2 - P29

OBSERVATIONS ON BREED DIFFERENCES IN SELECTED PARAMETERS OF LAMB MEAT HEALTH QUALITY

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Key words: sheep, lamb fattening, meat health quality, fatness, cholesterol, CLA, fatty acids profil

Background

The opinion-forming medical circles and the mass media, which exert an increasingly strong influence on the modern consumer, have expressed serious, though partly ungrounded objections to the health quality of animal products, including meat (Pisulewski et al., 1999; Zduńczyk, 2000). Counteracting these unfavourable opinions for livestock breeders poses a serious challenge to animal scientists and meat processors and can largely determine the economic situation of both the breeders and meat processing plants. In view of the above, animal scientists face the task of testing and explaining the mechanisms behind the interaction of factors affecting the health quality of source food materials and of determining the possibility of enhancing the health-promoting properties of meat and other food products of animal origin. Previous studies into lamb meat primarily showed the great scope for nutritive factors in this respect (Bas and Morand-Fehr, 2000; Mir et al., 2000; Fisher et al., 2000; Rowe et al., 1999) but the latest research also pointed to the importance of genetic differences (Arsenos et al., 2000; Sanudo et al., 2000). Increasingly numerous studies in this area should help in the future to produce lamb meat with the "functional food" properties, and thus enable a more effective market promotion of lamb meat products.

Objective

The objective of this research was to determine differences in lamb meat quality depending on lamb genotype (breed) in terms of health quality, i.e. level of fatness, fatty acid profile and the content of conjugated linoleic acid (CLA) and total cholesterol.

Methods

29 ram-lambs of three meat breeds: Ile de France (IF), Suffolk (S) and Texel (T), East Friesian (Fr) milk sheep and prolific Finnsheep (F) were investigated After weaning at 70 days of age, the lambs were fattened intensively (*ad libitum* feeding) with a complete pelleted feed until reaching 35-45 kg of body weight.

Basic parameters of health quality of meat of the experimental lambs were analysed, such as selected parameters of carcass and meat fatness, fatty acid profile, and the content of CLA and total cholesterol in muscular tissue.

Lamb slaughter, carcass cutting and partial dissection of right half-carcass (leg and brisket with ribs) were performed following the methods applied at the National Research Institute of Animal Production (Nawara et al., 1963). The content of muscular and fatty tissue in half-carcass was estimated using regression equations elaborated by Osikowski (1977). Fat layer over the loin eye was measured in section behind the last thoracic vertebrae. The content of intramuscular fat was determined on the *musculus adductor* in a Soxhlet apparatus. Fatty acid profile and the content of conjugated diene of linoleic acid c9, t11 (CLA) and total cholesterol were determined in intramuscular fat extracted in a Soxhlet apparatus from the *musculus semitendinosus.*

Fatty acid profile and the level of conjugated diene of linoleic acid c9, t11 (CLA) were determined using gas chromatography (Hewlett Packard 6890) with a flame-ionization detector on column Rtx 2330 (105 m x 0.25 mm x 20 μm). Cholesterol content was determined using gas chromatography (Hewlett Packard 5890 sII) with a flame-ionization detector on column HP-1 (25 m x 0.20 mm x 0.11 μm).

The results were analysed statistically with one-factorial analysis of variance.

Results and discussion

Large differences were observed for parameters of carcass fatness and for fat content of muscular tissue depending on the breed of the lamb (Table 1). The principal differences in this respect occurred between Texel and Friesian lambs which were characterized by a significantly lower carcass fatness and higher meat to fat ratio than the lambs of the other meat breeds: Ile de France, Suffolk, and the prolific Finnsheep. It is worth noting the highest content of intramuscular fat in Ile de France ram lambs, twice greater than in the Friesian breed. A particularly favourable tissue composition of carcasses in Texel lambs and in crosses with Texel genotype was confirmed by Janssens (2001) and Niżnikowski et al. (2001).

There were no statistically significant differences in the cholesterol content, although Texel and Finnsheep muscles tended to differ from the other breeds, with the muscles of T and F ram lambs containing an average of 8.7% less cholesterol than the similar groups IF, S and Fr.

