EFFECT OF FEEDING EWES WITH RAPESEEDS ON SOME HEALTH QUALITY COMPONENTS OF MEAT OF LAMBS SLAUGHTERED AT 60 DAYS OF AGE

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Background

Studies on the possibility and extent to which the composition of fatty acids in animal (ruminant) fats can be modified indicate that this goal can be achieved quite easily. Giving feeds rich in polyunsaturated fatty acids (vegetable oils, seeds of oil-bearing plants) or protected fat supplements to lactating cows and sheep leads to the desired increase in the proportion of unsaturated acids at the expense of saturated acids in milk fat (Mansbridge and Blake, 1997). Feeding animals with vegetable oils and seeds of oil-bearing plants also results in an increased proportion of conjugated linoleic acids (CLA) in milk fat (Stanton et al., 1997; Kelly et al., 1998). It was also found (Borys et al., 1999) that light slaughter lambs born from ewes with a higher CLA level in milk were characterized by lower fatness of carcass and meat, better fatty acid profile, and higher CLA content in meat compared to the offspring of ewes with a lower CLA level. In light of the above, it seemed justified to assume that the seeds of oil-bearing plants fed to nursing ewes can be used to influence the composition of ewes' milk and in this way to modify the health properties of meat of light slaughter lambs which rely on ewes' milk for the major nutrients.

Objective

The objective of the present research was to determine the possibility and extent to which the composition of ewes' milk and indirectly the health quality of meat of milk lambs can be modified through the use of whole rapeseeds in the feeding of ewes.

Methods

The experiment was carried out on 50 Friesian x Polish Merino F_1 crosses and their offspring from 4 to 10 weeks of lactation. The ewes were randomly assigned to two groups which were fed according to the National Research Institute of Animal Production standards (Osikowski et al., 1983) with rations of the same nutritive value. The rations contained the same bulky feeds (silage, forage, hay) and concentrate feeds: ground wheat and barley, rapeseed meal and mineral supplements for group K (control), and additionally 150 g of whole double-low rapeseeds per 1 ewe per day for group R. The yield and chemical composition of ewes' milk and fatty acids in milk were determined from a test milking at 50-60 days of lactation. 6 ram lambs born from ewes from group K and R each were slaughtered at an average of 60 days of age and subjected to partial dissection 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). Intramuscular fat, fatty acid profile, the content of conjugated diene of linoleic acid c9, t11 (CLA) and total cholesterol were determined in 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 0.22 mm x 0.11 μm).

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

Results and discussion

The use of rapeseeds was found to have a beneficial though non-significant effect on the milk yield of ewes (7.7% higher in group R) and a beneficial effect on the dry matter and solids content of milk (0.4 percentage units higher in group R than in group K).

The feeding of rapeseeds was observed to have a clearly beneficial effect on both the percentage content of CLA in total fatty acids and the absolute CLA content in ewes' milk, being 0.20 percentage units and 48.4% higher in group R, with significant differences at $P \leq 0.01$ in both cases (Table 1). At the same time, however, the milk of the rapeseed-fed ewes contained 18.5% more cholesterol ($P \leq 0.05$) than the milk of ewes from group K which received no rapeseed.

Introduction of rapeseeds into the rations of nursing ewes made clear changes to the composition of milk fatty acids. Percentage proportion of individual fatty acids in total fatty acids and the absolute content of fatty acids in milk were found to differ significantly, being additionally modified by significant differences in the fat content of milk of ewes from groups K and R. In general, the milk of R ewes was characterized by a lower content of saturated (SFA) and a higher content of unsaturated fatty acids (UFA) and a 37.1% more favourable (higher) UFA:SFA ratio (Table 1). As regards unsaturated fatty acids, the feeding of rapeseeds modified (increased) mainly the proportion of monounsaturated fatty acids (MUFA) while practically having no effect on the percentage proportion of polyunsaturated fatty acids (PUFA). As a result, this made the PUFA to MUFA ratio poorer (17.6% lower) in group R. The addition of rapeseed had a beneficial effect on the content and ratio of hypo- (DFA) and hypercholesterolemic (OFA) acids in ewes' milk. Fat in milk of R ewes contained significantly more DFA and the same amount of OFA acids.

with a 45.8% higher DFA:OFA ratio, which also concerned the absolute content of these groups of acids in milk despite modifications resulting from differences in the level of fat in milk from groups R and K (Table 1).

