PRODUCING BRIGHT RED PASTURE-FED BEEF

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Background

The balance between anti and pro-oxidants in the muscle differs in pasture and grain-fed cattle. Pasture is a good source of antioxidants like α-tocopherol and β-carotene. However, beef of steers grazed on pasture has a higher content of polyunsaturated fatty acids in the membrane phospholipids than that of grain-fed animals, increasing the susceptibility of meat to oxidation. The interaction between these two factors modifies the colour and colour stability of beef. Finishing cattle on grass is economically advantageous in many countries. Colour of grass-fed beef is a critical factor limiting its marketability because many consumers consider grass-fed beef as inferior as it is sometimes darker than meat from grain-fed cattle. The information regarding colour and colour stability of pasture fed cattle is contradictory, most of the colour evaluation was done subjectively and had not taken into consideration the antioxidant content of the feed or muscle. A detailed analysis of the colour stability of pasture–fed beef will provide the Australian meat industry with critical information in order to compete successfully in the domestic and export markets.

Objective

To analyse the colour stability of fresh, ground and aged grass and grain-fed beef muscles.

Materials and Methods

In a previous experiment, Lanari et al (1999) showed that supplementing cattle raised on good quality pasture with 2500 IU/head/days did not increased the α-tocopherol concentration of the muscle. The vitamin E content of pasture and grain-fed beef supplemented with 2500IU/head/day were equivalent. In the present trial the feeding conditions were similar, therefore, it was considered that, for this experiment, supplementation of pasture-fed animals was not necessary.

Twenty-one steers were randomly divided into three groups of seven animals each. For 110 days (August-November) prior to slaughter, each group was fed one of the following diets.

a) Pasture-fed (PAST) predominantly Rhodes grass or

b) Sorghum-based feedlot ration, containing 48 (GRN0) or 2500 (GRN2500) IU/head/day of α–tocopheryl acetate (Vitamin E).

At 24 h post mortem, the longissimus lumborum (LL) and the semimembranosus (SM) from each carcase were removed. Three sections of each muscle were vacuum-packaged and stored for different time periods at 0-1°C. After 2 or 30 days of storage, cores were cut, wrapped with oxygen permeable fresh meat film and displayed for 10 or 14 days at 4°C in the dark. Portions of LL aged for 6 or 30 days were ground, wrapped in fresh meat film and displayed at 4°C for 8 days in the dark.

α–Tocopherol concentration in the muscle and in the feeds was determined at day 1 post-mortem by the method of Liu et al (1996). Total pigment concentration was calculated according to van Laack et al (1996). Meat colour (CIE L*a*b*) variations during display were obtained using a Minolta CR-200 chromameter. A decrease in a* is related with an increase of discolouration.

Experimental data were analysed using the proc mixed procedure of SAS (1998). For all the colour parameters, the effects of carcass weight and fat cover thickness were considered as covariates.

Results and Discussion

Table 1 shows the α-tocopherol and total pigment content in muscle for the different treatments. Within each muscle type, GRN0 meat had the lowest α-tocopherol concentration. Supplementation with vitamin E increased significantly ($P<0.05$) the α-tocopherol content in muscle. However, the difference in vitamin E content between PAST and GRN2500 samples was not significant ($P>0.05$).
The total pigment concentration was not affected ($P>0.07$) by the feeding treatments.

Table 1 α-Tocopherol and total pigment contents (±SD) in muscle

MUSCLE	PAST		GRN0		GRN2500	
	α-Toc (μg/g)	Total pigment (mg/g)	α-Toc (μg/g)	Total pigment (mg/g)	α-Toc (μg/g)	Total pigment (mg/g)
LL	4.40 (±0.27)	6.00(±0.92)	1.75 (±0.17)	5.95 (±0.49)	4.76 (±0.29)	6.00 (±1.06)
SM	4.51 (±0.24)	5.31 (±0.94)	2.38 (±0.09)	5.63 (±0.86)	5.19 (±0.25)	5.03 (±0.29)

Variations in post-slaughter chilling rates may produce detectable differences in meat colour. Renerre (1990) reported that slow chilled meat had a paler appearance than rapidly chilled cuts. Carcass weight and fat cover thickness can influence the chilling rate and consequently alter meat surface colour. The average carcass weight and fat thickness for the PAST cattle were: 199 kg and 5 mm, while the grain fed cattle weighted 243 (GRN0) and 236 kg (GRN2500) with a fat thicknesses of 13 and 10 mm respectively. Although there were considerable differences in weight and fat thickness, their effect on surface colour were not significant ($P<0.10$).

Fig 1a presents a* variations during display of fresh and aged LL. At all times, a* values of fresh LL were GRN2500 > GRN0 > > PAST ($P<0.05$). From days 1 to 4, the treatment effect on the colour of aged LL was not significant ($P>0.10$). From day 4 to the end of the display, the colour and colour stability in PAST and GRN2500 aged LL were similar ($P>0.10$) and significantly better ($P<0.01$) than in GRN0 LL. Aging for 30 days did not altered ($P>0.10$) a* levels in PAST LL. In contrast, a* in grain-fed aged LL were lower ($P<0.01$) than in their fresh counterparts. After 10 days storage, a* for fresh and aged PAST samples was 18.32 while for grain-fed meat, a* values were 21.0 (GRN2500 fresh), 21.0 (GRN0 fresh), 17.8 (GRN2500 aged) and 15.4 (GRN0 aged).