In respect of percentage content of individual fatty acids (FA), there were some marked differences in the content of C14:0 (significantly higher in the IF group than elsewhere) and C17:0 acids (higher in meat breeds than in Friesians and Finnsheep), and between the Texel and other breeds for the content of monounsaturated fatty acids (MUFA): C17:1 and C18:1 (markedly higher in T) and polyunsaturated fatty acids (PUFA): C18:2, C18:3, C20:4 and C22:5 (significantly higher in Texels than in the other groups) – Tables 2. Clear and partly significant differences in the content and proportions of FA occurred between Texels and other breeds in respect of MUFA (lowest in T, by an average of 4.18 percentage units, NS), PUFA (by 7.52 percentage units higher in Texels. $P \leq 0.01$] and PUFA:MUFA ratio (by far the highest in Texels, by 89% on average, $P \leq 0.01$).

Differences in the content of conjugated linoleic acid (CLA) proved statistically non-significant, resulting from a high variation in the content CLA (v ranging from 26 to 66%) and from a small number of observations. However, the differences observed among the breeds for the CLA content, both for percentage content in total FA (a maximum of 0.07 percentage units, i.e. 33.3% between T

and F vs. S) and for the absolute content of CLA in muscular tissue (from 11% between F and Fr groups to 72% between IF and Fr) indicate the possibility of influencing CLA level in lamb meat through genetic factors. However, this needs to be confirmed on larger material.

The lack of literature data on the health properties of lamb meat of the experimental breeds makes further discussion impossible, but the results obtained show that it is justified to continue the studies in this area.

Conclusions

Under intensive fattening to high weight standards, large breed differences were found for the parameters of carcass fatness and fat content of meat, which were generally more favourable in terms of health-promoting properties in the Texel and East Friesian breeds than in the meat breeds Ile de France and Suffolk and in the prolific Finnsheep breed.

In general terms, the meat of Texel and Finnsheep lambs proved to be the best in respect of the health-promoting properties, mainly due to lower cholesterol and higher CLA contents, and in Texels also because of a significantly more favourable proportions of PUFA to MUFA acids than in lambs of the other breeds.

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Table 1. Parameters of carcass and meat fatness and the content of total cholesterol and CLA

Trait	Breed of lambs				
	IF n = 6	S n = 7	T n = 4	Fr n = 6	F n = 6
Estimated content in half-carcass (%):					
- muscular tissue (EMT)	62,8a	59,9Bb	70,6ABa	67,7Cb	59,1AC
- fatty tissue (EFT)	22,6AD	20,5CF	12,3ABCa	15,2DEFa	22,6BE
- EMT:EFT	2,81BE	2,93CF	5,58ABCG	4,47DEFG	2,65AD
Fat over the loin "eye" - mm	3,0ab	2,8df	1,3acd	1,4bef	2,8ce
% intramuscular fat	4,8ABab	3,4a	3,5b	2,5A	3,1B
Cholesterol - mg/100 g tissue	58,5	56,0	52,3	57,8	53,4
CLA: - % in FAP	0,24	0,21	0,28	0,22	0,28
- mg /100 g tissue	4,2	6,3	9,2	6,5	7,2

AA, BB ... - P≤0.01; aa, bb ... - P≤0.05. FAP – fatty acid pool

Table 2. Content and proportions of fatty acid groups in intramuscular fat

Breed	SFA	UFA	UFA:SFA	MUFA	PUFA	PUFA:MUFA	DFA	OFA	DFA:OFA	PUFAΩ6:Ω3
IF	41,66	57,54	1,40	45,76	11,79B	0,26B	70,06	29,14	2,43	6,61
S	38,58	59,75	1,53	46,13	13,62C	0,30C	72,10	26,23	2,78	7,33
T	38,98	60,35	1,53	42,45	20,40ABCD	0,53ABCD	73,68	25,65	2,90	7,03
Fr	38,33	60,98	1,63	46,63	14,35D	0,32A	72,60	26,72	2,73	6,40
F	38,92	59,78	1,53	48,00	11,78A	0,25A	71,72	26,98	2,65	6,68

AA, BB ... P≤0.01; aa, bb ... P≤0.05. Fatty acids: SFA – saturated, UFA – unsaturated, MUFA – monounsaturated, PUFA – polyunsaturated, DFA – hypocholesterolemic, OFA - hypercholesterolemic