Carcass and quality traits when breeding for high quality slaughter lamb

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Introduction

The request for lean and tender meat from the higher quality cuts challenges the lamb meat production to put greater emphasis on carcass and meat quality traits in the production of lamb meat.

Nortura, the largest slaughtering and meat processing company in Norway (~70% of the market share of lamb, swine, beef and white meat), has developed a terminal sire line (Nor-X) for use in crossbreeding for production of high quality slaughterlamb. Until date, top selection of Nor-X rams has been for lean percentage measured by computer tomography (CT) (Kvame and Vangen, 2006). In order to include more carcass and quality traits in the selection programme, a new 3-year research project was initiated in the beginning of 2006. Experimental work includes recording of carcass and meat quality traits of live-animal, carcasses and meat cuts. One objective was to examine meat quality traits for lamb and to investigate how meat quality traits can be measured commercially to be included into a breeding programme for Nor-X, as practiced for terminal sire lines in pigs. The current breeding goal for the Nor-X sheep is high carcass lean percentage, low carcass fat percentage and high growth rate.

Material and Method

Results for the first year of recording included data of 110 Nor-X lambs (64 ram and 46 ewe lambs) from the research nucleolus flock at UMB (Kvame et al., 2006, Kvame and Vangen, 2006). All lambs had records on live-weight (LW), ultrasound muscle- and fat depth recorded at the 3rd lumbar vertebrae, lean, fat and bone weight estimated by CT, pH and temperature decline, EUROP classification (slaughter weight, fatgroup and meat class), ultimate pH (pH_{48}), weight of cuts and meat products, intramuscular fat (IMF), drip loss and meat colour of the left *m. longissimus dorsi* (LD).

The lambs were slaughtered in four groups of 30 lambs per week (20 the last week) for four subsequent weeks. Carcasses were dissected within 48-78 hours post slaughter. PH/temperature decline was measured for the right *m.longisssimus dorsi* (LD) and *m.semimembraneous* (SM) at 1, 4, 7, 10, 13 and 48 (pH_{48}) hour post slaughter on average, using a portable meter. IMF was analysed by Foodscan using Near Infrared Transmittance for analysis of mission (850-1050nm) (Gjerlaug-Enger, 2006). Muscle colour measures (L*, a* and b*) were recorded on the cut surface after slicing across the fibres and exposing the surface to air at –4 °C for one hour using a Minolta Chromameter. EZ-drip loss was recorded as the mean of two replicates using a technique described by Christensen (2006) and Gjerlaug-Enger (2006).

Results and discussion

Data was analysed using SAS statistical software package. Model 1 included effect of: sex (1, 2), number of lambs (1, 2), dam age (1, 2, 3-4, 5<), group (1, 2, 3, 4) and slaughter weight (SLV) (covariate) (the traits SLV and slaughter percent were corrected for age at slaughter) (Table 1). Meat quality traits were then analysed by model 2 fitting sire, number of lambs and sex as fixed effects and SLV as covariate (Table 2). There was a clear genetic variation in IMF between sires ($P<0.05$). Significant variation between sires was also found for drip loss and meat colour ($P<0.05$). Though, the small percentage drip loss found for Nor-X lambs suggest that drip loss is not a great challenge for Nor-X lamb, given the method used. Effect of slaughter weight was significant for live weight data and cuts, but not for meat quality traits. Ram and Ewe lambs were of similar live weight pre-slaughter, but ewe lambs had significant lower weight of lean and a larger weight of all fat depots, including IMF ($P<0.05$) (results not presented). Temperature decline was significant larger for LD than SM at 1, 4, 7 hour post slaughter. PH decline varied largely between animals within time of measure, but there was a trend of larger pH decline for SM than LD for all recordings (results not presented).

Table 1 show means and root mean square error, coefficient of determination (R^2), coefficient of variation (CV), and significance of each trait in the model. Table 2 present least square means and standard errors for meat quality traits expressed by sire.

Table 1. Means and standard deviation (stdev), coefficient of variation (CV), coefficient of determination (R^2), and significance of each trait in model 1. Lambs=number of lambs. *P<0.05,**P<0.001,***P<0.0001. [1]Covariate=age at slaughter. Slaughter weight was the covariate for all other traits.

