PE7.46 The relationship between the subjective eating quality ranking of lamb meat cuts in a national competition with objective measurements 427.00

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Abstract-Lamb producers were invited to submit lambs into a national competition to identify these animals producing premium eating quality lamb legs. 35 legs selected from 1500 carcasses were submitted and allocated into four Competition Classes according to their genetic background. Each leg was evaluated by measuring the tenderness of the rump and assessing the eating quality of the rump and topside using two panels of expert judges. The objective shear force results and subjective assessment by the judges agreed in the identification of the four finalists for each Class and the winners in three of the four Classes. The ranking order of the eating quality within a Class, as identified by the judges, could not be predicted using shear force figures. Judges used additional criteria such as flavour, juiciness and aroma to establish their ranking order. To objectively predict this ranking order requires inputs from sophisticated analytical techniques that quantify flavour, juiciness and aroma. Determination of the yield of five primal leg cuts revealed there were 'high' and 'low' rump plus topside lamb leg profiles. These profiles are not important if the market demands lamb legs. If the market moves, however, to boned out convenient high quality leg cuts then a 'high' rump plus topside designer leg, as identified in this research, would be in demand. Such a lamb leg would deliver economic and eating quality benefits to the industry.

Index Terms-Financial gains, judging, lamb leg competition. Leg cut yields, market opportunities, ranking eating quality, tenderness.

I. INTRODUCTION

In New Zealand, a national steak competition was introduced in 2002 by the Beef and Lamb Marketing Bureau to make beef producers and retailers aware that the profitability and sustainability of their beef industry was linked to the eating quality characteristics of beef. The competition has been an outstanding success as indicated by the increased numbers of competitors entering the competition each year, improvements in mean tenderness values and extensive media publicity. There has also been increased financial support from industry across the farm to folk supply chain. In 2007, a limited tasting competition was introduced to evaluate whether the lamb industry was interested in a National Lamb Competition. There was widespread support from the industry and agreement that lamb legs would be used to compare whether there were any differences in the meat yields and eating quality of lamb legs sourced from different breeds and environment. The purpose of this paper is to report on the 2008 National Lamb Competition and to examine the relationship between the subjective evaluations of grilled rump and topside cuts with objective rump quality measurements. The event was also used to compare the yield of five major leg retail cuts to assess if there were any trends that could impact on the marketing of single muscle cuts. Any lamb breed could enter the competition but carcass weights were restricted to 15.0 - 17.5kg. To ensure equity across the industry, the yield of meat from lamb legs was independently determined by computerized axial tomography. Tenderness, pH and cooking loss was determined on the rump cut. Tasting evaluation was by an expert panel using hot grilled rump and topside cuts. In 2008, thirty five competitors who submitted seventy legs from 35 carcasses which were selected from 1500 lambs. The legs were allocated to one of four Competition Classes which represented their genetic background. The four Classes were Dual Purpose (Class1), Dual Purpose X Terminal (Class 2), Composite /Crossbred X Terminal (Class 3) and Terminal (Class 4) as agreed by the industry. Four finalists were identified per Class based on their meat yield and tenderness. The ranking within a class was determined from the eating characteristics of freshly grilled rump or topside cuts using two separate judging panels. The meat industry was interested on the impact of breed, management and processing on eating qualities of the product and the scientists on the ability of objective measurements to predict the outcome of the competition, muscle profile variations within a leg and and the economic

value of specific muscle cuts. The competition has raised some interesting industry and research issues. The number of competitor has doubled from 35 in 2008 to 69 in 2009.

II. MATERIALS AND METHODS

Animals: Each competitor supplied 25-50 lambs to a processing plant which had to yield 15.0 to 17.5kg carcasses with less than 12mm back fat (75% of supplied lambs had to conform to this specification). From this line of lambs, one typical lamb was selected and boned out to yield two full lamb legs with hocks removed. The two legs were vacuum packed, chilled to 1oC and forwarded to Lincoln University. Lamb Legs: The meat yield from one vacuum packed leg was determined by scanning the leg with low level X-ray dosages which produce two dimensional sequenced slices across the leg. Measurements from 18 slices from the hock to top of the leg, allowed accurate determination of the percentage muscle (meat), fat and bone in each leg. The other vacuum packed leg was boned out into five main primal cuts: rump, topside, silverside, thick flank and shank. All portions were weighed and reported as percentage of the leg . Treatment of Rump: A portion of the rump was cooked to an internal temperature of 75oC and the force (KgF) to 'bite' across the cooked meat determined using a MIRINZ tenderometer. Cooking loss was determined from the meat weight loss during cooking. Allocation of legs into Classes and evaluation by judges: The lamb legs were allocated into one of the following four Classes based on breed. Class 1 (Dual Purpose), dam and sire of the same breed; Class 2 (Dual Purpose X Terminal), dam and sire must be purebred of a recognized breed, Class 3 (Composite / Crossbred X Terminal), ewe to any recognized terminal sire. The four finalists in each group were identified by a score accrued by allocating marks based on leg meat yield (50%) and rump tenderness (50%). Eating quality evaluation was by two separate panels of four judges with two judges being recognized competition chefs. The rump and topside were boned out, grilled on a hot plate to medium-rare and evaluated, whilst hot, on the five parameters: - aroma, taste, tenderness, juiciness and texture.

