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

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Introduction

- About 80% of light carcass lambs of dairy sheep breeds are exported from Slovakia. Breeding of specialized meat breeds with heavy slaughter lamb production is expanding.
- FA composition plays an important role in definition of fat quality. Subcutaneous fat is edible part of slaughtered lambs.
- FA composition affect 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 fat.

Objectives

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

LLTR
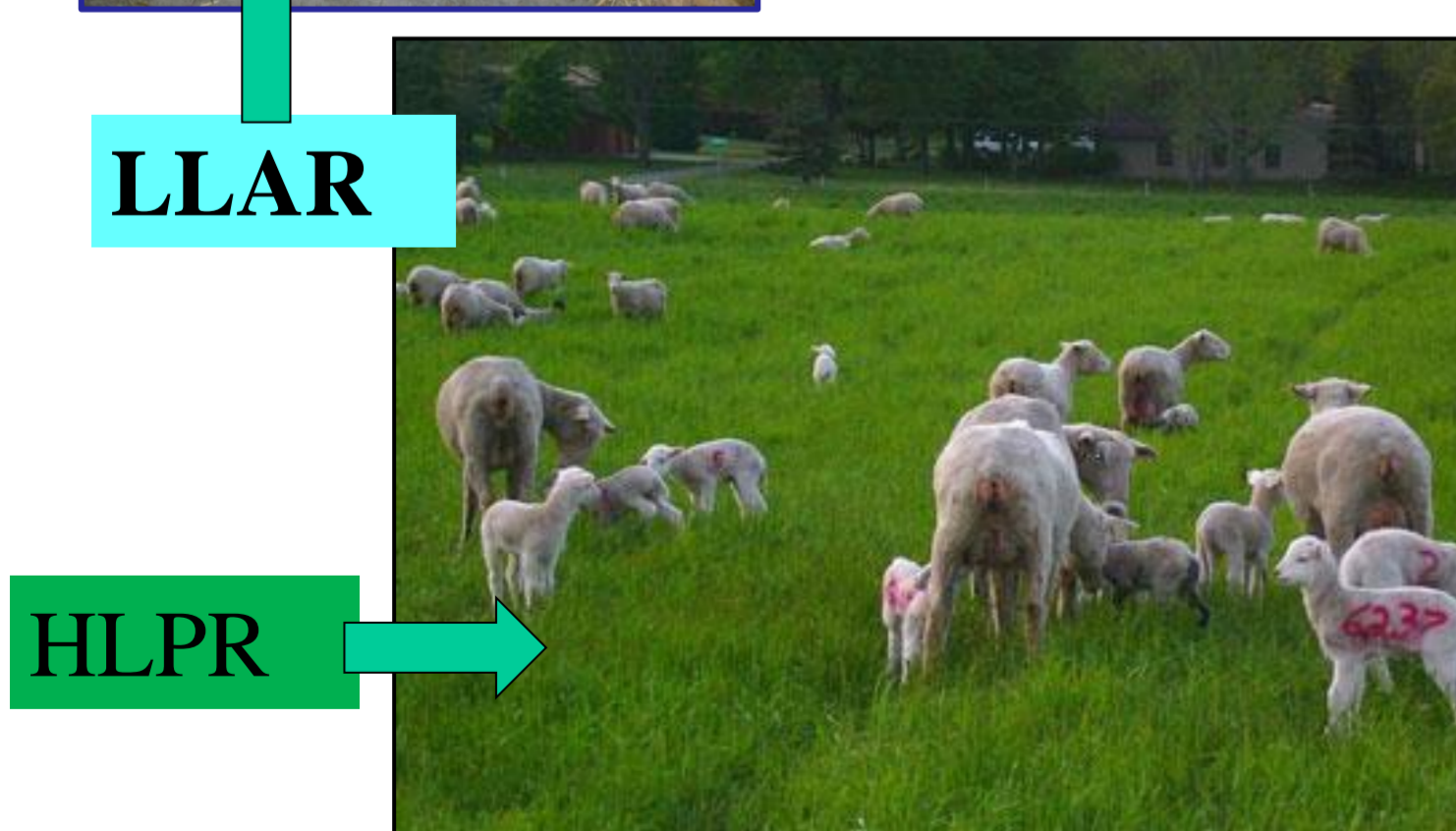
HLTR

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 average age was 63.6, 55.3, 105.0 and 108.9 days respectively.
- **Fat samples – subcutaneous fat; probes taken from the area of root of tail.**

LLTR

HLTR

LLAR

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 subcutaneous fat.

