

FATTY ACID PROFILE OF *M. L. D.* MUSCLE IN LAMBS FATTENED TO 30 KG BODY WEIGHT UNDER DIFFERENT FEEDING CONDITIONS

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Abstract

The aim of the study was to determine the effect of feeding on the fatty acid profile of m.l.d. (musculus longissimus dorsi) intramuscular fat in lambs of Polish Mountain sheep, fattened to 30 kg body weight. Rams fed a complete diet with a structural hay supplement and grazed on a mountain pasture with mothers were investigated. Compared to ad libitum feeding of the complete diet, the extensive feeding based on pasture and mother's milk positively modified the lipid profile of m.l.d. intramuscular fat by increasing the n-3 PUFA content.

Key words: LAMB, MUSCLE, FEEDING, FATTY ACID

At present, sheep in Poland are mainly used for meat and thus lamb meat production determines whether sheep farming is profitable or not. One of the most important criteria for consumer evaluation of food, including meat products, is their healthiness or availability of valuable nutrients (Jakubowski, 1995). Therefore, consumer interest in lamb meat quality has stimulated breeders to find and promote food production methods that meet the criteria set by dieticians. Threats associated with incorrect feeding are associated, among others, with excessive levels of energy components, unfavourable profile of fatty acids or excessive meat cholesterol content.

The aim of the study was to determine the suitability of Polish Mountain sheep lambs for production of high-value lamb meat characterized by appropriate fatty acid profile under varying conditions of fattening to 30 kg body weight.

Materials and methods

Material for analysis was collected from 18 rams of Polish Mountain sheep (POG) fattened to 30±2 kg body weight. Lambs were divided based on the analogue principle into groups I and II according to birth type and fattened in a typical sheep farm of the Bieszczady region. The rams were born in March 2007. On farm I, after weaning at 56 days of age, lambs were fed a structural hay supplement and a complete diet containing 6 MJ energy and 120 g CP with a structural hay supplement of 100 g/kg diet. On farm II, ram-lambs were kept with mothers throughout fattening and grazed under typical production conditions of a mountain pasture. At the final body weight of 30±2 kg, lambs were subjected to 24-hour feed withdrawal with constant access to water, and slaughtered in specialist abattoirs.

Samples of *m.l.d.* muscle were taken from lamb carcasses at the 11th-13th thoracic vertebrae and analysed for fat content using the Soxhlet method and for acid content using a modified method of Folch et al. (1975). Separation and quantitative determination of individual fatty acids were carried out by way of gas chromatography (TRACE GC ULTRA, SUPELCOWAX 10 column: 30 m x 0,25mm x 0,25µm, with helium (7,5 ml/min) as the carrier gas).

The results obtained were analysed statistically by two-way analysis of variance using the Tukey test (Statistica, 2008)

Results and discussion

The rams kept on mountain pasture and those fed on mother's milk (extensive system) did not differ in the content of *m.l.d.* intramuscular fat compared to those fattened on a complete diet in the sheep house. Fat content was low and ranged from 1,27 % to 1,52 %.

Chromatographic analysis showed that the fattening method used had an effect on the fatty acid profile of *m.l.d.* fat in rams of Polish Mountain sheep (Table 1).

Table 1

Fatty acid content of *m.l.d.* fat

Trait	Group		SEM
	I	II	
Fat in <i>m.l.d.</i> ; %	1,27±0,43	1,52±0,53	0,07
SFA	41,57±4,20	42,13±2,25	0,47
MUFA	41,17±3,81a	35,64±2,65b	0,63
<i>C18:1n-7</i>	3,37±0,65	3,90±0,70	0,43
<i>C18:1 n-9</i>	34,93±4,08A	29,26±2,66B	0,64
<i>C18:2 n-6</i>	7,16±3,49	8,21±2,18	0,36
UFA	56,19±3,23	53,28±2,32	0,50
PUFA	15,02±6,43	17,64±4,45	0,75
<i>C18:3 n-3</i>	1,47±0,19A	2,50±0,69B	0,13
<i>C20:5 n-3</i>	0,85±0,57a	1,15±0,36b	0,07
PUFA n-3	4,10±0,96	5,42±1,42	0,24
PUFA n-6	10,92±3,17	12,22±3,55	0,61
PUFA n-6/n-3	2,66±0,81	2,25±0,65	0,12
MUFA/SFA	0,99±0,01a	0,85±0,05b	0,02
PUFA/SFA	0,36±0,12	0,42±0,13	0,02
DFA/OFA	2,86±0,79	2,64±0,36	0,09
IT	1,11±0,20	1,21±0,14	0,02
IA	0,44±0,1	0,42±0,07	0,01
CLA	1,07±0,23	1,34±0,53	0,07