Feeding ewes with rapeseeds had a beneficial effect on carcass and meat fatness in their offspring (Table 2). R lambs were characterized by a significantly (35.4%) higher meat to fat ratio ($P \leq 0.01$), with a considerably lower internal fatness of carcass and a lower content of intramuscular fat by 37.9 and 21.2% respectively (NS). This could have resulted from the significantly higher CLA level in the milk of R ewes, which has an effect on lower fat deposition in the animals' bodies.

Feeding the ewes with rapeseeds had no effect on the cholesterol content in muscles nor on the CLA proportion in total fatty acids. Due to differences in intramuscular fat content, the muscles of lambs from group K contained 24.8% more CLA than R lambs. Intramuscular fat of R lambs was characterized by a markedly more beneficial fatty acid profile, 17% higher UFA:SFA ratio (thanks to lower SFA and higher UFA content), 42.5% higher PUFA:MUFA ratio (thanks to higher proportion of PUFA), and 27.6% higher DFA:OFA ratio (thanks to a significantly higher DFA and lower OFA content) (Tab. 2).

Conclusions

The results obtained lead to us to conclude preliminarily that the use of whole double-low rapeseeds (150 g/1 ewe/day) in the feeding of lactating ewes made it possible to achieve:

- in ewes' milk: an increased content of fat, CLA, cholesterol and proportion of MUFA, accompanied by a poorer PUFA:MUFA ratio,
- in milk lambs (aged 60 days): a significant decrease in carcass fatness and intramuscular fat content, an increase in CLA without change in cholesterol level, and clearly favourable changes of the fatty acid profile in muscular tissue.

References

Borys B., Borys A., Grześkiewicz S. (1999) Rocz. Inst. Przem. Mięsn. i Tł. 36: 115-125. • Kelly M.L., Berry J.R., Dwyer D.A., Griinari J.M., Chouinard P.Y., van Amburgh M.E., Bauman D.E. (1998) J. Nutr. 128: 881-885. • Mansbridge R.J., Blake J.S. (1997). Br. J. Nutr. 78 (Suppl. 1): 37-47. • Nawara W., Osikowski M., Kluz I., Modelska M. (1963). Wycena tryków na podstawie badania wartości potomstwa w stacjach oceny tryków Instytutu Zootechniki za rok 1962.Wydawnictwo własne IZ Kraków nr 166. • Osikowski M. (1977) Badania nad współzależnością między pomiarami przyżyciowymi i poubojowymi a wartością rzeźną jagniąt merynosowych. Wydawnictwo własne IZ Kraków nr. 390. • Stanton C., Lawless F., Kjellmer G., Harrington D., Devery R., Connolly J.F., Murphy J. (1997) J. Food Sci. 62: 1083-1086.

Table 1. Effect of feeding rapeseed to ewes on the composition and content of health-promoting components in milk

	Feeding of ewes	
	K	R
No. of ewes	25	24
Daily milk yield - g	663	714
% protein	5,7	5,6
% fat	5,6a	6,0a
% solids	16,8a	17,2a
Cholesterol - mg/100 g milk	5,4	6,1
CLA: - % FAP	0,59A	0,79A
- mg/100 g milk	31,4A	46,6A
Fatty acids (mg/100 g milk):		
SFA	3767	3919
UFA	1330A	1848A
UFA:SFA	0,35A	0,48A
MUFA	1139A	1623A
PUFA	192a	256a
PUFA:MUFA	0,17a	0,14a
DFA	1634A	2305A
OFA	3463	3462
DFA:OFA	0,48A	0,70A

Table 2. Effect of feeding rapeseed to ewes on parameters of fatness and content of health-promoting components in the muscular tissue of milk lambs at 60 days of age

	Feeding of ewes	
	K	R
No. of lambs	6	6
Parameters of fatness		
- meat:fat ratio	4,13A	5,59A
- fat over the ribs - mm	2,9	1,8
- intramuscular fat - %	3,3	2,6
Cholesterol - mg/100g muscular tissue	61,4	63,8
CLA: - % FAP	0,40	0,40
- mg/100 g muscular tissue	12,6	10,1
Fatty acids (% FAP):		
SFA	45,1	41,1
UFA	53,8	57,6
UFA:SFA	1,20	1,41
MUFA	38,5	37,0
PUFA	15,3	20,7
PUFA:MUFA	0,40	0,57
DFA	64,8a	69,7a
OFA	34,0a	29,0a
DFA:OFA	1,92	2,45

AA - $P \leq 0.01$; aa - $P \leq 0.05$, FAP - fatty acid pool, Fatty acids: SFA – saturated, UFA – unsaturated, MUFA – monounsaturated, PUFA – polyunsaturated, DFA – hypocholesterolemic, OFA - hypercholesterolemic