

Fatty acids profile of intramuscular fat in light and heavy carcass lambs



margetin@cvzv.sk

M. Margetin^{1,2}, D. Apolen¹, M. Oravcová¹, O. Debreceni², D. Peškovičová¹, O. Bučko², Z. Horečná²

¹ Animal Production Research Centre Nitra, Hlohovecká 2, 954 41 Lužianky, Slovak Republic

² Slovak University of Agriculture Nitra, Tr. Andreja Hlinku 2, 949 76 Nitra, Slovak Republic



Introduction

- About 80% of light carcass lambs of dairy sheep breeds are exported from Slovakia. Breeding of specialized meat breeds with heavy carcass lamb production is expanding.
- FA composition plays an important role in definition of meat quality.
- FA composition affects nutritional value; n-3 PUFA have beneficial effects in human physiology and health (preventing the occurrence of coronary heart diseases, neurological dysfunctions, inflammatory and immune diseases, etc.).
- Lack of information on quality of light and heavy carcass lambs, in particular as regards fatty acid profile of meat and fat.

Objectives

To determine differences in nutritional value of intramuscular fat on the basis of fatty acids profile analysis in light and heavy carcass lambs raised in different nutrition conditions.



LLAR

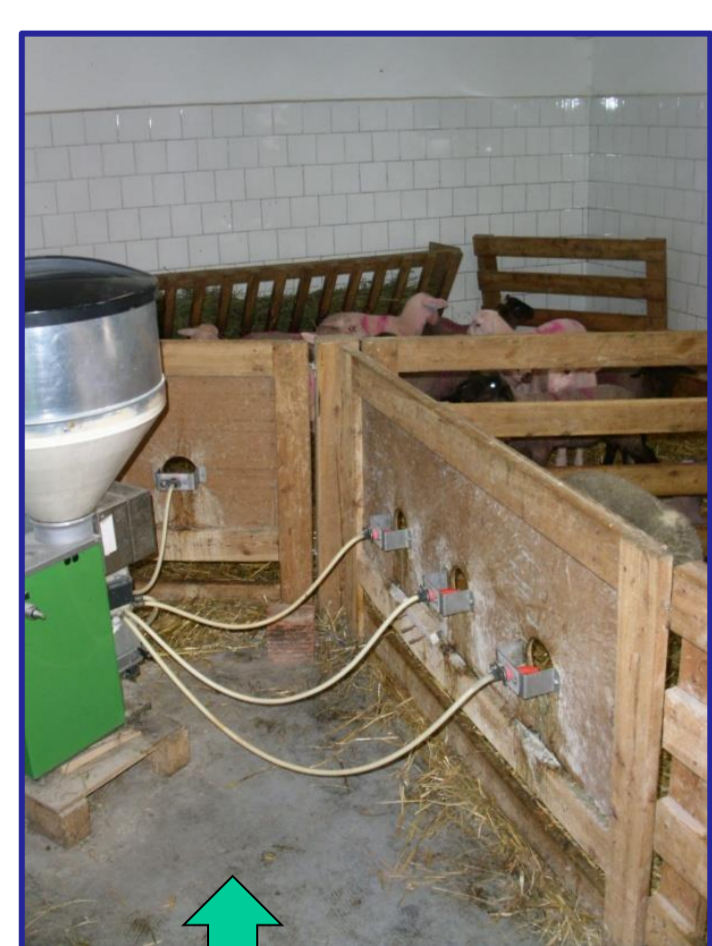


HLPR

Material and methods

Biological material

- 40 light carcass lambs (carcass weight to 13 kg):
 - 20 - artificial rearing (LLAR; milk replacer),
 - 20 - traditional rearing (LLTR; mother milk + forage).
- 40 heavy carcass lambs (carcass weight over 13 kg):
 - 20 - pasture rearing under mothers (HLPR),
 - 20 - traditional rearing in sheepfolds, with using concentrates (HLTR).
- The average empty live weight of lambs before killing was in LLAR 17.8 kg, LLTR 17.6 kg, HLPR 29.2 kg and HLTR lambs 32.5 kg and an average age was 63.6, 55.3, 105.0 and 108.9 days, respectively.
- Meat samples (*Musculus longissimus lumborum et thoracis - MLLT*) – intramuscular fat.