MUFA — Monounsaturated Fatty Acids

SFA — Saturated Fatty Acids

PUFA — Polyunsaturated Fatty Acids

UFA = MUFA + PUFA

ID = $\Sigma(C\ 14:1, C\ 16:1, C18:1\ n-9, C18:1\ n-7)/\Sigma(C\ 14:1, C\ 16:1, C18:1\ n-9, C18:1\ n-7) + (C14:0, C16:0, C\ 18:0)$

IT = $\Sigma(C14:0, C16:0, C18:0)/\Sigma(MUFA, PUFA\ n-3, PUFA\ n-6, PUFA\ n-3/n-6)$

IA = $\Sigma(C\ 12:0, C14:0, C16:0)/UFA$

OFA = SFA – C18:0

DFA = UFA + C18:0

Compared to lambs fattened with a complete diet, pasture-grazed lambs were characterized by a similar percentage of total SFA and 5,53 p.u. lower ($P \leq 0,05$) total MUFA. SFA level was 41–42 g/100 g of tissue and was typical of the meat of farm animals in which fatty acids form about 50 % of total acids determined in adipose tissue, whereas the others are MUFA (approx. 45 %) and PUFA (only 5 %). On farm II, *C18:1 n-7* acid was lower by 5,67 p.u. ($P \leq 0,01$). Similar results were reported by Velasco et al. (2001) and Borys et al. (2007). In pasture-grazed lambs, low fat deposition is paralleled by a decrease in *de novo* synthesis of SFA and above all MUFA (Biedermann et al., 2000). Fattening method had no effect on the percentage of total UFA and PUFA, but *C18:3* and *C20:5* were shown to be 1,03 ($P \leq 0,01$) and 0,3 p.u. higher ($P \leq 0,05$). It is worth noting that EPA plays an important role in the human body as it has a beneficial effect on the cardiovascular system, inhibits the growth of some cancers, relieves inflammations and allergies, and increases body immunity (Radzik-Rant, 2005). Many studies have confirmed the high content of UFA, especially *C18:3* in pastured ruminants unlike in ruminants fed indoors (Diaz et al., 2002; Aourousseau et al., 2004). Compounds such as triacylglycerides and plant galactolipids are rich in linoleic, linolenic and eicosapentaenoic acids (EPA). α -linolenic acid (50 % of all acids) is naturally found in grass (Radzik-Rant, 2005). Therefore, the increase in the content of n-3 acids, obtained in the present study in lambs fed pasture grass was the natural consequence of the feeding used. Pasture-fed lambs showed a tendency towards increased CLA. The difference shown was not confirmed statistically and failed to support the results of many studies, in which CLA level

increased significantly in the meat fat of animals fed based on forage (Santos-Silva et al., 2002; Nuereberg et al., 2008; Pompa-Roborzyński and Kędzior, 2006).

It is concluded that fattening Polish Mountain sheep lambs to 30 kg body weight on a grass pasture results in lamb meat characterized by a more beneficial proportion of total n-3 PUFA and lower total MUFA.

Supported by the State Committee for Scientific Project 2P06Z 04729

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ЖИРНОКИСЛОТНИЙ СКЛАД ВНУТРІШНЬОМ'ЯЗОВОГО ЖИРУ ЯГНЯТ МАСОЮ ТІЛА 30 КГ ЗАЛЕЖНО ВІД ГОДІВЛІ

Резюме

Метою роботи було дослідження впливу годівлі на жирнокислотний склад внутрішньом'язового жиру (*musculus longissimus dorsi*) ягнят польської гірської породи масою тіла 30 кг. Одній групі ягнят згодовували вволю повноцінний раціон сінного типу, іншу групу ягнят випасали на гірському пасовищі разом з вівцематками. Встановлено, що внутрішньом'язовий жир ягнят, які випасалися на полонинах і споживали молоко вівцематок містило більше жирних кислот n-3 PUFA, ніж жир ягнят, яким згодовували повнораціонний комбікорм.

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ЖИРНОКИСЛОТНЫЙ СОСТАВ ВНУТРИМЫШЕЧНОГО ЖИРА ЯГНЯТ МАССОЙ ТЕЛА 30 КГ В ЗАВИСИМОСТИ ОТ КОРМЛЕНИЯ

Аннотация

Целью работы было исследование влияния кормления на жирнокислотный состав внутримышечного жира (*musculus longissimus dorsi*) ягнят польской горной породы массой тела 30 кг. Одной группе ягнят скармливали вволю полноценный рацион сеного типа, другую группу ягнят выпасали на горном пастбище вместе с овцематками. Установлено, что внутримышечный жир ягнят, которые выпасались на полонинах и потребляли молоко овцематок содержало больше жирных кислот n-3 PUFA, чем жир ягнят, которым скармливали полнорационный комбикорм.

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