Trait	Type of lambs				P	Sex of lambs		P	SEM
	LLAR	LLTR	HLPR	HLTR		Ram lambs	Ewe lambs		
C12:0 (lauric)	1.57	0.59	1.22	1.19	<0.001	1.26	1.02	0.029	0.423
C14:0 (MA)	5.85	6.64	8.38	9.38	<0.001	7.95	7.18	0.035	0.551
C16:0 (PA)	27.7	24.1	22.7	28.5	<0.001	26.2	25.3	0.028	0.715
C16:1 *cis9* (palmitooleic)	0.42	0.61	0.64	0.48	<0.001	0.54	0.54	0.913	0.595
C17:0 (margarinic)	0.54	1.41	1.28	1.47	<0.001	1.15	1.21	0.253	0.753
C18:0 (SA)	9.6	12.6	17.9	15.00	<0.001	13.7	13.8	0.747	0.681
C18:1 *trans9* (elaidic)	0.11	0.27	0.33	0.22	<0.001	0.23	0.24	0.304	0.934
C18:1 *trans11* (TVA)	0.11	1.08	4.04	1.18	<0.001	1.59	1.61	0.614	0.987
C18:1 *cis9* (OA)	40.2	36.8	25.5	27.0	<0.001	31.8	32.9	0.029	0.909
C18:2 n-6 (LA)	7.38	2.78	2.84	2.26	<0.001	3.82	3.80	0.890	0.912
C18:3 n-6 (GLA)	0.05	0.04	0.02	0.03	<0.001	0.03	0.04	0.016	0.664
C18:3 n-3 (ALA)	0.25	0.570	1.379	0.840	<0.001	0.78	0.74	0.239	0.889
C18:2 *cis9.trans11* (RA)	0.17	0.75	1.96	0.60	<0.001	0.84	0.90	0.311	0.871
C20:4 n-6 (AA)	0.22	0.16	0.29	0.10	0.240	0.14	0.25	0.113	0.153
C20:5 n-3 (EPA)	0.01	0.03	0.08	0.04	0.005	0.03	0.05	0.078	0.232
C22:5 n-3 (DPA)	0.05	0.18	0.37	0.19	<0.001	0.16	0.23	0.092	0.310
C22:6 n-3 (DHA)	0.01	0.05	0.09	0.05	<0.001	0.04	0.06	0.064	0.323

Conclusion

Findings based on analyses of fatty acids profile of EMF (subcutaneous fat) in lambs are as follows:

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

SCF in HLTR lambs has the highest content of SFA, the lowes PUFA/SA ratio and the highest AI a TI (Table 2).

SCF in LLAR lambs has the lowest content of TVA, RA, CLA and other health beneficial FAs. In contrast, this group of lambs has the highest LA/ALA and omega 6/omega 3 FAs ratios.

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

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

Table 2. Sum of fatty acids of similar type, characteristic rations of fats and some important indexes 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	46.3	49.1	55.9	60.2	<0.001	53.8	52.0	0.006	2.728
Branched chain FA	0.53	2.41	2.25	2.66	<0.001	1.96	1.96	0.924	0.260
MUFA	44.8	44.7	34.9	34.1	<0.001	39.0	40.3	0.029	2.565
PUFA	8.9	6.13	9.17	5.55	<0.001	7.26	7.60	0.111	0.889
Trans MUFA	1.16	3.70	6.63	3.22	<0.001	3.63	3.72	0.285	0.369
Cis MUFA	43.5	41.3	30.6	31.1	<0.001	36.0	37.3	0.022	2.358
CLA	0.21	0.82	2.21	0.67	<0.001	0.94	1.01	0.301	0.283
n-6 PUFA(omega 6)	7.69	3.00	3.18	2.42	<0.001	4.03	4.12	0.606	0.799
n-3 PUFA (omega 3)	0.42	0.87	2.00	1.15	<0.001	1.06	1.16	0.197	0.307
Essencial	7.63	3.35	4.22	3.10	<0.001	4.61	4.54	0.449	0.934
DFA	63.2	63.4	61.9	54.6	<0.001	59.9	61.7	0.015	0.645
C18:2 n-6 / C18:3 n-3 (LA/ALA)	31.0	4.98	2.15	2.77	<0.001	10.3	10.1	0.783	0.913
∑ n-6 PUFA/∑ n-3 PUFA	19.2	3.52	1.61	2.15	<0.001	6.84	6.42	0.467	0.912
PUFA/ SFA	0.19	0.13	0.17	0.09	<0.001	0.14	0.15	0.059	0.799
Atherogenic index (AI)	1.00	1.07	1.45	1.82	<0.001	1.41	1.25	0.008	0.709
Thrombogenic index (TI)	1.57	1.63	1.93	2.40	<0.001	1.95	1.81	0.006	0.759
HH index	1.44	1.33	1.00	0.82	<0.001	1.10	1.19	0.022	0.771

*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)