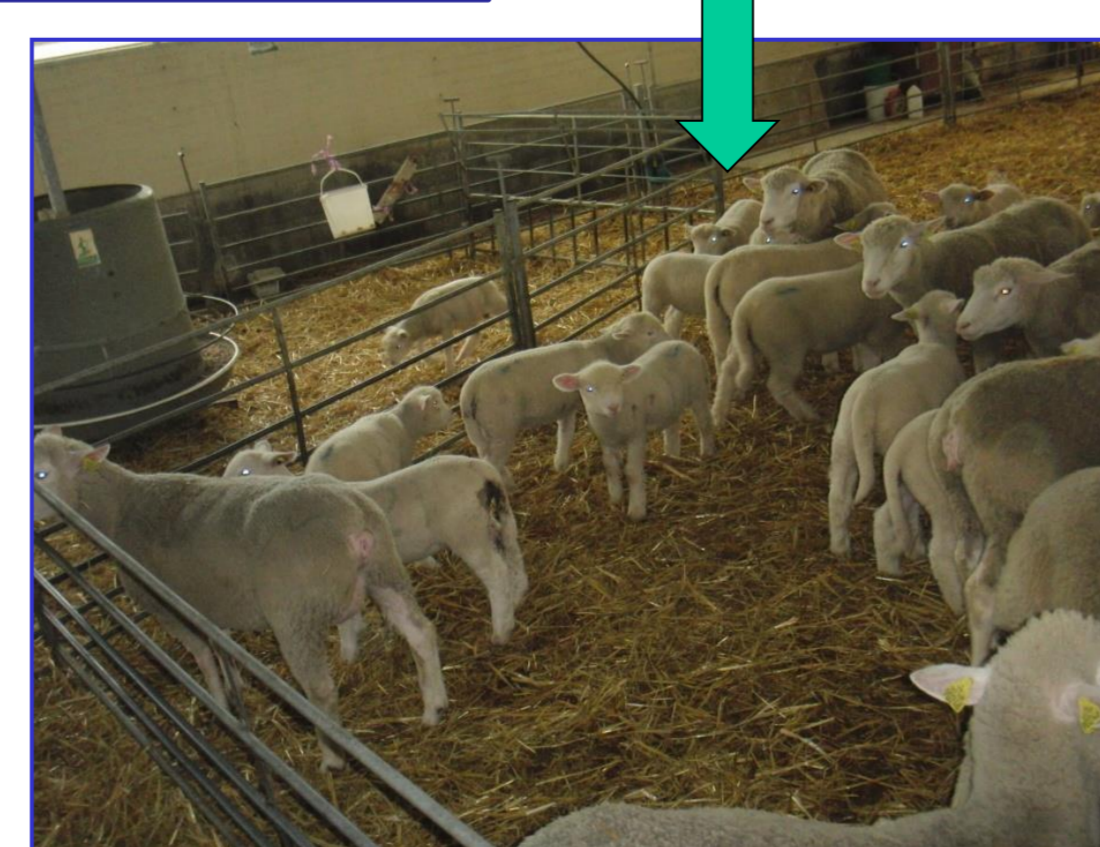


LLAR



LLTR

HLTR



HLPR

Analyzed traits

- 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 type of lambs (LLTR, HLPR, HLTR) and sex of lambs.

Results

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

Trait	Type of lambs				P	Sex of lambs		P	SEM
	LLAR	LLTR	HLPR	HLTR		Ram lambs	Ewe lambs		
C12:0 (lauric)	1.36	0.47	0.75	1.06	<0.001	0.94	0.87	0.466	0.351
C14:0 (MA)	5.21	5.31	5.63	8.30	<0.001	6.12	6.10	0.943	1.223
C16:0 (PA)	26.7	23.0	21.8	28.5	<0.001	24.8	25.2	0.363	1.602
C16:1 cis9 (palmitoleic)	0.35	0.51	0.50	0.46	<0.001	0.44	0.47	0.091	0.068
C17:0 (margarinic)	0.41	1.14	1.13	1.27	<0.001	0.97	1.00	0.469	0.159
C18:0 (SA)	10.1	12.68	15.65	14.52	<0.001	13.3	13.2	0.681	1.545
C18:1 trans9 (elaidic)	0.13	0.24	0.28	0.28	<0.001	0.22	0.24	0.007	0.031
C18:1 trans11 (TVA)	0.11	1.00	4.1	1.1	<0.001	1.54	1.58	0.540	0.318
C18:1 cis9 (OA)	37.9	35.4	24.5	28.4	<0.001	30.9	32.2	0.007	1.972
C18:2 n-6 (LA)	9.07	4.81	6.42	2.73	<0.001	6.16	5.36	0.006	1.205
C18:3 n-6 (GLA)	0.08	0.05	0.05	0.04	<0.001	0.06	0.05	0.169	0.014
C18:3 n-3 (ALA)	0.25	0.72	2.38	0.91	<0.001	1.14	0.99	0.004	0.207
C18:2 cis9,trans11 (RA)	0.15	0.67	1.82	0.55	<0.001	0.73	0.87	0.004	0.196
C20:4 n-6 (AA)	1.56	1.66	1.83	0.450	<0.001	1.65	1.10	0.003	0.753
C20:5 n-3 (EPA)	0.06	0.35	0.82	0.14	<0.001	0.41	0.28	0.046	0.264
C22:5 n-3 (DPA)	0.18	0.63	0.92	0.30	<0.001	0.57	0.44	0.028	0.242
C22:6 n-3 (DHA)	0.08	0.25	0.29	0.09	<0.001	0.19	0.17	0.455	0.125

