EFFECT OF DIETARY FAT ON FAT CONTENT AND FATTY ACID COMPOSITION OF DOES MILK

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Abstract - In this studies was examined the effect of dietary fat on fat content and fatty acid composition of does milk. For this purpose 4.5 and 9.0% rapeseed oil were added to a rabbit diet. Fat addition leads to an increased content of fat (not significant) and of monounsaturated fatty acids (% of total fatty acids) in the milk of does. The amount of saturated fatty acids decreased. Rapeseed oil favoured a raised content of oleic acid. Also the effect of state of lactation on milk composition was estimated. Fat content of the milk was higher at 6th than at 2nd lactation and also at 1st than at 21st day of lactation. Fatty acid composition also was affected by day of lactation.

INTRODUCTION

Dietary fatty acid composition influences milk composition of sows and also of suckling pigs, moreover it improves defences against infections and catch inflammations. One part of the fatty acids get to the utero, the most part of ω-3 fatty acids comes through the milk into the suckling pigs (FRITSCHE et al., 1993). D'AMBOLA et al. (1991) found out that suckling rabbits have a better defence against pulmonary diseases when the does are fed with fish oil and safflower oil diets and they concluded, that pharmacologic dietary ω-6 and ω-3 fatty acids supplementation impairs this ability. On this account it should be studied the effect of the addition of different amounts of rapeseed oil on the fat content and fatty acid composition of the milk of does and in further investigations also of new-born and weanling rabbits. In the present paper the effect of rapeseed oil diets on the milk composition will be described.

MATERIAL AND METHODS

Samples of milk from ZIKA-hybrid does, which were divided into three feeding groups, were analysed. The control group got pelleted feed for rabbits without addition of rapeseed oil, the two other groups got diets with 4.5 and 9.0% added rapeseed oil respectively. At the 1st day of 2nd and 6th lactation milk was taken after nursing from stomach of young rabbits (from 4 different does) which were put into sleep in view of this and further investigations.

At the 21st day of the 2nd and 6th lactation milk were kept from does after oxytocin administration by a milking machine composing a moulded glas tube and an adjustible vacuum pump which was invented and used by SCHLEY (1975). Fat content and fatty acid composition of the milk were determined. Crude fat was separated by ether extraction. After this fatty acids were ascertained by gas chromatography. Peaks were identified based on their retention time relative to fatty acid methylester reference peak. Peak areas were measured by HP Data Station.

Table 1 shows the fat content and the fatty acid composition of rapeseed oil and diets. Control diet contained 4.0% crude fat, while the fat content in experimental diets increased to 8.8 and 11.7%. Addition of rapeseed oil led to a higher amount of C 18:1 and to smaller amounts of C 18:2 and C 16:0 in experimental diets compared with control. The raising fat content of the experimental diets led to further effects in the total content of different fatty acids showed in table 1.

Table 1 : Fat content and fatty acid composition of the diets (fatty acids in % of total fatty acids)

		Control	Experimental	
			4.5% rapeseed oil	9.0% rapeseed oil
Crude fat (%)		4.00	8.80	11.70
Fatty acids	Rapeseed oil			
C 14:0	0.14	0.22	0.17	0.17
C 16:0	5.48	16.28	9.50	7.74
C 16:1	0.29	0.35	0.35	0.35
C 18:0	1.68	2.59	2.28	2.13
C 18:1	55.45	18.52	42.71	48.73
C 18:2	20.19	47.22	28.89	24.55
C 18:3	8.96	8.00	8.23	8.69
C 20:0	0.53	0.33	0.49	0.52
C 20:1	1.39	0.78	1.19	1.28
C 22:0	0.36	0.49	0.46	0.41

Data were analysed using procedure ANOVA of SPSS-X program. The main effects of diet, number and day of lactation as well as their interactions were included into the model. Significantly different means of dietary groups were determined by Duncan's multiple range test of procedure ONEWAY. Differences were accepted as significant at $p < 0.05$ and will be showed by different letters in the present paper.

