

Fatty acids profile of intramuscular and extramuscular fats in lambs raised under grazing system



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Introduction

- About 80% of light slaughter lambs of dairy sheep breeds are exported from Slovakia (especially to Italy).
- Breeding of specialized meat sheep breeds with heavy slaughter lamb production is expanding.
- In addition to the intensive rearing of lambs (lambs reared in sheep barns using concentrates) more and more lambs are reared on pasture (nutrition based on mother milk and pasture).
- Lack of information on carcass quality of heavy lambs raised on pastures, in particular as regards fatty acid profile of meat and fat.
- We assume that the knowledge gained will help domestic consumption of meat of heavy lambs, due to the expected high quality.

Objectives

To determine carcass quality of heavy lambs on the basis of fatty acids profile of intramuscular and extramuscular fat.



Material and methods

Evaluated lambs and analyzed samples

- 20 lambs of Ile de France breed - IF (13 ram lambs and 7 ewe lambs) raised under mothers on pasture.
- Average empty live weight of evaluated lambs 27.3 kg; age 107 days; dressing percentage 48.9%.
- Meat samples (*Musculus longissimus lumborum et thoracis - MLLT*) – intramuscular fat.
- Fat samples from root of tail – extramuscular fat.



Analyzed traits

- Carcass parameters.
- Physico-chemical properties of meat:
 - average amount of total water in *MLLT* – 1.26 g 100 g⁻¹;
 - total proteins – 21.7 g 100 g⁻¹;
 - total fat – 1.93 g 100 g⁻¹;
- Fatty acids profile (totally 69 FAs) – gas chromatography.

Statistical analysis

- By means of ANOVA we detected significance of differences among individual FAs or FAs groups in dependence on the fat type (IMF or EMF) and sex.



Results

Table 1 Effects of fat type and sex on fatty acid composition (g/100g FAME) of heavy carcass lambs.

Trait	Fat type		P	Sex		P	Interact. (P)	SEM
	IMF	EMF		Ram lambs	Ewe lambs			
C12:0	0,750	1,216	0,0002	0,976	0,990	0,9062	0,2288	0,341
C14:0	5,630	8,383	<0.0001	6,704	7,309	0,2566	0,2442	1,584
C16:0	21,801	22,672	0,0818	21,968	22,505	0,2768	0,0289	1,468
C16:1 <i>cis</i> 9	0,496	0,638	<0.0001	0,564	0,571	0,7487	0,0274	0,068
C17:0	1,125	1,283	0,0006	1,174	1,235	0,1536	0,7337	0,126
C18:0	15,655	17,858	0,0102	17,072	16,441	0,4428	0,6633	2,452
C18:1 <i>trans</i> 11 (TVA)	4,049	4,036	0,9312	4,028	4,057	0,8542	0,6007	0,482
C18:1 <i>cis</i> 9 (OA)	24,488	25,524	0,1150	24,888	25,124	0,7158	0,3694	1,936
C18:2 n-6 (LA)	6,420	2,840	<0.0001	4,954	4,306	0,1096	0,0245	1,192
C18:3 n-6 (GLA)	0,051	0,018	<0.0001	0,036	0,033	0,4357	0,0281	0,013
C18:3 n-3 (ALA)	2,380	1,379	<0.0001	2,001	1,758	0,0281	0,1516	0,320
C18:2 <i>cis</i> 9, <i>trans</i> 11 (RA)	1,822	1,960	0,3244	1,733	2,049	0,0277	0,1991	0,416
C20:4 n-6 (AA)	1,839	0,285	<0.0001	1,206	0,908	0,3137	0,0192	0,880
C20:5 n-3 (EPA)	0,821	0,084	<0.0001	0,529	0,376	0,2164	0,0409	0,365
C22:5 n-3 (DPA)	0,915	0,365	0,0002	0,640	0,640	0,9989	0,0258	0,392
C22:6 n-3 (DHA)	0,289	0,094	0,0002	0,192	0,191	0,9722	0,0852	0,142

(IMF – intra muscle fat; EMF extra muscle fat)

Conclusion

Lambs of IF breed reared by their mothers on pasture have an excellent quality, especially on the basis of results obtained by analyzing the spectrum of fatty acids of meat and fat.

Relatively high proportion of polyunsaturated fatty acids and health-promoting fatty acids.

The average content of conjugated linoleic acid (CLA) in meat samples was 1.82 g/100 g FAME. A favorable ratio of omega 6 and omega 3 fatty acids: 1.87 in IMF and 1.62 in EMF.

Many significant differences we found when we compared IMF and EMF fatty acids.

Table 2. Sum of fatty acids of similar types depending on fat type and sex of heavy carcass lambs.

Trait	Fat type		P	Sex		P	Interact. (P)	SEM
	IMF	EMF		Ram lambs	Ewe lambs			
Saturated FA	48,701	55,930	<0.0001	51,978	52,653	0,5416	0,1401	3,306
Branched chain FA	1,922	2,245	<0.0001	2,030	2,136	0,1237	0,0455	0,202
<i>Cis</i> monounsaturated FA	29,284	30,610	0,1111	29,646	30,248	0,4630	0,3023	2,449
<i>Trans</i> monounsaturated FA	7,036	6,632	0,0940	6,814	6,854	0,8654	0,5756	0,708
Polyunsaturated FA	17,214	9,165	<0.0001	13,702	12,677	0,3162	0,0200	3,041
CLA	2,103	2,205	0,4926	1,988	2,320	0,0301	0,1951	0,444
n-6 PUFA	8,554	3,215	<0.0001	6,374	5,395	0,1652	0,0169	2,086
n-3 PUFA	4,551	1,995	<0.0001	3,470	3,076	0,2766	0,0227	1,077
Essential FA ¹	12,705	5,065	<0.0001	9,558	8,212	0,1833	0,0184	2,992

¹Essential FA = LA+GLA+ALA+AA+EPA+DPA+DHA

Table 3. Characteristic ratios of fats depending on fat type and sex in heavy carcass lambs

Trait	Fat type		P	Sex		P	Interact. (P)	SEM
	IMF	EMF		Ram lambs	Ewe lambs			
C18:2 n-6 / C18:3 n-3 (LA/ALA)	2,676	2,148	0,0011	2,335	2,488	0,3111	0,0354	0,450
∑ n-6 PUFA / ∑ n-3 PUFA	1,867	1,623	<0.0001	1,759	1,732	0,5363	0,2329	0,130
PUFA / Saturated	0,360	0,165	<0.0001	0,279	0,246	0,2395	0,0285	0,081