Conclusion

Findings based on analyses of fatty acids profile of IMF in lambs are as follows:

The highest proportion of CLA, ALA, omega 3 and other health beneficial FAs in four analysed groups of lambs were found in HLPR lambs (Tables 1 and 2).

HLTR lambs have the highest SFA, the lowest PUFA/SA ratio and the highest atherogenic and thrombogenic indices (Table 2).

LLAR lambs have the lowest TVA, RA, CLA and other health beneficial FAs. In contrast, this group of lambs have the highest LA/ALA and omega6/omega3 FAs ratios.

Meat of HLTR lambs fed concentrates is of lower quality than meat of HLPR lambs from pasture rearing.

Meat of LLAR lambs fed milk replacer is of lower quality than meat of LLTR lambs from traditional rearing.

Table 2. Sum of fatty acids of similar type, characteristic ratios of fats and some important indices depending on type of lambs and sex of lambs.

Trait	Type of lambs				P	Sex of lambs		P	SEM
	LLAR	LLTR	HLPR	HLTR		Ram lambs	Ewe lambs		
Saturated - SFA	44.8	45.6	48.7	57.9	<0.001	49.2	49.3	0.892	0.791
Branched chain FA	0.45	1.92	1.92	2.43	<0.001	1.66	1.72	0.319	0.920
MUFA	42.5	43.3	34.1	35.3	<0.001	38.0	39.6	0.005	0.804
PUFA	12.7	11.1	17.2	6.8	<0.001	12.8	11.1	0.008	0.723
Trans MUFA	1.35	3.85	7.04	3.27	<0.001	3.8	3.9	0.390	0.950
Cis MUFA	41.0	39.7	29.3	32.4	<0.001	34.8	36.4	0.002	0.875
CLA	0.19	0.75	2.10	0.65	<0.001	0.85	0.99	0.006	0.922
n-6 PUFA(omega 6)	11.0	6.7	8.5	3.3	<0.001	8.02	6.70	0.005	0.730
n-3 PUFA (omega 3)	0.84	2.08	4.55	1.50	<0.001	2.48	2.01	0.016	0.800
Essencial	9.33	5.53	8.80	3.64	<0.001	7.30	6.35	0.003	0.794
DFA	65.4	67.1	67.0	56.7	<0.001	64.1	64.0	0.730	0.737
C18:2 n-6 / C18:3 n-3 (LA/ALA)	39.1	6.80	2.68	3.06	<0.001	13.1	12.7	0.706	0.907
\sum n-6 PUFA/ \sum n-3 PUFA	14.6	3.25	1.86	2.21	<0.001	5.35	5.59	0.673	0.841
PUFA/ SFA	0.29	0.25	0.36	0.12	<0.001	0.27	0.23	0.016	0.661
Atherogenic index (AI)	0.91	0.87	0.97	1.58	<0.001	1.09	1.07	0.691	0.752
Thrombogenic index (TI)	1.44	1.31	1.24	2.13	<0.001	1.52	1.54	0.568	0.794
HH index	1.55	1.57	1.38	0.90	<0.001	1.38	1.32	0.231	0.670

*1 : Essencial FA = LA + ALA;

*2 : DFA (desirable fatty acids) – according Costa et al. (2009),

*3 : AI and TI – according Ulbricht and Southgate (1991), Komprda et al. (2012)

*4 : ratio hypocholesterolaemic / hypercholesterolaemic FA – according Santo-Silva et al. (2002)