SELECTING FOR INCREASED SIRE IMF% ESTIMATED BREEDING VALUE IMPROVES AUSTRALIAN LAMB EATING QUALITY

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I. INTRODUCTION

Intramuscular fat (IMF%) is known to be a strong positive driver of consumer-perceived lamb eating quality [1], where an increase of 1% IMF% accounts for an improvement of about two units of overall liking [2]. Given the importance of IMF% to consumer overall liking, a new sire IMF% Australian Sheep Breeding Value (ASBV; derived from lab-determined loin chemical IMF%) has been introduced. Whilst previous research has demonstrated an improvement of 0.6 IMF% per 1% increase in sire IMF% ASBV [3], its impact on eating quality has not been phenotypically tested. However, given the impact of IMF% on eating quality, and the correlation between IMF% across cuts [4], we would expect to see an improvement in eating quality across multiple cuts due to increasing sire IMF% ASBV. We hypothesised that selection for increased IMF% ASBV will improve eating quality, with the largest effects within the loin due to the location of lab-determined chemical IMF% used to develop this trait.

II. MATERIALS AND METHODS

Ewe and castrated male Terminal sired lambs (n = 1365, from sires n = 160 with IMF% ASBV) from the Katanning and Kirby 'Meat and Livestock Australia Resource Flock' had the *longissimus lumborum* (loin), *rectus femoris et vastus lateralis* (knuckle) and *semimembranosus* (topside) excised. The *biceps femoris* (outside), *gluteus medius* (rump), rack, leg, and shoulder from a subset of 277 carcases were also collected. A 40g sample of each loin was collected for chemical IMF% determination using a near infrared procedure, validated by solvent extraction [5]. Grilled (loin, knuckle, topside, outside, rump) and roasted cuts (rack, leg, shoulder) were each assessed for overall liking by ten individual untrained consumers on hedonic scales (0: worst to 100: best) during consumer taste panels. Individual consumer responses (n = 42 650) for overall liking were analysed using a linear mixed effects model. Fixed effects included flock (Katanning, Kirby), birth year (2017, 2018), sex (ewe, castrated male) and cut (loin, knuckle, topside, outside, rump, rack, leg, shoulder), with carcase weight included as a covariate, and relevant interactions between these terms. Sire identification, animal identification and consumer within a session were included as random terms. Sire IMF% ASBV and loin chemical IMF% were independently tested as covariates in this model. Lastly, the phenotypic association between chemical IMF% and sire IMF% ASBV was tested using this model structure, with chemical IMF% fitted as the dependent variable, and sire identification as the only random term.

III. RESULTS AND DISCUSSION

Increasing levels of both chemical IMF% ($P < 0.01$) and sire IMF% ASBV ($P < 0.05$) were associated with improved eating quality. For chemical IMF%, this association was strongest in the loin - an expected outcome given that this cut was the site of direct measurement. Within this cut, a 1% increase in chemical IMF% produced about a two-unit improvement in overall liking scores (Table 1). Supporting our hypothesis, similar yet smaller effects were seen in the rack and topside (Table 1), although this association was not evident in the knuckle, outside, rump, leg, or shoulder. Previous research has reported a moderate correlation between IMF% of the loin and that of other cuts, with the highest

IMF% correlation between the loin and topside (0.40) [4]. This aligns well with our results where the effects on eating quality were strongest in the rack (an extension of the loin) and the topside, and likely explains why there was no effect in other cuts.

In contrast to the chemical IMF% result, the association between sire IMF% ASBV and eating quality was restricted to the loin only. In this case, a 1% increase in sire IMF% ASBV produced a two-unit improvement in overall liking scores (Table 1), a response similar in magnitude to the effect of chemical IMF%. In this dataset, there was no phenotypic association between chemical IMF% and sire IMF% ASBV, which may explain why there was no corresponding eating quality effects in other cuts. This lack of phenotypic association may simply reflect the limited range in sire IMF% ASBV used in this study, however given this, it is then not clear why sire IMF% ASBV caused such a marked improvement in loin eating quality. This may implicate effects of this ASBV that extend beyond IMF%.

Table 1. Change in overall liking score and standard error, derived from least square means, with associated p-value per 1% sire IMF% ASBV and chemical IMF% for lamb knuckle, loin, outside, rump, topside, leg, rack, and shoulder cuts.

Range	Sire IMF% ASBV (-1.29-0.27%)	p-value	Chemical IMF% (2.39-7.03%)	p-value
Knuckle	-1.8 ± 1.4	0.19	0.9 ± 0.4	0.06
Loin	2.1 ± 0.7	<0.01	2.3 ± 0.2*	<0.01
Outside	0.9 ± 1.4	0.54	0.1 ± 0.4	0.98
Rump	-0.5 ± 1.4	0.70	0.8 ± 0.4	0.10
Topside	0.9 ± 0.7	0.22	1.5 ± 0.2*	<0.01
Leg	-0.3 ± 1.4	0.86	0.5 ± 0.4	0.24
Rack	1.2 ± 1.6	0.43	2.0 ± 0.4*	<0.01
Shoulder	-0.5 ± 1.5	0.75	-0.1 ± 0.4	0.76

IV. CONCLUSION

As expected, chemical IMF% had a marked association with eating quality in the loin, and smaller effects in the rack and topside, cuts where the phenotypic correlation is known to be strongest. The lack of correlation of loin IMF% in other cuts likely explains the corresponding lack of impact on eating quality. The impact of sire IMF% ASBV on eating quality was limited to the loin and was not linked to phenotypic expression of chemical IMF%, suggesting an eating quality improvement delivered through some unidentified mechanism. Further research is required to understand this effect.

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