RESULTS AND DISCUSSION

The fat content of the milk raised, showing a tendency, but not significant, by fat addition to the diet (table 2). Fat content of milk was affected significant by number and day of lactation. Fat content was higher in 6th lactation than in 2nd. Does milk fat content changed in view of day of lactation. Milk of 21st day contents only 13.1% compared with milk from 1st day with 20.5%. Interactions between number and day of lactation on fat content of milk were found.

The fatty acid composition of the milk was obviously affected by the fatty acid composition of the diet (figure 1 and table 2). The most frequent acid of the milk from control group is C 18:2 with an amount of 18.4%. After this are following C 8:0, C 16:0 and C 10:0 with nearly equal parts. The content of saturated fatty acids C 8:0, C 10:0, C 14:0 and C 16:0 of the milk decreased by oil addition, while monounsaturated fatty acids C 18:1 and C 20:1 increased. The most important fatty acid in the experimental groups was C 18:1 with nearly 30 and 36%, this is also the fatty acid with the highest amount of rapeseed oil and of the experimental diets. The content of the fatty acids C 18:0 and C 18:2 did not change significant in the milk by rapeseed oil addition to the diet.

Figure 1 : Fatty acid composition of the milk (% of total fatty acids)

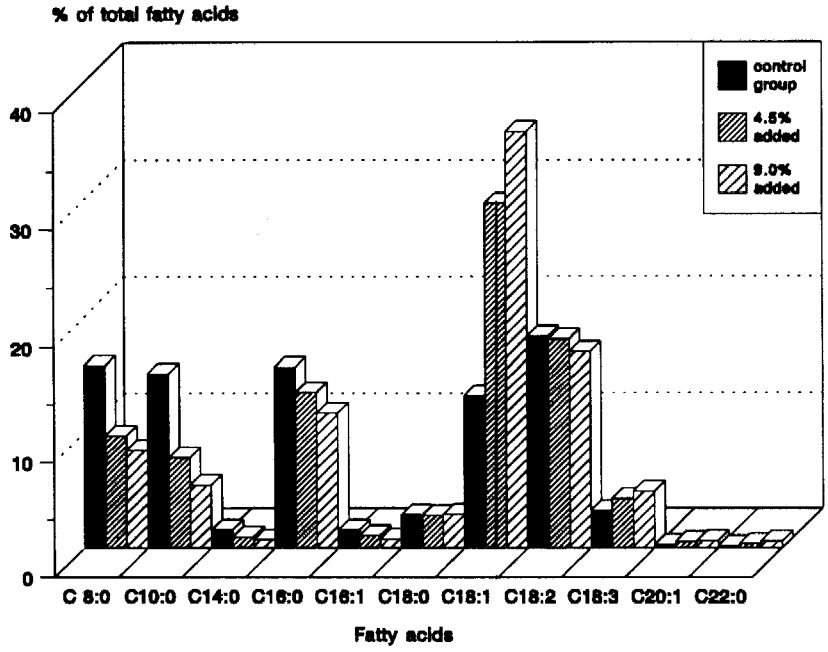

Table 2: Fat content and fatty acid composition of the milk (% of total fatty acids)

