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The effect of live weight, genotype and sex on carcass and meat quality of lambs

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Abstract

Forty lambs of two genotypes (28 improved Jezersko-Solcava with Romanov (JSR) and 12 crossbreeds JSR with Texel (JSRxT)) were used to evaluate the effect of live weight, genotype and sex on carcass and meat quality. Lambs were fed with commercial concentrate and hay *ad libitum*, weaned at around 60 days of age. JSR lambs were slaughtered at 29 or 43 kg and JSRxT lambs at 45 kg live weight. Increased slaughter weight in JSR lambs had no significant effect on dressing percentage and carcass conformation. Carcasses of heavy JSR lambs were longer, wider and fatter, had higher percentage of neck, back and rib with flank and lower percentage of shoulder and hindleg, with redder meat (higher a* value). Crossbred lambs had better dressing proportion (48.7%) than purebred lambs (46.2 %) at the same live weight at slaughter. Their carcasses were shorter and wider, had better conformation and lower fatness scores, with higher chest and lower back percentage. They also had higher percentage of muscle and lower percentage of bone in hindleg. Genotype had a significant effect on b* value, being higher in crossbreeds. Females had better dressing proportion and carcass fatness. Males had higher proportion of neck, chuck and shoulder and lower proportion of back and lighter colour of meat.

Goal

The aim of the following research was to compare carcass characteristics and meat quality traits of improved Jezersko-solcava lambs and their crossbreds with Texel breed and to evaluate the effect of live weight and sex on those traits.

Material and methods

- 12 JSR-light lambs (6 males, 6 females), slaughtered at 29.5 kg
- 16 JSR-heavy lambs (6 males, 10 females) slaughtered at 43.3 kg
- 12 JSRxT lambs (6 males, 6 females) slaughtered at 45 kg
- Weighing of carcasses, cold carcasses, non-carcass components and carcass cuts.
- Measuring of pH, meat colour, carcass length, leg width and shoulder width.
- Subjectively estimation of carcass conformation and carcass fatness.
- Separating of carcasses into seven cuts shown on Figure 1.

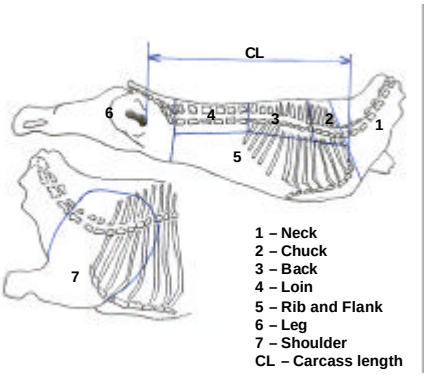

Figure 1: Lamb carcass cuts

Data were analyzed using the GLM procedure of SAS (1990).

Model: $Y_{ijk} = \mu + G_i + S_j + b_i (X_{ijk} - \overline{X}_i) + e_{ijk}$

G_i - as fixed effect of group (JSR-light, JSR-heavy and JSRxT)
S_j - as fixed effect of sex
X - as live weight at slaughter

Results and discussion

Non-carcass components

Table 1: Effect of slaughter weight, genotype and sex on non-carcass components in improved Jezersko-solcava lambs (JSR) and their crossbreds with Texel (JSRxT) (LSMeans ±SEE).

Non-carcass components (%)	Group (G)			Sex (S)	
	JSR-light (29.5 kg)	JSR-heavy (43.3 kg)	JSRT (45.0 kg)	male	female
Liver	1.3 ± 0.04^{c}	1.8 ± 0.03^{a}	1.6 ± 0.04^{b}	1.6 ± 0.004^{a}	1.5 ± 0.003^{b}
Lungs	1.3 ± 0.06^{b}	1.6 ± 0.05^{a}	1.4 ± 0.06^{b}	1.4 ± 0.05^{a}	1.4 ± 0.04^{a}
Heart	0.3 ± 0.01^{b}	0.4 ± 0.01^{a}	0.4 ± 0.01^{a}	0.35 ± 0.01^{a}	0.32 ± 0.01^{b}
Spleen	0.09 ± 0.005^{b}	0.14 ± 0.005^{a}	0.15 ± 0.006^{a}	0.13 ± 0.004^{a}	0.13 ± 0.004^{a}
Head	2.9 ± 0.05^{c}	3.8 ± 0.04^{a}	4 ± 0.05^{b}	3.8 ± 0.04^{a}	3.3 ± 0.03^{b}
Pelt	4.9 ± 0.2^{c}	8.2 ± 0.2^{a}	8.9 ± 0.2^{b}	7.3 ± 0.2^{a}	7.4 ± 0.2^{a}

Values in the same row inside group or inside sex with different superscripts are statistical significant ($p < 0.05$).

