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INFLUENCE OF PRE-SLAUGHTER HOLDING TIME, GROWTH PATH AND CASTRATION ON MEAT QUALITY CHARACTERISTICS OF BEEF *M. LONGISSIMUS THORACIS*

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Applied Science

in

Animal Science

at Massey University, Palmerston North, New Zealand.

Bridget M. Peachey

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ABSTRACT

Peachey, B.M. 1999. Influence of pre-slaughter holding time, growth path and castration on meat quality characteristics of beef *M. longissimus thoracis*. M.Appl.Sc Thesis, Massey University, Palmerston North, New Zealand. 85 pp.

The New Zealand Beef Industry has included among its research goals the need to enhance product consistency and consumer satisfaction. Identifying on-farm and post-slaughter techniques for producing quality meat will permit the delivery of a more consistent product.. The objectives of this study were to examine the influence of castration, pre-slaughter holding time, and growth path on meat quality characteristics with emphasis on meat tenderness. Sixty male Hereford x Angus cattle were used, half of which were castrated at weaning. They were then ranked within their castration groups on their growth performance during a 100-day pre-trial period. Of the 40 faster-growing animals, 20 were randomly selected to be slaughtered at 16-18 months of age at approximately 550 kg liveweight (the fast group; F) and the remaining 20 were managed in such a way that they reached the same liveweight as the slower-growing 20 animals (S) at 25 months of age (restricted group; R). Once at the abattoir half the animals were randomly selected within castration and growth path groups to be held for either 4 or 28 hours pre-slaughter. Measures of meat quality characteristics were made on a sample of the *M. longissimus thoracis*, of each animal that was removed soon after slaughter. The bulls produced meat with higher ultimate pH values (5.64 vs 5.46, $P<0.001$) and meat that was significantly tougher than steers as evaluated by MIRINZ peak force (6.6 vs 4.6 kg, $P<0.001$), and sensory toughness (6.10 vs 4.50, $P<0.001$), both before and after adjustment for differences in pH. Animals held for 4h pre-slaughter had tougher meat as measured by Instron compression maximum load (92.8 vs 82.0, $P<0.05$). Cattle in Group F produced meat that had a higher ultimate pH ($P<0.001$), however, meat from animals in Group F was significantly more tender as measured by sensory analysis ($P<0.001$). There were few differences between cattle in Groups R and S suggesting that differences in tenderness in this and other studies between animals on fast and slow growth rates were a result of differences in animal age rather than in inherent growth potential of the animals. Results suggest that holding cattle under appropriate welfare standards and allowing them enough time to recover from trucking and environmental stress should result in acceptable meat. Results from this trial have practical implications for producers and processors, and for the production of beef for the New Zealand Quality Mark. In this trial beef was tougher when it was from bulls or from older groups of cattle, with these two effects appearing to be additive. It is therefore suggested that cattle age and gender criteria should be considered for inclusion in the Quality Mark system.

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ERRATA

Page	Paragraph	Line	Correct item	Item to be replaced
27	2	7	(Purchas & Grant 1995)	(Purchas & Grant 1997)
42	1	1	Figure 3.2	Figure 3.1
46	3	2	Figures 3.3 and 3.4	Figures 3.2 and 3.3
47	1	2	Figure 3.3	Figure 3.2
48	1	4	Figure 3.4	Figure 3.3
49	1	7	Purchas & Grant (1995)	Purchas & Grant (1997)
50	4	3	Purchas & Grant 1995	Purchas & Grant 1997
51	1	1	Purchas & Grant (1995)	Purchas & Grant (1997)
52	4	1	Purchas & Grant (1995)	Purchas & Grant (1997)
56	3	8	Purchas & Grant 1995	Purchas & Grant 1990
58	2	6	it is	it s
66	8	1	G.P. 1989:	G.P.:

References:
Add;

Hood, D.E.; Tarrant, P.V. 1981: The problem of dark cutting in beef. Martinus Nijhoff, The Hague.

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LIST OF ABBREVIATIONS

*	P<0.05
**	P<0.01
***	P<0.001
+	P<0.1
NS	P>0.1
%	percent
°C	degrees Celsius
µm	micrometre
c/kg	cents per kilogram
cm^2	centimetre squared
cm^2/g	centimetre squared per gram
g	gram
g/kg	gram per kilogram
kg	kilogram
kg/day	kilogram per day
kgf	kilogram force
kPa	kiloPascals
mg	milligram
ml	millilitre
mm	millimetre
mm/min	millimetre per minute
mm^3	millimetre cubed
mW	milli Watts
nm	nanometres
&	and
28h	28 hour pre-slaughter holding period
3Cut Wt	joint weight of 3 muscle cuts – knuckle, outside and inside
4h	4 hour pre-slaughter holding period
c.	about
CC Length	carcass length
CL	cooking loss
Cohes	cohesiveness
Cwt	carcass weight
Dchew	deviations from mean for chewiness
Dcohes	deviations from mean for cohesiveness
Dhardness	deviations from mean for hardness
Dinijuic	deviations from mean for initial juiciness
Dovjuice	deviations from mean for overall juiciness
Dr%	dressing-out percentage
Dtoughness	deviations from mean for toughness
EMA	eye muscle area
EXJ	expressed juice
F group	fast growth path group
FD	fibre diameter
hr	hour
Inijuic	initial juiciness

IY	initial yield
KCl	potassium chloride
KP Fat	kidney and pelvic fat
LD	*longissimus dorsi*
LD2	load at 20 mm
LD8	load at 80 mm
LSMeans	least square means
Lwt	liveweight
Max	maximum
MFI	myofibrillar fragmentation index
mo	months of age
NaCl	sodium chloride
n	number
Ovjuice	overall juiciness
PF	peak force
PF-IY	peak force minus initial yield
pH_u	ultimate pH
R group	restricted growth path group
r	correlation coefficient
R^2%	coefficient of determination
RMSE	residual means standard error
RSD	residual standard deviation
S group	slow growth path group
Sarco	sarcomere length
SE	standard error
Sig	significance
TotalWD	total work done
vs	versus
WB	Warner-Bratzler
Wt	weight