	Diet			Date				Probability of Interaction
	Control	Experimental		number of lactation		day of lactation		
		4.5% rapeseed oil	9.0% rapeseed oil	2nd	6th	1st	21st	(diet, number and day of lactation*)
	n = 16	n = 16	n = 16	n = 24	n = 24	n = 24	n = 24	
Crude fat (%)	15.91 ± 4.01	16.78 ± 6.61	17.65 ± 5.36	14.45a ± 5.49	19.10b ± 4.17	20.45a ± 3.68	13.11b ± 4.14	n x d
Fatty acids								
C 8:0	15.89a ± 8.47	9.73b ± 5.67	8.48b ± 5.79	11.34 ± 7.02	11.40 ± 7.88	5.17a ± 2.63	17.57b ± 4.93	f x d; n x d
C 10:0	15.20a ± 5.51	7.86b ± 3.61	5.46b ± 2.80	9.71 ± 5.36	9.31 ± 6.36	6.22a ± 3.69	12.80b ± 5.75	f x d; n x d
C 14:0	1.57a ± 0.57	0.96b ± 0.25	0.71b ± 0.27	1.09 ± 0.57	1.07 ± 0.50	1.38a ± 0.56	0.78b ± 0.28	f x d; f x n x d
C 16:0	15.74a ± 5.30	13.49ab ± 4.42	11.73b ± 4.25	13.35 ± 4.53	13.96 ± 5.26	17.62a ± 3.53	9.69b ± 1.78	n x d
C 16:1	1.57a ± 0.81	1.05ab ± 0.66	0.76b ± 0.46	1.02 ± 0.54	1.23 ± 0.87	1.43a ± 0.81	0.82b ± 0.48	n x d
C 18:0	2.90 ± 0.61	2.83 ± 0.38	2.94 ± 0.51	3.05a ± 0.58	2.72b ± 0.35	3.06a ±0.57	2.72b ± 0.36	f x d
C 18:1	13.22a ± 3.34	29.76b ± 3.44	35.84b ± 3.21	26.58 ± 10.33	25.97 ± 10.27	29.28a ± 9.76	23.27b ± 9.92	n.s.
C 18:2	18.38 ± 4.05	18.14 ± 2.32	17.07 ± 3.80	17.32 ± 4.15	18.41 ± 2.56	18.14 ± 4.67	17.59 ± 1.54	f x d
C 18:3	3.25a ± 0.82	4.29b ± 1.17	4.92b ± 1.70	4.05 ± 1.67	4.26 ± 1.18	3.50a ± 1.31	4.81b ± 1.26	f x d
C 20:0	0.11a ± 0.03	0.14bc ± 0.02	0.17bd ± 0.05	0.14 ± 0.05	0.14 ± 0.03	0.15a ± 0.05	0.13b ± 0.04	n.s.
C 20:1	0.29a ± 0.07	0.54bc ± 0.09	0.63bd ± 0.10	0.49 ± 0.17	0.48 ± 0.17	0.55a ± 0.17	0.42b ± 0.15	n.s.
C 22:0	0.18a ± 0.16	0.37b ± 0.35	0.60b ± 0.80	0.43 ± 0.68	0.33 ± 0.33	0.66a ± 0.64	0.10b ± 0.04	f x d

*f=diet; n = number of lactation; d = day of lactation

C 18:2 also were affected neither by number nor by day of lactation. Number of lactation only played a role in C 18:0 content. This content was lower in 6th lactation. In comparison 1st and 21st day of lactation there was a higher content of C 8:0, C 10:0 and C 18:3 at day 21. Other fatty acids had a lower content at this part of lactation (table 2). Interactions between day of lactation and diet or day and number of lactation were found in view of different fatty acids.

Considering all these results it became clear that the fatty acid composition of does milk is affected by dietary fatty acid composition. This also was pointed out by FRITSCHE *et al.* (1993) and DROCHNER (1989) about studies in swine. Rapeseed oil especially favours the amount of oleic acid (C 18:1). Also the day of lactation affected the fatty acid composition of the milk. At day 21 of lactation especially the content of C 8:0 and C 10:0 was higher and the content of C 16:0 and C 18:1 was lower than at 1st day. Fat content was lower at 21st day of lactation and was higher in 6th than in 2nd lactation.

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Einfluß von Futterfett auf den Fettgehalt und das Fettsäuremuster der Milch von Häsinnen - In den vorliegenden Untersuchungen wurde der Einfluß von Rapsöl auf den Fettgehalt und die Fettsäurezusammensetzung von Kaninchenmilch geprüft. Zu diesem Zweck wurden dem Kaninchenfutter 4,5 und 9,0% Rapsöl zugesetzt. Die Ölzulagen führten zu einem erhöhten Gehalt an Fett (nicht signifikant) und den einfach ungesättigten Fettsäuren in der Kaninchenmilch. Der Anteil der gesättigten Fettsäuren an den Gesamtfettsäuren nahm ab. Rapsöl bewirkte insbesondere ein Ansteigen der Ölsäure (C18:1). Des weiteren wurde der Einfluß der Laktation auf die Milchzusammensetzung geprüft. Der Fettgehalt der Milch lag in der 6. Laktation höher im Vergleich zur 2. Laktation und am 1. im Vergleich zum 21. Tag. Des weiteren ergaben sich signifikante Einflüsse des Laktationstages auf das Fettsäuremuster.