There where significant differences between genotypes with higher proportion for liver and lungs at JSR and higher proportion of head and pelt at crossbred lambs. The percentage of non-carcass components increased with increasing live weight at slaughter. Sex effected only liver, heart and head proportion, with male lambs having higher values.

Carcass characteristics

Table 2: Effect of slaughter weight, genotype and sex on carcass characteristics in improved Jezersko-solcava lambs (JSR) and their crossbreds with Texel (JSRxT) (LSMeans ±SEE).

Carcass characteristics	Group (G)			Sex (S)	
	JSR-light (29.5 kg)	JSR-heavy (43.3 kg)	JSRT (45.0 kg)	male	female
HCW (kg)	13.5 ± 0.2^{c}	20.4 ± 0.2^{a}	21.5 ± 0.2^{b}	18.1 ± 0.2^{a}	18.8 ± 0.2^{b}
CCW (kg)	13 ± 0.2^{c}	19.9 ± 0.2^{a}	20.8 ± 0.2^{b}	17.6 ± 0.2^{a}	18.2 ± 0.2^{b}
DP (%)	45.7 ± 0.5^{a}	46.2 ± 0.5^{a}	48.7 ± 0.5^{b}	45.9 ± 0.5^{a}	47.8 ± 0.4^{b}
FAT	3 ± 0.1^{b}	3.5 ± 0.1^{a}	3 ± 0.1^{b}	2.9 ± 0.1^{a}	3.4 ± 0.1^{b}
EUROP-conformation*	3 ± 0^{a}	3 ± 0^{a}	4 ± 0^{b}	3.3 ± 0^{a}	3.3 ± 0^{a}
CL (cm)	58.7 ± 0.5^{c}	66.5 ± 0.5^{a}	62.5 ± 0.5^{b}	62.5 ± 0.5^{a}	62.7 ± 0.4^{a}
LW (cm)	18 ± 0.4^{c}	22.4 ± 0.3^{a}	23.5 ± 0.4^{b}	21.2 ± 0.3^{a}	21.4 ± 0.3^{a}
SW (cm)	15.1 ± 0.2^{c}	18.3 ± 0.2^{a}	19.7 ± 0.2^{b}	17.9 ± 0.2^{a}	17.5 ± 0.2^{a}

HCW: hot carcass weight; CCW: cold carcass weight; DP: Dressing proportion; FAT: carcass fatness; *EUROP-conformation: E=5. U=4. R=3. O=2. P=1; CL: Carcass length; LW: Leg width; SW: Shoulder width
Values in the same row inside group or inside sex with different superscripts are statistical significant ($p < 0.05$).

Crossbred lambs had higher dressing proportion (48.7 %) and carcass conformation, but lower values for carcass fatness than JSR lambs. Carcasses of crossbreds were shorter and wider than JSR carcasses. Increased slaughter weight in JSR lambs had no significant effect on dressing percentage and carcass conformation. With increasing slaughter weight lambs became fatter. Females had higher dressing percentage (47.8 %) than males (45.9 %) and higher carcass fatness.

Carcass cuts

Table 3: Effect of slaughter weight, genotype and sex on carcass cuts in improved Jezersko-solcava lambs (JSR) and their crossbreds with Texel (JSRxT) (LSMeans ±SEE).

