# EFFECT OF SUPPLEMENTAL DIETARY FAT FOR RABBITS ON MILK COMPOSITION AND REARING PERFORMANCE OF YOUNG RABBITS

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## ABSTRACT

This work was designed to determine the degree to which a supplement of rape oil added to female rabbit feeds influences the quantitative composition of higher fatty acids in milk and litter weight from birth to weaning. The present experiment confirmed that the fatty acid composition of rabbit milk lipids had been affected by the dietary fat. The fat supplement caused a decrease in the proportion of saturated fatty acids, which seems beneficial for young rabbits, just as the increase in the overall level of unsaturated acids. There were no significant differences between the groups in the number of rabbits born. The higher weaning weights of rabbits resulted from the increased amount of milk available to the litter and from the modification of the milk's fatty acid profile.

**Key words:** rabbit, fat, milk.

## INTRODUCTION

Fat as a source of condensed energy enables increasing the energy value of feed mixtures and changing the fatty acid profile (XICCATO *et al* 1995, PARIGI-BINI *et al* 1996). The composition of dietary fatty acids was found to influence the composition of mother's milk in many species of animals (D'AMBOLA *et al*. 1991).

This work was designed to determine the degree to which a supplement of rape oil added to female rabbit feeds influences the quantitative composition of higher fatty acids in milk and litter weight from birth to weaning.

## MATERIAL AND METHODS

Thirty New Zealand White rabbit does and all their progeny were investigated. Females of the foundation stock were caged individually on deep litter, in a non-heated closed facility. Mating frequency was moderate, i.e., between 10 and 14 days after kindling. The animals were fed complete pelleted diets.

Two experimental groups of 15 females were established according to the following design:

- group A – control – fed a basal diet of standard composition,
- group B – fed the group B diet supplemented with 4% vegetable (rape) oil.

In relation to the basal diet, the energy value of 1 kg rape diet increased from 10.42 to 11.5 MJ DE.

During the experiment, milk was collected from all females at 3 and 18 days after kindling to determine higher fatty acids in the lipid fraction of the milk (KOWALSKA, 2003). Analysis was made with gas chromatography by determining the gases in the form of methyl esters using gas chromatographer VARIAN 3400.

Data were collected on the conception rate, the number of live and stillborn rabbits per litter, litter weight at 24 h after birth, the number of rabbits and litter weight at 21 and 35 days of age, and milk index (NIEDZWIADEK, 1981), according to the formula

$$M=[(C_2 – C_1): (21 x C_2)] \times 100$$

where: M – milk index of the does, $C_1$ – litter weight (g) at 24 hours after birth, $C_2$ – litter weight (g) at 21 days after birth.

Statistical calculations were made with the SAS packet.

## RESULTS AND DISCUSSION

After the rape oil was added to the diet, crude fibre content of the feed was 5.05% in group B compared to 3.24% in group A. Other nutrients remained at similar levels (Table 1).

**Table 1. Results of basal analysis of the feed mixtures**

| Group | Dry matter (%) | Ash (%) | Crude protein (%) | Crude fat (%) | Crude fibre (%) | N-free extractives (%) |
|---|---|---|---|---|---|---|
| A | 87.40 | 5.83 | 16.74 | 3.24 | 14.12 | 55.20 |
| B | 88.74 | 5.30 | 16.34 | 5.05 | 14.27 | 52.61 |

Analysis of saturated fatty acids (SFA) in the lipid fraction of does’ milk taken on day 3 of lactation showed an almost 50% lower content of saturated acids – caprylic ($C_8$), capric ($C_{10}$) and lauric ($C_{12}$) in group B compared to group A. These differences were highly significant. The proportion of other saturated acids followed a similar pattern. Total SFA in milk fat was 81.875 in group A and 52.206 in group B (Tab. 2). These means differed highly significantly.

In group B, the proportion of unsaturated acids in milk lipids showed an upward trend, from about 100% for linoleic ($C_{18:2}$) and linolenic acids ($C_{18:3}$) to over 300% for oleic acid

($C_{18:1}$). The overall level of unsaturated fatty acids (UFA) in milk fat was lower in group A (18.125) than in group B (47.794), the difference being statistically significant.

