

EFFECT OF AGE AND NUTRITION ON MEAT FLAVOUR OF LEAN, HEAVY WEIGHT CRYPTORCHID AND WETHER LAMBS

Channon, H.A.[†], Thatcher, L.P.[‡], and Leury, B.J.^{*}[†] Victorian Institute of Animal Science, Agriculture Victoria, Private Bag 7, Sneydes Road, Werribee Victoria, 3030 Australia[‡] L.P. Thatcher and Associates, P.O. Box 74, Rutherglen Victoria, 3685 Australia^{*} Department of Agriculture and Resource Management, The University of Melbourne, Parkville Victoria, 3052 Australia**Introduction:**

One of the reasons for declining lamb consumption in Australia has been attributed to inconsistent supply of heavy lean lambs. This is due to the seasonal production pattern of heavy weight lean lambs within prime lamb producing regions in Australia, leading to supply deficits of lambs meeting required carcass specifications at different times of the year. To address this problem, industry initiatives have focussed upon the production and marketing of lambs on a year round basis to meet carcass specifications of 18-26 kg with a fat depth of 6 to 15 mm at the GR site. One strategy for overcoming the supply deficit is to use animals of up to 18 months of age to extend the availability of heavy weight, lean lamb carcasses weighing more than 22 kg. However, the use of older lamb carcasses to supply market requirements for larger, leaner lamb carcasses may be constrained by perceptions of poor meat quality. Therefore, this study was conducted to determine whether meat and fat quality of older cryptorchids and wethers, up to 18 months of age, would restrict their use in the production of heavy weight lamb carcasses.

Materials and Methods:

One hundred and sixty three second cross Poll Dorset x Border Leicester/Merino cryptorchid and wether lambs born in May 1991 were grown and managed on annual pasture at an average liveweight of 50 kg prior to slaughter. Lambs were allocated to one of seven slaughter groups (SG) on the basis of sex and liveweight, eight weeks after weaning. A designated SG was finished every two months from 6 to 18 months of age. To minimise potential effects of pre-slaughter nutrition on carcass and meat quality parameters, lambs in each treatment group to be slaughtered were placed on a rising plane of nutrition about 6 weeks prior to slaughter. Lambs in all slaughter groups were supplemented with a 30% lupin: 70% wheat ration from January to mid February 1992 to maintain liveweight. Lambs to be slaughtered at eight and ten months of age were fed a 30% lupin: 70% wheat ration at production levels (liveweight gains of 200-250 g/day were achieved) compared with all other lambs over 6 weeks prior to slaughter, to attain an average slaughter liveweight of 50 kg. A rising plane of nutrition of lambs in all other slaughter groups was achieved by grazing lambs at reduced stocking rates on good quality annual pasture.

Subcutaneous fat colour of lamb carcasses in all groups, except those slaughtered at six months of age, was visually assessed 24 h after slaughter and described as either white, creamy or yellow in colour, with the consistency of subcutaneous fat subjectively judged as either soft or hard. After slaughter, *M. biceps femoris* muscles were dissected from the hindleg of each carcass and stored in air-tight plastic wrapping at -20°C until required for sensory appraisal. Subjective assessment of meat was conducted at the conclusion of the experiment to allow meat from cryptorchid and wether lambs of 6 to 18 months of age to be directly compared. For sensory analysis, a modified method of Winger and Pope (1981) was used. Muscles from four cryptorchid and four wether carcasses from each slaughter group (total of 56 samples) were denuded of subcutaneous fat and minced. Fat was mixed in with mince at 8% by weight and 15 ml 0.1% (w/v) xanthan solution (KeltrolRD, Kelco International) was added to 100g mince. Ten trained taste panellists were involved over 7 sittings. Each panellist was given 4 samples of 15 g per sample per sitting and scored aroma, flavour and overall acceptability on scales of 1-9 where higher scores indicated stronger aroma and flavour and lower overall acceptability. Taste panel data for meat flavour were analysed using regression techniques to obtain F-tests for the sources of variation and residual maximum likelihood (REML) procedures in Genstat 5.2.2 (Genstat 5 Committee 1990) to obtain treatment means and standard errors of differences, adjusted for panellist and sitting.

Results:

Cryptorchids produced subcutaneous fat with higher ($P<0.01$) levels of total unsaturated fatty acids (44.4 and 42.0%, respectively) compared with wethers and lower ($P<0.01$) levels of total saturated fatty acids (55.5 and 57.8%, respectively). Levels of both total unsaturated and saturated fatty acid in subcutaneous fat were not influenced by lamb age at slaughter. Linoleic acid and total polyunsaturated fatty acid levels were higher ($P<0.001$) in subcutaneous fat from lambs slaughtered at ten months of age compared with lambs in all other treatment groups (Table 1); there was no significant effect of sex on these parameters. The incidence of yellow, soft subcutaneous fat was higher in cryptorchid lamb carcasses compared with wethers. Cryptorchid and wether lambs supplemented with a lupin:wheat ration in late summer and slaughtered at 10 months of age also had a higher incidence of yellow, soft subcutaneous fat compared with lambs in other treatment groups. No differences due to lamb sex or age were found for aroma. Significant differences between cryptorchids and wethers were found for meat flavour, with meat from cryptorchids judged as having a stronger flavour than wethers. Lamb age tended to influence meat flavour, however, it was not significant at the 5% level. For overall acceptability, no significant differences were found between meat from cryptorchid and wether carcasses, however the interaction of age x sex was significant.

