The accuracy of the Meat Standards Australia (MSA) beef grading model to predict eating quality in steers treated with different Hormonal Growth Promotants (HGPs)

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Abstract. Steers implanted with different HGPs resulted in differential effects on eating quality and carcass traits. Using the MSA beef grading model, which has a single adjustment for HGP implants, and accounts for the associated changes in carcass traits, resulted in a reasonable prediction of eating quality for the different HGP formulations.

Keywords: residual analysis, hormonal growth promotants

I. INTRODUCTION

The MSA beef grading model uses commercial inputs to predict eating quality of individual beef cuts. In developing the MSA model Watson et al. [1] concluded that the HGP effect could be described by a direct effect on eating quality over-and-above the indirect changes in other carcass traits which also impact eating quality. Packer et al [2] compared the effects of different HGP formulations on eating quality of the striploin and rump muscles, aged for 5 or 35 days. Their results showed that the different HGPs resulted in different impacts on eating quality and other carcass traits used in the MSA model. However, it was not known if the single HGP term in the MSA beef grading model, along with changes in carcass traits, accurately predicted variation in eating quality due to different HGP implant types.

II. MATERIALS AND METHODS

A detailed description of the animals, sample preparation, consumer tasting protocol were provided by Packer et al [2]. Briefly, 300 crossbred steers were randomly allocated into three HGP treatment groups comprising control (CON), Compudose 100 (OES) or Component TE-200 (TBA+OES) groups and fed a concentrate ration for 73 days. Four animals were excluded due to loss or encapsulation of the implant. At boning the left striploin and left and right rumps were collected. For each muscle/ageing combination, five 25mm steaks were cut and frozen at either 5 or 35 days post-mortem. Subsequently these samples were mixed with those from other experiments and grilled to medium doneness. A starter sample along with six half test steaks were served to untrained consumers. Sensory scores for tenderness, juiciness, liking of flavour and overall acceptability were weighted by 0.3, 0.1, 0.3 and 0.3 respectively and summed to calculate a meat quality score (MQ4). The 10 MQ4 scores for each sample were clipped by removing the two highest and two lowest MQ4 scores. The MSA grading model (2009 version) used individual hot carcass weight, hump height, marbling and ossification scores, ribfat, ultimate pH and muscle temperature to predict MQ4 scores for the anterior (STA045) and posterior (STP045) striploin portions, along with rump (RMP131) portions aged for 5 or 35 days. Residuals were calculated as the observed MQ4 - predicted MQ4 scores. Residuals for the STA045, STP045 and RMP131 were analysed in a model with fixed effects for HGP treatment and ageing. The first order interaction was not significant ($P>0.05$).

III. RESULTS AND DISCUSSION

Implantation with TBA+OES increased carcass weight, hump height and ossification score and decreased marbling score relative to the CON carcasses (Table 1). Steers implanted with OES had carcass traits that were intermediate between the CON and TBA+OES groups. Table 2 showed that HGP and ageing effects had significant ($P<0.05$) effects on the residuals for the STA045 and STP045 portions, whilst only the HGP effect was significant ($P<0.05$) for the RMP131. A positive residual indicated that the MSA model MQ4 prediction

Table 1. Mean carcass traits (± standard deviations) for crossbred steers from the control (CON), oestradiol only (OES) and trenbolone acetate and oestradiol (TBA+OES) groups

Carcass traits	CON (n=100)	OES (n=99)	TBA+OES (n=97)
Hot carcass weight (kg)	237 ± 16	249 ± 16.5	261 ± 14.9
Hump height (mm)	87 ± 9.9	90 ± 10.5	97 ± 9.9
Marbling score	278 ± 50.8	273 ± 50.8	274 ± 53.7
Ossification score	132 ± 11.5	145 ± 13.3	151 ± 17.9
Rib fat (mm)	4.3 ± 1.38	4.1 ± 1.05	3.9 ± 1.01
Ultimate pH	5.52 ± 0.103	5.53 ± 0.091	5.52 ± 0.081

was lower than the actual MQ4 score, whilst a negative residual indicated that the MSA model over predicted the MQ4 scores. The MSA model indicated that the model prediction for the STA045 and STP045 portions were 1.9 and 3.9 MQ4 units higher than the actual MQ4 scores for the CON, 3.4 and 2.3 MQ4 units too low for the OES, whilst the model over predicted by 0.8 for the STA045 and under predicted by 1.1 for the STP045. For the RMP131 the model MQ4 predicted score was lower than the actual MQ4 score for all three treatment groups. For both the STA045 and STP045 portions aged for 5 days the MSA model tended to overestimate the MQ4 score whilst the reverse was true for 35 days ageing. Although the MSA model under predicted the MQ4 scores for the RMP131 aged at 5 and 35 days, the high variance meant that it was not significant (P>0.05). As expected the residuals from the test data set used to develop the MSA model reported by Watson et al [4] were very low. In contrast Thompson et al [3] reported that MQ4 residuals for the striploin and blade cuts were of the order of ±2 MQ4 units, whilst residuals for the topside were much larger, up to 8 MQ4 units.

Table 2. F ratios and predicted means for residuals (observed MQ4 – predicted MQ4 scores) for the anterior (STA045) and posterior (STP045) striploin portions and rump (RMP131) aged 5 and 35 days

Cut	Df	F ratios		R^2	HGP				Ageing		
		HGP	Ageing		CON	OES	TBA	Se	5	35	Se
STA045	3,290	**6.1**	**19.6**	0.10	-1.9^{a}	3.4^{b}	0.8^{ab}	1.1	-2.0 ^{a}	3.5^{b}	0.9
STP045	3,290	**7.8**	**22.8**	0.12	-3.9 ^{a}	2.3^{b}	-1.1^{a}	1.1	-3.9 ^{a}	2.1^{b}	0.9
RMP131	3,582	**4.6**	2.8	0.02	2.6 ^{a}	5.6^{b}	3.8^{ab}	0.1	3.3	4.7	0.6

Bolded F ratios indicated the term was significant at P<0.05,
$^{a, b}$ indicate that means in each row differed significantly P<0.05

IV CONCLUSION

Even though the TBA+OES implants resulted in lower MQ4 scores than OES implants, the use of a single HGP term in the MSA model in combination with the changes in carcass traits provided a reasonable prediction of eating quality for striploin and rump muscles.

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REFERENCES

1. Watson, R., Polkinghorne, R., Gee, A., Porter, M., Thompson, J.M., Ferguson, D., Pethick, D., McIntyre, B. 2008a. Effect of hormonal growth promotants on palatability and carcass traits of various muscles from steer and heifer carcasses from a Bos indicus–Bos taurus composite cross. *Australian Journal of Experimental Agriculture*, **48**(11), 1415-1424.
2. Packer, D.T., Geesink, G., Polkinghorne, R., Thompson, J.M., Ball, A.J. 2017. The impact of two different hormonal growth promotants (HGPs) on the eating quality of feedlot finished steer carcasses. *Animal Production Science*, Submitted.
3. Thompson, J.M., Polkinghorne, R., Hwang, I.H., Gee, A.M., Cho, S.H., Park, B.Y., Lee, J.M. 2008. Beef quality grades as determined by Korean and Australian consumers. *Australian Journal of Experimental Agriculture*, **48**(11), 1380-1386.
4. Watson, R., Polkinghorne, R., Thompson, J.M. 2008b. Development of the Meat Standards Australia (MSA) prediction model for beef palatability. *Australian Journal of Experimental Agriculture*, **48**(11), 1368-1379.