**Table 2. Composition of higher fatty acids in the lipid fraction of rabbit milk at day 3 of lactation (% of total acids).**

| Fatty acids | Group A | | Group B | | Oil |
|---|---|---|---|---|---|
| | x | v% | x | v% | |
| $C_8$ | 45.111 A | 22,1 | 22.638 A | 16,6 | 3.273 |
| $C_{10}$ | 22.427 B | 18,4 | 11.859 B | 12,1 | 1.677 |
| $C_{12}$ | 2.188 C | 12,8 | 1.321 C | 16,2 | 0.182 |
| $C_{14}$ | 1.124 | 18,6 | 1.086 | 12,8 | 0.000 |
| $C_{16}$ | 9.308 | 14,4 | 10.783 | 11,4 | 5.864 |
| $C_{16:1}$ | 0.737 a | 12,6 | 1.207 a | 15,6 | 0.000 |
| $C_{18}$ | 1.673 D | 12,1 | 4.279 D | 13,6 | 1.500 |
| $C_{18:1}$ | 6.497 E | 11,6 | 24.059 E | 12,4 | 57.294 |
| $C_{18\text{-}2.\ n\text{-}6}$ | 8.893 F | 11,4 | 17.151 F | 11,8 | 19.946 |
| $GC_{18:3.\ n\text{-}6}$ | 0.307 | 19,8 | 0.411 | 14,6 | 0.000 |
| $C_{18:3}$ | 1.489 G | 14,6 | 4.271 G | 8,9 | 9.295 |
| CLA | 0.033 b | 14,4 | 0.064 b | 11,4 | 0.000 |
| $C_{20}$ | 0.038 H | 18,5 | 0.161 H | 12,6 | 0.356 |
| $C_{20:4.\ n\text{-}6}$ | 0.147 I | 9,8 | 0.273 I | 11,5 | 0.000 |
| $C_{20:5}$ $EPA_{.\ n\text{-}3}$ | 0.010 J | 14,3 | 0.025 J | 16,3 | 0.000 |
| $C_{22}$ | 0.000 K | 12,6 | 0.077 K | 8,7 | 0.000 |
| $C_{22:1}$ | 0.000 L | 14,4 | 0.166 L | 14,9 | 0.504 |
| $C_{22:6}$ $DHA_{.\ n\text{-}3}$ | 0.013 M | 11,6 | 0.168 M | 11,9 | 0.110 |
| SFA | 81.875 N | 14,8 | 52.206 N | 16,4 | 12.851 |
| UFA | 18.125 O | 20,1 | 47.794 O | 20,6 | 87.149 |

Numbers in the rows with the same letters differ significantly (a.b at $P \leq 0.05$; A.B.at $P \leq 0.01$)

Similar trends for the composition of higher fatty acids in the lipid fraction of milk were observed in samples taken on day 18 of lactation. In the group of saturated acids, downward trends occurred for all the acids discussed, but the content of unsaturated acids increased (Table 3).

A comparison of the composition of fatty acids in the lipid fraction of rabbit milk taken on different days of lactation reveals that the content of SFA on day 18 of lactation tended to decrease in group A. In the rape oil supplemented group B, SFA content did not show a downward tendency and remained at a similar level during the lactation period analysed. The proportion of unsaturated fatty acids increased in milk of group A rabbits in the final stage of lactation. Differences between the means were confirmed statistically. This trend concerned both monounsaturated and polyunsaturated acids. When the rape oil supplemented diet was fed, the level of UFA in milk lipids was similar and did not decrease in subsequent periods of lactation.

**Table 3. Composition of higher fatty acids in the lipid fraction of rabbit milk at day 18 of lactation (% of total acids)**