Carcass cuts	Group (G)			Sex (S)	
	JSR-light (29.5 kg)	JSR-heavy (43.3 kg)	JSRT (45.0 kg)	male	female
CCW* (kg)	13 ± 0.2^{c}	19.9 ± 0.2^{a}	20.8 ± 0.2^{b}	17.6 ± 0.2^{a}	18.2 ± 0.2^{b}
Kidney (%)	0.88 ± 0.03^{a}	0.80 ± 0.03^{a}	0.70 ± 0.03^{b}	0.8 ± 0.02^{a}	0.8 ± 0.02^{a}
Kidney fat (%)	2.1 ± 0.2^{a}	2.6 ± 0.2^{a}	2.4 ± 0.2^{a}	1.4 ± 0.2^{a}	3.3 ± 0.2^{b}
Neck (%)	6 ± 0.2^{b}	6.5 ± 0.2^{ab}	7 ± 0.2^{a}	7.2 ± 0.2^{a}	5.9 ± 0.2^{b}
Chuck (%)	7.8 ± 0.1^{a}	7.4 ± 0.1^{a}	7.6 ± 0.2^{a}	8 ± 0.1^{a}	7.2 ± 0.1^{b}
Shoulder (%)	18.1 ± 0.2^{b}	16.3 ± 0.1^{a}	16.5 ± 0.2^{a}	17.4 ± 0.1^{a}	16.6 ± 0.1^{b}
Back (%)	6.7 ± 0.1^{b}	7.6 ± 0.1^{a}	6.7 ± 0.1^{b}	6.7 ± 0.1^{a}	7.3 ± 0.1^{b}
Loin (%)	7.3 ± 0.2^{a}	7.8 ± 0.2^{a}	7.6 ± 0.2^{a}	7.3 ± 0.2^{a}	7.8 ± 0.2^{a}
Rib and flank (%)	19.1 ± 0.3^{b}	20.2 ± 0.3^{a}	20.8 ± 0.3^{a}	19.9 ± 0.3^{a}	22.2 ± 0.2^{a}
Hindleg (%)	31.9 ± 0.3^{b}	30.8 ± 0.2^{a}	30.6 ± 0.3^{a}	31.3 ± 0.2^{a}	30.8 ± 0.2^{a}
Hindleg composition:					
-muscle (%)	70.4 ± 0.7^{c}	72.4 ± 0.6^{a}	76 ± 0.7^{b}	73.8 ± 0.6^{a}	72.1 ± 0.5^{a}
-fat (%)	5.6 ± 0.6^{a}	6.6 ± 0.6^{a}	4.9 ± 0.6^{a}	4 ± 0.6^{a}	7.4 ± 0.5^{b}
-bone (%)	23.9 ± 0.3^{c}	21 ± 0.3^{a}	19.1 ± 0.3^{b}	22.2 ± 0.3^{a}	20.5 ± 0.2^{b}

*CCW: cold carcass weight
Values in the same row inside group or inside sex with different superscripts are statistical significant ($p < 0.05$).

Crossbred lambs had higher proportion of chest and lower proportion of back. With increasing live weight at slaughter, increased the proportion of back and rib and flank but decreased the proportion of shoulder and leg. The results of the dissection of the hindleg had shown higher proportion of muscle and lower proportion of bone at crossbreds. Female had higher values for kidney fat, back and hindleg fat.

Meat quality

Table 4: Effect of slaughter weight, genotype and sex on meat quality in improved Jezersko-solcava lambs (JSR) and their crossbreds with Texel (JSRxT) (LSMeans ±SEE).

Meat quality	Group (G)			Sex (S)	
	JSR-light (29,5 kg)	JSR-heavy (43,3 kg)	JSRT (45 kg)	male	female
CIE L*	40.8 ± 0.5^{a}	39.5 ± 0.4^{a}	40.4 ± 0.5^{a}	41.2 ± 0.4^{a}	39.3 ± 0.4^{b}
a*	17.2 ± 0.3^{b}	18.4 ± 0.3^{a}	19.2 ± 0.4^{a}	18.4 ± 0.3^{a}	18.1 ± 0.3^{a}
b*	7 ± 0.2^{a}	7.2 ± 0.2^{a}	8.7 ± 0.2^{b}	7.8 ± 0.2^{a}	7.5 ± 0.2^{a}
pH 45	6.3 ± 0^{b}	6.2 ± 0^{ab}	6.1 ± 0^{a}	6.2 ± 0.04^{a}	6.2 ± 0.03^{a}
pH 24	5.7 ± 0^{b}	5.5 ± 0^{a}	5.5 ± 0^{a}	5.6 ± 0.02^{a}	5.6 ± 0.01^{a}

Values in the same row inside group or inside sex with different superscripts are statistical significant ($p < 0.05$).

There were no significant differences in meat lightness and redness between JSR and crossbred lambs. Heavier lambs had higher redness. Sex had no effect on pH values but effected L* values. Male lambs had lighter meat (higher L value) than female lambs.

Conclusions

On the basis of attained results, we can conclude that industrial crossing of JSR ewes with Texel rams improved carcass quality of crossbred lambs and had no or minor effect on studied meat quality. With increasing slaughter weight, JSR lambs became fatter, but measured meat quality traits did not change. The differences between sexes showed that females had higher dressing percentage and higher carcass fatness than males and that sex had no or minor effect on studied meat quality traits.