III. RESULTS AND DISCUSSION

Table 1 lists the objective measurements of the lamb legs in the Competition Classes, the order in which they were ranked and overall score (percentage) allocated by the judges from the two panels. Table 1 shows that in Classes 1, 2, 3 and 4 the subjective identification of the top four lamb legs in each Class corresponds to the selection based on rump tenderness only. The overall winner in Classes 1, 2 and 3 identified by the judges matches the legs identified by rump tenderness but this was not the case for Class 4. In each Class, the subjective ranking of the legs into first, second, third and fourth place could not be predicted by the tenderness results. Clearly, the additional selection criteria of juiciness flavour and odour used by the judges affected the tenderness based rankings. This is not unexpected since it is recognized that once tenderness reaches an acceptable level that other factors such as flavour and juiciness influence consumer judgments. To take these factors into account requires reliable objectives measurements for taste, juiciness and aroma.

Class	Entrant	Breed	Leg Weight (Kg)	Tenderness (KgF)	Muscle (%)	Fat (%)	pH	Cooking Loss (%)	Judges Score (%)
1	1	R	3.06	4.2	74.6	9.8	5.54	21	84.3
	2	R	2.91	5.9	73.1	9.9	5.69	25	81.1
	3	P	2.88	5.7	71.0	13.5	5.59	21	80.3
	4	R	2.78	8.2	76.6	6.6	5.56	19	76.6
	5	TR	3.05	8.2	70.1	14.4	5.63	23	-
2	1	R/B/SX	3.22	5.6	67.2	15.9	5.61	19	82.6
	2	TF/TFX	3.23	6.2	76.0	8.9	5.66	21	81.4
	3	P/DX	3.06	6.1	76.6	6.0	5.52	22	79.1
	4	R/TX	3.09	6.5	78.7	5.8	5.59	23	77.5
	5	C/Su/TX	3.17	6.5	68.7	15.2	5.70	20	-
	6	R/TX	2.93	6.5	76.2	8.3	5.51	19	-
	7	C/DDX	3.05	6.6	74.3	9.5	5.58	20	-
	8	P/TX	3.05	8.1	74.1	10.6	5.51	21	-
	9	R/TX	2.79	8.5	76.7	7.3	5.59	26	-
3	1	G/RX/G	2.88	4.6	70.8	14.2	5.71	18	80.6
	2	H/C/HXH/B/R	2.80	4.8	74.4	9.4	5.65	17	80.4
	3	R/C/T X T	2.78	5.0	73.4	11.5	5.63	19	79.3
	4	T X T	3.00	5.2	79.2	4.9	5.53	19	78.3
	5	Co X WD	3.79	5.5	68.8	18.4	5.66	23	-
	6	R/T X T	3.00	5.6	78.7	8.1	5.66	28	-
	7	C/T X T	3.24	5.6	78.5	8.0	5.50	14	-
	8	T X T	2.93	5.8	77.2	8.9	5.68	20	-
	9	T / C X T	3.26	6.1	75.5	10.1	5.63	21	-
	10	R/T X S/T	3.14	6.5	73.7	9.9	5.59	22	-
	11	K X PD	2.93	6.6	74.0	11.1	5.60	23	-
	12	BR X S	2.97	6.9	71.5	14.7	5.50	19	-
	13	F/T/BXF/T/R	2.95	7.2	73.0	11.9	5.60	11	-
4	1	W	2.90	6.8	74.4	10.5	5.57	19	80.6
	2	T	2.83	6.4	77.2	6.1	5.62	14	80.4
	3	T	2.91	6.3	78.3	7.0	5.54	19	79.3
	4	S/WD	3.63	6.0	78.9	8.8	5.57	23	77.9
	5	T	2.77	7.2	77.2	6.7	5.56	16	
	6	T	2.91	8.7	76.6	8.7	5.52	24	

Table 1: Details of entrants, leg weights, analysis and judging.