| Fatty acids | Group A | | Group B | | Oil |
|---|---|---|---|---|---|
| | x | v% | x | v% | |
| $C_8$ | 34.28 A | 22,4 | 23.225 A | 16,4 | 3.273 |
| $C_{10}$ | 17.328 B | 18,6 | 11.886 B | 18,6 | 1.677 |
| $C_{12}$ | 1.798 a | 12,3 | 1.274 a | 11,3 | 0.182 |
| $C_{14}$ | 1.052 b | 14,7 | 0.894 b | 9,8 | 0.000 |
| $C_{16}$ | 11.159 c | 16,4 | 10.017 c | 11,8 | 5.864 |
| $C_{16:1}$ | 0.860 d | 15,3 | 1.073 d | 16,4 | 0.000 |
| $C_{18}$ | 2.916 C | 11,2 | 8.550 C | 21,4 | 1.500 |
| $C_{18:1}$ | 11.881 D | 8,9 | 20.016 D | 17,8 | 57.294 |
| $C_{18\text{-}2.\ n\text{-}6}$ | 14.961 E | 14,6 | 17.242 E | 14,6 | 19.946 |
| $GC_{18:3.\ n\text{-}6}$ | 0.566 e | 13,2 | 0.492 e | 12,6 | 0.000 |
| $C_{18:3}$ | 2.436 F | 11,4 | 4.389 F | 13,6 | 9.295 |
| CLA | 0.075 f | 15,8 | 0.093 f | 16,8 | 0.000 |
| $C_{20}$ | 0.112 g | 16,6 | 0.160 g | 18,6 | 0.356 |
| $C_{20:4.\ n\text{-}6}$ | 0.357 h | 14,2 | 0.277 h | 16,4 | 0.000 |
| $C_{20:5}$EPA. $_{n\text{-}3}$ | 0.025 | 11,6 | 0.032 | 15,3 | 0.000 |
| $C_{22}$ | 0.053 | 9,8 | 0.073 | 17,4 | 0.000 |
| $C_{22:1}$ | 0.051 G | 18,6 | 0.172 G | 15,8 | 0.504 |
| $C_{22:6}$DHA. $_{n\text{-}3}$ | 0.080 H | 11,4 | 0.136 H | 17,6 | 0.110 |
| SFA | 68.707 I | 18,9 | 56.078 I | 16,4 | 12.851 |
| UFA | 31.293 J | 21,4 | 43.922 J | 21,4 | 87.149 |

Numbers in the rows with the same letters differ significantly (a.b at P≤0.05; A.B.at P≤0.01)

Table 4 presents data on reproductive performance of third parity females of both feeding groups. The dietary fat supplement had a positive effect on average neonatal weight, which showed highly significant differences between the groups. This trend persisted also on days 21 and 35 of rabbits' age. In group B the lowest feed intake by a female and her young was noted (the difference was statistically significant in relation to group A). There were significant differences between milk yields of group A and B females, which indicates a rise in the milk production of oil supplemented females.

## CONCLUSIONS

The present experiment confirmed that the fatty acid composition of rabbit milk lipids had been affected by the dietary fat. The fat supplement caused a decrease in the proportion of saturated fatty acids, which seems beneficial for young rabbits, just as the increase in the overall level of unsaturated acids.

There were no significant differences between the groups in the number of rabbits born. The higher weaning weights of rabbits resulted from the increased amount of milk available to the litter and from the modification of the milk's fatty acid profile.

**Table 4. Results of reproductive performance of third-parity females**

| Item | Group A | | Group B | |
|---|---|---|---|---|
| | x | v% | x | v% |
| Litter size (head) | 6.8 | 14.7 | 7.1 | 18.3 |
| No. of rabbits born live per litter (head) | 6.6 | 6.9 | 6.9 | 12.1 |
| % reared to 21 days of age | 83.2 | | 87.9 | |
| % reared to 35 days of age | 82.1 | | 87.4 | |
| Neonatal weight (g) | 57.66A | 15.6 | 68.95A | 16.2 |
| Rabbit weight at 21 days of age (g) | 298.6a | 22.4 | 347.20a | 18.4 |
| Rabbit weight at 35 days of age (g) | 810.6B | 21.5 | 962.6B | 11.4 |
| Feed intake by female and offspring (g/day) | 350C | 25.8 | 276C | 21.3 |
| Weight gains to 21 days of age (g/day) | 11.47 | 15.3 | 13.25 | 14.8 |
| Weight gains to 35 days of age (g/day) | 21.51b | 17.9 | 25.53b | 12.4 |
| Milk index | 3.4c | 11.7 | 4.0c | 11.5 |

Numbers in the rows with the same letters differ significantly (a.b at $P \leq 0.05$; A.B.at $P \leq 0.01$)

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