	Mean (stdev)	CV	R^2	Sex	Lambs	Age dam	Group	Covariate
LW pre slaughter	42.0 (1.50)	3.6	0.86	ns	*	*	***	***
Fat depth	1.84(0.53)	29.0	0.26	*	ns	ns	ns	**
Muscle depth	27.7 (1.95)	7.1	0.33	ns	ns	ns	*	***
Slaughter weight[1]	18.1 (1.22)	6.7	0.64	ns	*	ns	***	**
Meat Class (EUROP)	8.8 (1.10)	12.5	0.44	**	ns	ns	*	***
Fatgroup (EUROP)	4.8 (1.35)	28.5	0.29	***	*	ns	ns	**
Slaughter percent[1]	43.1 (1.85)	4.3	0.25	ns	**	ns	*	ns
LEAN	14.32 (0.68)	4.8	0.82	*	ns	ns	ns	***
FAT	2.91 (0.58)	19.8	0.69	***	ns	ns	ns	***
Subcutan fat	1.33 (0.34)	25.8	0.55	***	ns	ns	ns	***
Intermuscular fat	1.58 (0.27)	16.8	0.62	***	ns	ns	ns	***
Leg	6.17 (0.18)	2.9	0.93	ns	ns	*	ns	***
Loin/back	2.33 (0.14)	5.9	0.80	ns	ns	ns	ns	***
Side	2.21 (0.16)	7.5	0.73	*	ns	ns	ns	***
Shoulder	3.28 (0.11)	3.5	0.91	ns	ns	ns	ns	***
Breast	3.54 (0.17)	4.8	0.87	***	ns	ns	ns	***
Ultimate pH (pH_{48})	5.67 (0.08)	1.4	0.13	ns	ns	ns	ns	ns
Intramuscular fat	2.15 (0.41)	19.2	0.41	***	ns	ns	***	ns
Drip loss	0.38 (0.24)	63.0	0.22	ns	ns	ns	*	ns
Meat Colour (L*)	36.30 (1.72)	4.8	0.18	*	ns	ns	ns	ns
Meat Colour (a*)	17.00 (0.95)	5.6	0.35	*	ns	ns	*	ns
Meat Colour (b*)	2.53 (0.81)	32.2	0.22	ns	ns	ns	*	ns

Table 2. Least square means and standard errors for meat quality traits presented by sire. IMF=intramuscular fat

Id sire	N	Ultimate pH	IMF	Dripp loss (%)	L*	a*	b*
5010	12	5.64±0.025	2.47±0.13	0.42±0.084	36.0±0.52	17.0±0.32	2.61±0.27
5026	10	5.70±0.026	2.05±0.13	0.33±0.094	35.4±0.55	17.6±0.34	2.23±0.28
5069	10	5.69±0.026	2.28±0.13	0.24±0.084	36.4±0.55	16.8±0.34	2.19±0.28
5076	20	5.69±0.019	2.24±0.10	0.32±0.063	35.9±0.40	17.2±0.24	2.69±0.20
5077	7	5.64±0.032	2.31±0.16	0.61±0.102	37.7±0.69	17.0±0.42	3.47±0.35
5092	7	5.68±0.031	1.86±0.16	0.36±0.106	37.8±0.73	17.1±0.45	3.24±0.37
5124	6	5.65±0.033	2.47±0.17	0.37±0.106	37.0±0.67	16.6±0.41	2.33±0.34
5135	8	5.73±0.030	2.29±0.15	0.27±0.095	36.6±0.65	16.8±0.40	2.21±0.33
5189	9	5.65±0.028	2.10±0.14	0.35±0.100	34.9±0.60	17.4±0.37	2.18±0.30
5194	9	5.64±0.028	2.10±0.14	0.43±0.097	34.6±0.61	17.5±0.37	2.21±0.31

Conclusion

Present study illustrate that there is genetic variation in intramuscular fat for Nor-X. Hence, Intramuscular fat can be selected on for improved product quality within the breed. Future work must include estimation of genetic parameters for IMF and how this trait can be measured commercially for incorporation into Nor-X breeding programme. Furthermore, drip loss does not seem to be a challenge for Nor-X lamb.. A complete genetic analysis for all meat quality data and their genetic correlations to carcass traits and cuts will be examined and presented when more data is available. More data is also needed to describe the temperature and pH decline for LD and SM Nor-X lamb.

References

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