FATTY ACID COMPOSITION OF M. LONGISSIMUS DORSI OF DIFFERENT FAT GRADES OF ICELANDIC LAMB

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Background

The consumption of lamb meat is very high (30 kg/person/year) in Iceland. It influences the overall intake of both wholesome and unwholesome nutrients. It is therefore very important to give the consumers in Iceland accurate and reliable information on nutritional composition. A discussion has been among scientists in Iceland that Icelandic lamb meat may contain higher amounts of C20 and C22 omega3 (n-3) fatty acids than other lamb meat [1,2]. C20 and C22 n-3 fatty acid have been reported to be able to pass through the rumen and to be incorporated into the phospholipids of the muscles of ruminants [3]. The supplementation of the feeds of the mother ewes with fish meal or fish oil could possibly increase n-3 levels in the lambs. But these fatty acids are found low concentrations in lambs regardless of feeds.[3,4] Another offered explanation is that a cold climate may induce biosynthesis of unsaturated fatty acids.[5,6] Most of the Icelandic lambs are slaughtered at 4-5 months of age much younger than in most lamb producing countries. They have less intramuscular fat and a higher proportion of phospholipids which could alone explain why PUFA's are in a higher proportion.[7,8,9]

Objectives

The aim of the study was to find the effect of the four main fat grades of Icelandic lamb meat on the intramuscular fat and fatty acid composition of M. longissimus dorsi. The fat grades are II, I A, I B and I C. They are comparable to the EC grades 1, 2, 3 and 4 respectively.

Methods

Ten carcasses (5 ewes and 5 rams) from each of the fat grades 1, 2, 3 and 4 of lambs slaughtered in September at the age of 4 months were selected. The carcasses were deboned 24 hours after slaughter and the muscle longissimus dorsi was trimmed of all subcutaneous fat and vacuum packed and stored at - 20°C. Fat was determined using the NMKL method (Nordisk metodkommitté för livsmedel, 1974). Fat was extracted from the muscle using the Bligh and Dyer (1959) method. Hydrolysis and methylation of the fatty acid was made by a method of the Swedish Meat Research Institute (1990). The fatty acid esters were separated and analysed on a 30 m × 0,32 mm (id) fused silica column, Omegawax™320 in a Varian Star 3400 gas chromatograph with a flame ionisation detector.

Results and discussion

The amount of intramuscular lipids increased with a higher carcass fat grade (Table 1). The proportions (%) of polyunsaturated fatty acids and n-3 fatty acids decreased while the proportion of monounsaturated fatty acids increased with increased lipid content. The proportions of C20:4n-6, C20:5n-3, C22:5n-3 och C22:6n-3 decreased with increased fat but their origin is in the phospholipids. The concentrations (mg/100g muscle) of SFA and MUFA increased with higher fat grade. The mean concentrations (mg/100g) of C20:5, C22:5 and C22:6 are 23,3, 22,9 and 8,43 respectively. They did not change with increased intramuscular fat. Their concentrations are similar as found in other studies with lamb meat.[3,7,8,9]

Conclusions

1. Lamb can be a valuable source of C20 and C22n-3 fatty acids given the high consumption in Iceland, but it is in most cases predominated by high fish consumption
2. The proportions (%) of C20 and C22n-3 acids in t M. longissimus dorsi of Icelandic lamb is higher than in other studies due to lower intramuscular fat, but the concentrations (mg/100g) of these acid are similar.
3. The concentrations of C20 and C22n-3 are not affected by increased intramuscular fat.

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Table 1

Omega 3 and 6 fatty acids in M. longissimus dorsi in different fat grades of Icelandic lamb

	Mean	SD	Range	Grade 1	Grade 2	Grade 3	Grade 4	SE	Significance
Fat, %			1,15 - 4,12	1,62	2,14	2,51	2,71	0,19	* *
Fatty acids %									
18:2n-6	3,69	0,96	2,42 - 7,63	4,24	3,54	3,50	3,47	0,30	n s
18:3n-3	2,12	0,36	1,38 - 3,17	2,21	2,11	2,11	2,04	0,12	n s
20:4n-6	1,10	0,38	0,53 - 2,59	1,47	1,04	1,03	0,87	0,10	* *
20:5n-3	1,12	0,35	0,56 - 2,53	1,43	1,12	1,07	0,85	0,09	* *
22:5n-3	1,09	0,35	0,60 - 1,80	1,41	1,09	1,00	0,85	0,09	* * *
22:6n-3	0,41	0,12	0,19 - 0,78	0,48	0,46	0,38	0,28	0,03	* * *
PUFA	9,51	2,22	5,90 - 18,2	11,2	9,36	9,09	8,36	0,64	*
P/S	0,23	0,06	0,14 - 0,46	0,27	0,23	0,22	0,21	0,02	n s
n-3	4,72	1,00	2,78 - 8,02	5,53	4,78	4,56	4,02	0,27	* *
n-6	4,79	1,32	3,11 - 10,2	5,71	4,58	4,53	4,34	0,40	n s
n-6/n-3	1,01	0,12	0,79 - 1,27	1,02	0,96	0,99	1,07	0,04	n s
Unidentified	6,35	0,94	4,72 - 8,83	6,12	6,82	6,29	6,17	0,29	n s

mg/100g muscle	**Mean**	**SD**	**Range**	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**SE**	**Significance**
n-3	101	23,1	60,5 - 149	86,1	101	112	106	6,90	n s
n-6	102	22,5	56,3 - 167	88,4	95,3	109	113	6,60	n s
SFA	915	297	477 - 1677	666	865	1030	1098		* *
MUFA	986	353	459 - 1923	678	931	1102	1233		* *
PUFA	203	43,9	117 - 316	175	197	221	219		n s
20:5n-3	23,3	4,70	15,7 - 34,5	21,8	23,4	25,8	22,3	1,46	n s
22:5n-6	22,9	6,08	13,4 - 37,7	21,7	22,7	24,7	22,3	1,97	n s
22:6n-6	8,43	2,33	4,9 - 14, 1	7,40	9,70	9,30	7,30	0,68	n s