From days 1 to 6, a* in fresh SM (Fig. 1b) ranked as: GRN2500 > GRN0 > PAST, similar to fresh LL. However, and in contrast with the LL, from day 7 to the end of the storage period, the treatment effect was not significant ($P>0.06$). a* values in aged SM (Fig.1b) followed a similar patters as aged LL. Comparison across muscle type showed that colour response to aging in PAST LL and SM differed. At day 10 of display, aging reduced the a* values of the SM from 18.1 to 13.8 while no difference was detected in LL a* = 18.3.

Fig 1c shows the redness of fresh and aged ground LL during display at 4 °C. During the whole display period, a* values of fresh PAST ground LL were lower ($P<0.05$) than those from grain-fed beef. The supplementation effect was not significant ($P>0.10$). From day 1 to 6, the colour stability of ground beef from PAST LL aged 30 days was much higher ($P<0.01$) than in the GRN0 and GRN2500 aged samples. From day 7 to 8 a* for PAST and GRN2500 LL were similar ($P>0.07$) and significantly higher than those from GRN0 LL. A comparison between fresh and aged meat showed during 6 days of display, the PAST aged samples have the best colour followed by the fresh grain-fed LL. Between 2 and 8 days of display, a* values of PAST fresh LL was similar or higher than in the grain-fed meat.

Conclusions

Fresh (2-6 days post-mortem) meat from grain-fed cattle with and without vitamin E supplementation had a better colour than pasture-fed beef kept in the same conditions. However, after 30 days aging, the colour and colour stability of pasture and grain fed supplemented beef were similar and better than that from grain-fed un-supplemented beef. Aging grass-fed beef for 15 to 30 days will allow the meat industry to obtain a product of similar or better colour stability as the grain-fed meat with lower production costs

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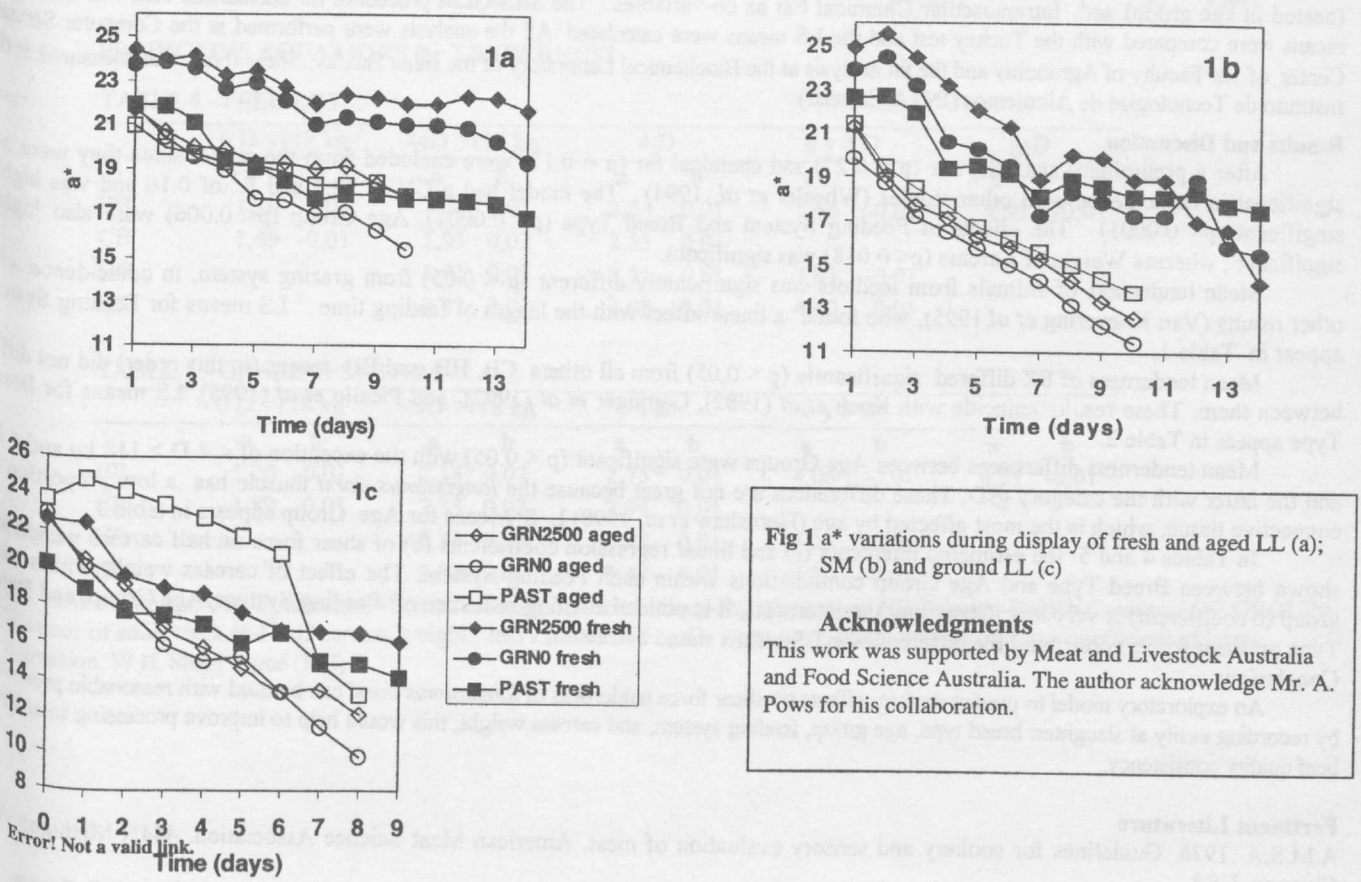

Fig 1 a* variations during display of fresh and aged LL (a); SM (b) and ground LL (c)

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