Abbreviations:

R, Romney	TR, TEFRom	P, Perendale	B, Border	S, Southdown
TF, Texel Finn	C, Coopworth	Su, Suffolk	DD, Dorset Down	H, Hampshire
M, Merino	B, Borderdale	G, Grenbulk	PD, Poll Dorset	F, Finn
WD, White Dorper	W, Wiltshire	X, crossed with		

Examination of all the results indicated there was a trend for judges to prefer more tender meat. This has been observed and reported previously (1). There is also a tendency for the judges to prefer legs with increased fat. This could be linked to changes in juiciness and flavour but additional work is required to confirm this observation.

Table 2: Yield of retail leg cuts from finalists.

Class	Entrant	% of each leg cut				
		Rump	Silverside	Topside	Thick Flank	Shank
1	1	13	12	18	25	12
	2	11	12	15	25	11
	3	10	14	17	27	11
	4	13	14	18	25	10
2	1	12	11	17	26	9
	2	13	14	17	26	10
	3	10	14	18	24	10
	4*	18*	16*	19*	16*	12*
3	1*	17*	11*	25*	18*	8*
	2	14	14	18	22	11
	3	12	14	17	26	10
	4*	21*	14*	19*	17*	8*
4	1	13	13	17	26	11
	2	11	13	22	22	10
	3	13	11	18	26	11
	4	14	15	19	24	11

Table 2 lists the percentage yield of five retail cuts boned out from the legs of the finalists. Examination of the yield of the retail cuts showed there were differences in the cut yields from some legs. Thirteen of the legs yielded, on average, 12.2% rump, 13.2% silverside, 17.8% topside, 24.9% thick flank and 10.5% shank. Three lamb legs (labeled with an asterisk) sourced from different genetic backgrounds, yielded different cut profile than the other legs. The average retail cut yield from these three legs was 18.7% rump, 13.7% silverside, 21.0% topside, 17.0% thick flank and 9.3% shank. The profile differences are reflected particularly in the yields of the rump plus topside cuts which accounted for 30% of the lamb leg in the 13 lambs and 39.7% in the three identified lambs. There is, at least, a 30% increase in the rump plus topside cuts in these lamb legs. The question is: - Is this retail cut profile important to consumers? The answer is dependent on future consumer trends. For example, if the consumer demand is for whole lamb legs then the distribution of muscles across a leg is not important. If, however, the consumer market moves to small convenient lamb leg cuts then the yield of specific leg cuts becomes economically very important to the industry. Table 3 illustrates the economic value of a 3.0kg lamb leg boned out from the two types of legs. The dollar values are based on New Zealand retail prices of whole leg, $15.95/kg; rump $29.95/kg; topside $28.50/kg; silverside $22.50/kg; thick flank $22.50/kg and shank $15.95/kg.

Table 3: Retail dollar value of whole leg and leg cuts from lamb legs with different muscle profiles.

Product	Leg Profile A $ received	Leg Profile B $ received
Whole Leg	52.50	52.50
Rump	10.96	16.80
Silverside	8.91	9.25
Topside	13.62	16.07
Thick Flank	16.80	11.48
Shank	5.02	4.45
Total	55.31	58.05

Table 3 shows that if the market trend is towards boned out retail lamb leg cuts then 'designing' legs with increased rump and topside cuts is an economically desirable direction. However, the market trend will need to be identified and confirmed to enable lamb producers to respond by

selecting the correct genetic stock to match the future market demands and for meat scientists to recommend the ideal processing conditions to optimize the tenderness of these premium priced retail cuts. Finally, the influence of intramuscular fat levels on the flavour, juiciness and odour of boned out lamb leg cuts has yet to be determined.

IV. CONCLUSION

Meat tenderness is the primary factor on which judges subjectively assess meat quality and identify the finalists in an eating quality based competition. The judges, however, use other characteristics such as flavour, juiciness and odour in addition to tenderness to rank finalists into first, second, third and fourth. Shear force is a useful objective measurement to identify finalists but the individual ranking order cannot be determined by tenderness alone. Correct ranking order can only be achieved if sophisticated tools which accurately measure flavour, juiciness and odour are used in addition to tenderness. The distribution of retail cuts varied between the lamb legs with rump plus topside cuts showing a 30% increase at the same leg weight in some breeds. If there is a consumer and market trend to premium convenient lamb leg cuts, such as rump and topside, then lamb producers will need to respond to the market signals by selecting stock that yield 'rump plus topside' legs and meat scientists will need to identify the processing conditions to optimize the eating characteristics of such products, if economic gains are to flow to the industry.

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