Discussion:

Cryptorchid lambs generally had a higher incidence of yellow, soft subcutaneous fat than wethers at different slaughter ages. This can in part be explained by the higher total unsaturated and lower saturated fatty acid levels in subcutaneous fat from cryptorchid compared with wether lamb carcasses. In this study, meat from cryptorchid and wether lambs did not differ in terms of aroma and overall acceptability. Previous studies have also concluded that meat from rams, cryptorchids, wethers and ewes was not significantly different in organoleptic properties (Field 1971; Ford and Park 1980; Kirton *et al.* 1983). Kemp *et al.* (1972) and Lee (1986) also considered differences in meat flavour and palatability between rams, cryptorchids and wethers to be small. These observations together with the results of this study suggest that meat from both cryptorchid and wether carcasses would be suitable on organoleptic grounds, even though meat from cryptorchids was judged as slightly stronger in flavour than wethers.

In this experiment, the effects of age on both sensory characteristics and quality and consistency of subcutaneous fat were partly confounded by variable nutritional management strategies used to finish heavy weight lean lambs, managed on annual pasture and slaughtered at different ages. This was unavoidable due to the commercial focus of this study. Nevertheless, at a normal finishing age of 6 to 8 months,

aroma, flavour and acceptability of meat from cryptorchid and wether carcasses were not significantly different. In addition, aroma and overall acceptability of meat from both cryptorchid and wether carcasses did not become stronger and less acceptable with increasing age. Although the flavour of meat from both cryptorchid and wether carcasses tended to become stronger (particularly from 12 months of age), this was not significant at the 5% level. Similarly, Corbett *et al.* (1973) reported that flavour intensity of meat between cryptorchid, rams and wethers of 3 to 42 months of age was not significantly different whilst Kirton *et al.* (1983) found no difference in meat flavour of pasture-fed male and female sheep of 12 months to 4 years of age. Meat from cryptorchid lamb carcasses slaughtered at 10 months of age tended to have a stronger flavour than meat from wethers. In addition, a higher incidence of yellow, soft subcutaneous fat was found in cryptorchid and wether lambs slaughtered at ten months of age compared with lambs in other slaughter groups. Hopkins *et al.* (1995) found that meat from lambs fed a 3:1 oat:lupin ration at 993 g/day until slaughter was less desirable in both flavour and aroma than lambs fed lucerne, lucerne/silage or lucerne/oats. Bray *et al.* (1991) also found that meat from lambs fed lupins had a stronger taste than lambs fed pasture. Although the results of this study are consistent with these observations, reasons for differences in both meat flavour and consistency of subcutaneous fat from carcasses of lambs in this slaughter group are still unclear, but it is interesting to note that lambs slaughtered at ten months of age had the highest concentration of both linoleic acid and polyunsaturated fatty acids in subcutaneous fat. However, Channon *et al.* (1993) found that although linoleic acid levels in subcutaneous fat of cryptorchid lambs fed a ration of 100% lupins increased, this was not related to subjective changes in fat colour or consistency. Overall, no consistent relationship was observed between fatty acid composition of subcutaneous fat and flavour of meat from cryptorchid and wether lambs when slaughtered at different ages. This suggests that different nutritional management strategies used to finish lambs in different slaughter groups may have more of an influence on meat flavour and fat quality and consistency than lamb age, at least up to 18 months.

In conclusion, meat from cryptorchid and wether carcasses up to 18 months of age had acceptable sensory characteristics. The results of this study also indicate that feeding of lupins and wheat to finish lambs may influence meat flavour in cryptorchids and the quality and consistency of subcutaneous fat from both cryptorchid and wether lambs.

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Table 1 Average lamb age at slaughter (days), linoleic acid (%) and total polyunsaturated fatty acid (PUFA) (%) levels in subcutaneous fat, percentage of carcasses exhibiting yellow, soft subcutaneous fat and mean and standard error of the difference between means (s.e.d) for ratings of flavour and overall acceptability of meat from cryptorchid and wether lambs, slaughtered from 6 to 18 months of age

Treatment	Age (days)	Fatty acid composition in subcutaneous fat (%)		Percentage of carcasses exhibiting yellow, soft fat (%)		Flavour ¹		Overall Acceptability ²	
		Linoleic acid	PUFA	Cryptorchid	Wether	Cryptorchid	Wether	Cryptorchid	Wether
SG 6	208	1.33 ^A	2.68 ^{AB}	n.d.	n.d.	4.45	4.50	4.97 ^{AB}	4.82 ^{AB}
SG 8	280	1.91 ^B	2.94 ^B	7 (n=14)	17 (n=12)	4.97	4.97	4.11 ^A	4.21 ^A
SG 10	329	2.45 ^C	3.78 ^C	70 (n=10)	40 (n=10)	5.58	4.59	5.50 ^B	4.71 ^{AB}
SG 12	390	1.61 ^{ABD}	2.90 ^{AB}	0 (n=12)	0 (n=11)	4.79	4.45	5.30 ^B	4.27 ^A
SG 14	446	1.66 ^{BD}	2.89 ^{AB}	30 (n=10)	18 (n=11)	5.16	4.45	4.27 ^A	4.83 ^{AB}
SG 16	508	1.54 ^{AD}	2.71 ^{AB}	42 (n=12)	33 (n=12)	5.22	4.83	4.83 ^{AB}	5.49 ^B
SG 18	566	1.29 ^A	2.51 ^A	64 (n=14)	17 (n=12)	5.46	5.17	5.17 ^B	4.74 ^{AB}
s.e.d.		0.16	0.21						
Mean						0.42		0.45	
s.e.d.						5.10 ^a	4.71 ^b	4.88	4.72
						0.16			n.g.

Figures in rows with different superscripts are significantly different (P<0.01)

Figures in columns with different superscripts are significantly different (P<0.05)

s.e.d.'s for sex differences not given when significance level was greater than 5%

not determined

¹ Flavour scale: 1 absent to 9 very strong

² Acceptability scale: 1 extremely good to 9 extremely poor