THE CHANGES OF FATTY ACIDS PROFILE IN ADIPOSE TISSUE OF SHEEP DEPENDING ON FEEDING PERIOD ANALYZED ON LIVE ANIMALS

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Introduction

In recent years the change of fatty acid profiles in animal tissues has been considered in many investigations. These changes concern particularly n-3 polyunsaturated FA increase, because they have beneficial effect in human physiology and health preventing the occurrence coronary heart diseases, hypertension inflammatory and immune disorders and neurological dysfunctions (Williams, 2000). Also the conjugated linoleic acid C18:2 *cis*-9, *tran*-11 (CLA), present in ruminants fat, especially is taken into consideration because of its anticarcinogenic activity (Pariza et al., 2001). Many factors influenced the fatty acids composition, from them also nutrition and maintenance systems (Diaz et al., 2002; Rhee et al., 2003; Aurousseau et al., 2004).

The aim of presented study was analysis of fatty acids profile in adipose tissue of the same animals depend on feeding period. To this end the method of sampling by biopsy, worked out by authors has been used (Radzik-Rant et al., 2003).

Material and methods

The study was carried out on 20 ewes of Polish Lowland sheep in 2001 year and next 15 ewes in 2002 year. Fat samples were collected twice from the same animal: first before grazing season in May (at the age of 14 months) (period I), second before winter feeding in October (at the age of 18 months) (period II). During the experiment ewes has not been burdened by pregnancy or lactation. In winter ewes were fed hay and concentrate (75/25), in summer – grass from pasture reach of C18:3 FA and straw *ad libitum.* Subcutaneous adipose tissue (AT) samples have been taken by biopsy method from tail root part. Marked place was anaesthetized, then 2 cm cut was made. It allowed to take sufficient amount of adipose tissue. The cut place was sutured and completely healed after 10 days. The composition and content

of fatty acids (FA) were determinate by gas chromatography. To perform data the SPSS procedure of variance analysis was used.

Results

The differences of SFA content was not statistically significant in both observed periods (tab. 1). Period II influenced increase of UFA ($P \leq 0.01$). The content of MUFA increased in this period, especially oleic acid ($P \leq 0.01$). From among PUFA C18:3 and other n-3 acids increased (EPA-3 times, DHA-8 times) and C18:2 and other n-6 decreased ($P \leq 0.01$) what resulted also n-6/n-3 ratio decrease during grazing period. Grazing period positively effected *cis-9, trans 11* C18:2 CLA in adipose tissue ($P \leq 0.01$). At the same time the content of *trans*-11 C18:1 also increased but it was not confirmed statistically.

Discussion

The lack of differences in SFA content can be explained based on that synthesis of saturated fatty acids in ruminants is stimulated by diet FA (Chilliard, 1993). Lower content of SFA in diet during grazing period could increase de novo synthesis of acids in AT. Similar results were obtained by Rhee et al. (2003) in lambs from different production systems. Increase of C18:1 content in grazed lambs was reported by Velasco et al. (2003), similarly as a present study. It could be result of C18:0 desaturation or inhibition of desaturase activity converting C18:0 to C18:1 by oleic acid supplied in diet.

Aurousseau et al. (2004) and Diaz et al. (2002) also found increase of n-3 acids and decrease n-6 acids in lambs fed on the pasture. Grass reach in C18:3 could cause increase not only its content in AT but also EPA and DHA content, as a precursor of their synthesis. Diet PUFA do not inhibit lipoprotein lipase activity and allowed their infusion to adepocytes (Chilliard, 1993). Increased portion of CLA was confirmed by Aurousseau et al. (2004) in lambs and French et al. (2000) in steers fed grass. CLA with associated *trans*-11 C18:1 are intermediate in the ruminal biohydrogenation of C18:2. This reaction is catalyzed by linoleic acid isomeraze produced by ruminal bacterium *Butyrivibrio fibrisolvens*. This suggests that grass in the diet favored growth of those microorganisms. The second source of CLA is its endogenous synthesis by the animals tissues, major in AT, from *trans*-11 C:18:1 by $\Delta 9$ desaturase (Griinori et al., 2000). That is why accumulation of *trans* vaccenic acid in AT is beneficial in grass fed ewes.

Conclusions

The SFA content did not differ in both observed feeding periods. Oleic acid and n-3 PUFA increased and n-6 PUFA and n-6/n-3 ratio decreased during grazing period. Pasture feeding resulted increase of CLA content and insignificantly of *trans*-11 C18:1 acid. These results imply that favorable for human health fatty acid profiles in sheep could be obtain during grazing season.

Table 1. Fatty acids content in adipose tissue in the studied ewes depend on feeding period (g/100g fat).

Acids	Period I (Winter period)		Period II (Grazing period)		Significance
	Mean	S_E	Mean	S_E	
C 10:0	0,17	0,01	0,13	0,01	**
C 12:0	0,08	0,01	0,15	0,01	**
C 14:0	2,26	0,09	2,82	0,09	NS
C 15:0	0,80	0,02	0,79	0,03	NS
C 16:0	22,72	0,26	21,57	0,27	**
C17:0	1,23	0,04	1,96	0,04	**
C 18:0	21,82	0,31	20,03	0,32	**
C 14:1	0,63	0,03	0,34	0,03	**
C 15:1	0,11	0,01	0,07	0,01	**
C 16:1	2,49	0,07	2,12	0,07	**
C 16:1*izo*	0,37	0,03	0,55	0,03	**
C 18:1 *trans*11	3,09	0,12	3,35	0,12	NS
C 18:1 c	0,96	0,03	0,73	0,03	**
C 18:1 c 9	33,02	0,43	35,53	0,44	**
C 20:1	0,17	0,01	0,17	0,01	NS
C 18:2 n-6	2,52	0,07	2,24	0,07	*
C 18:2 CLA	0,39	0,00	0,50	0,00	**
C 20:2 n-6	0,08	0,00	0,05	0,00	**
C 18:3 n-3	0,87	0,02	0,99	0,02	**
C 20:3 n-3	0,02	0,00	0,04	0,00	**
C 20:4 n-6	0,22	0,01	0,16	0,01	**
C 20:5 n-3 EPA	0,02	0,00	0,06	0,00	**
C 22:5 n-3	0,19	0,00	0,06	0,00	**
C 22:6 n-3 DHA	0,01	0,00	0,08	0,00	**
∑ SFA	49,80	0,32	49,22	0,33	NS
∑ UFA	45,21	0,44	47,10	0,45	**
∑ MUFA	40,87	0,44	42,89	0,45	**
∑ PUFA	4,34	0,08	4,20	0,08	NS
∑ n-3	1,12	0,02	1,23	0,02	**
∑ n-6	2,83	0,07	2,47	0,07	**
n-6/n-3 ratio	2,53	0,08	2,02	0,08	**
UFA/SFA ratio	0,90	0,01	0,96	0,01	**

**- statistical significance at $P \leq 0.01$; * - $P \leq 0.05$; NS-not significant effect

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