRODUCTION

Under Australian pre-slaughter management, lambs normally undergo a period of feed deprivation extending to as much as 48 hours prior to slaughter [1] in order to reduce contamination of livestock and transport vehicles plus facilitate hygienic dressing. Recent work has shown that prime lambs have very high levels of non-esterified fatty acids (NEFA) and β-hydroxybutyrate (BHOB) at slaughter, suggesting that modern genotypes may respond differently to feed deprivation [2]. However, it is difficult to separate the combined effects of stress and feed deprivation on this circulating metabolite response. For instance, animals with greater muscling have a greater adipose response to adrenaline [3], implying that under pre-slaughter conditions they will demonstrate the greatest elevation in plasma NEFA. Yet contrary to this, under resting conditions lower muscled Merinos have a greater response to feed deprivation [4]. Therefore, in combination these effects may offset each other. Therefore, it is hypothesized that at slaughter where animals undergo both stress and feed deprivation that there will be no difference in NEFA and BHOB in the plasma of Merino and Terminal sired lambs.

II. MATERIALS AND METHODS

Samples were collected from 88 male and female lambs that were the progeny of Merino dams artificially inseminated using Terminal and Merino sires. Lambs were separated into three groups and subjected to either 24 (group 24), 36 (group 36) or 48 hours (group 48) of feed deprivation prior to slaughter. Groups were balanced for sex, siretype and sire identification. Prior to the on-set of feed deprivation, jugular blood samples were collected into lithium heparin tubes from lambs for determination of basal NEFA and BHOB concentration. Lambs were transported to a commercial abattoir (3.5 hours, 350km) where they were held in lairage, without feed but free access to water. Lambs were slaughtered all at the same time following 24, 36 and 48hrs off feed. At exsanguination, blood was collected into lithium heparin tubes and plasma analysed for NEFA and BHOB concentration. Lambs were dressed according to AUS-MEAT standards and hot carcass weight (HCWT) recorded. Plasma NEFA and BHOB concentrations and HCWT were analysed using linear mixed effect models (SAS Version 9.1, SAS Institute Cary, NC, USA) with fixed effects for siretype, sex, group as well as relevant interactions. Basal concentrations of each metabolite were also included as a covariate along with relevant interactions in their respective models. In the HCWT model, liveweight just prior to feed deprivation was included as a covariate. In all models, sires were included as a random term. Non-significant ($P > 0.05$) terms were removed in a stepwise manner.

III. RESULTS AND DISCUSSION

Contrary to the hypothesis, Merino sired lambs had a higher NEFA response compared to Terminal sired lambs at slaughter after 24, 36 and 48 hours of feed deprivation ($P<0.05$, Figure 1). In Merino sired lambs, NEFA increased

by 66% between 24 to 48 hours of feed deprivation compared to Terminal sired lambs which only increased by 44%. There was no difference in NEFA concentration between 24 and 36 hours for either Merino or Terminal sired lambs. Overall NEFA levels found in this study are higher than previously reported in these animals at rest [4]. However, the greater NEFA response in Merino sired lambs indicates that feed deprivation, rather than stress responsiveness is the driving factor influencing the genotype difference at slaughter. Plasma BHOB concentration was highest at 48 hours (0.55 ± 0.015 mmol/L), approximately 29% ($P<0.05$) higher than at 36 hours (0.42 ± 0.014 mmol/L) and 24 hours (0.43 ± 0.015 mmol/L). There was no difference in BHOB concentration between 24 and 36 hours off feed and no effect of siretype on plasma BHOB response to feed deprivation ($P>0.05$), supporting the hypothesis. Aligning with previous work [6], increasing feed deprivation was associated with a decrease in HCWT. When adjusted for liveweight, HCWT in the 48 hour feed deprived group (23.7 ± 0.21kg) was 0.4kg and 0.7kg lower than the 36 hour (24.1 ± 0.21kg) and 24 hour (24.4 ± 0.21kg) feed deprived groups.

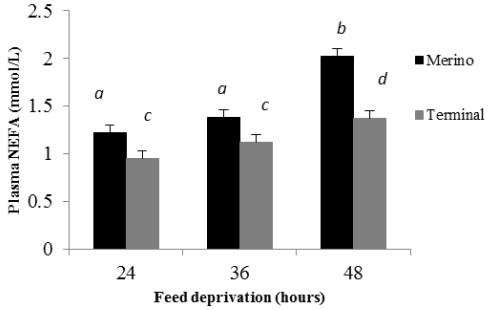

Figure 1. Effect of feed deprivation (hours) on plasma NEFA (mmol/L) levels in Merino and Terminal sired lambs. Annotations [a, b] that differ indicate significant difference ($P<0.05$).

IV. CONCLUSION

Under commercial slaughter conditions Merinos sired lambs mobilise greater amounts of fat compared to Terminal sired lambs. It appears that their response to feed deprivation is the key factor driving the difference between genotypes, as opposed to their stress response differences. Furthermore, increased feed deprivation beyond 36hrs causes a 3% loss in carcass weight which may be impacting the profitability of lamb producers and thus warrants further research.

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