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EFFECT OF DIETARY FISH OIL SUPPLEMENT ON REARING PERFORMANCE OF YOUNG RABBITS AND QUALITY OF THEIR MEAT

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Key words: rabbits, feeding, fish oil, meat quality

The aim of the study was to determine the effect of essential unsaturated fatty acids (EUFA) in fish oil supplemented to doe diets on rearing performance of young rabbits and quality of their meat obtained at the end of growth at 90 days of age.

Feeding a pelleted mixture containing 4% fish oil had a varying effect on rearing performance of young rabbits. It enabled better weight gains to be obtained at 21 and 35 days of age while having no effect on higher final weight on the day of slaughter. The fish oil supplement changed the fatty acid profile of intramuscular fat, increasing the level of *n-3* PUFA, especially EPA and DHA acids, but this was paralleled by poorer sensory quality of meat.

INTRODUCTION

Recent studies have shown a close relationship between food products and nutrients consumed, and human health. Human dietetics recommends increasing the daily intake of *n-3* polyunsaturated fatty acids (*n-3* PUFA) from 2.2 to 3.8 g and reducing the *n-6* to *n-3* PUFA ratio from 9-10:1 to 4-6:1 [Kolanowski & Świderski, 1997; Ziemlański, 1997].

The fatty acid profile of rabbit tissues depends on a number of factors, such as breed, type of tissue, age or slaughter weight. Diet composition also has a significant effect. Enriching complete diets with nutrients high in *n-3* PUFA enables the fatty acid profile of meat to be programmed as a result of certain components being transferred from the feed. In the animal body, EUFA function through the activity of eicosanoids synthesized from arachidonic and eicosapentaenoic acids. The beneficial effect of *n-3* EUFA was observed not only in diseases, but also in maintaining the pre- and postnatal growth and development of mammalian organisms [Innis, 1991; Migdał & Kaczmarczyk, 1991].

Enriching rabbit meat with long-chain unsaturated fatty acids can be beneficial for human health. This particularly concerns the increased amounts of eicosapentaenoic (EPA), docosapentaenoic (DPA) and docosahexaenoic acids (DHA) which give rise in the body to specific tissue hormones that have anti-inflammatory and antithrombotic action [Simopoulos, 1991]. The incontrovertible evidence of the beneficial effect of these acids on human health is very low incidence of cardiovascular diseases in the Eskimos whose diet is rich in these acids.

The aim of the study was to determine the effect of EUFA found in fish oil added to the diets of the foundation stock and infant rabbits on rearing performance and meat quality of rabbits obtained at the end of growth on day 90 of age.

MATERIAL AND METHODS

A total of 20 New Zealand White does of the foundation herd and all of their offspring were investigated in two feeding groups: Group I – fed a standard basal diet in pellet form, and Group II – fed a pelleted diet with 4% fish oil.

The complete standard diet given to rabbits contained dried meadow grass, soybean meal, wheat bran, ground maize, milk replacer, NaCl, Di calcium phosphate, and a mineral-vitamin supplement with a coccidiostat. In the experiment, animals from group II received a 4% fish oil supplement (Lyso) and a lower proportion of soybean meal, dried meadow grass and ground maize.

Rearing performance of rabbits, *i.e.* body weight 24 h after birth and at 21, 35 and 90 days of age, daily gains from 35 to 90 days of age, and feed conversion (kg/kg gain) were studied. At the end of the experiment, the animals were slaughtered (6 animals per group). Control slaughters and postslaughter analysis were performed in accordance with standard methods. Muscling and fatness traits of rabbit carcasses were analysed together with sensory evaluation of meat. The *longisismus dorsi* muscle was matured at 4°C for 3 days. Samples were heated in water (0.6% NaCl solution), one part muscle to two parts water, under gentle boiling until the temperature inside the sample reached 85°C. Sensory analysis included the evaluation of meat aroma, juiciness, tenderness and palatability on a 5-point scale.

After dissection, the samples of rear leg muscles were analysed for the profile of higher fatty acids using gas chromatog-

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TABLE 1. Results of proximate analysis of complete pelleted diets.

Group	Dry matter (%)	Crude ash (%)	Organic matter (%)	Crude protein (%)	Crude fat (%)	Crude fibre (%)	N-free extractives (%)	Metabolizable energy (MJ/kg)
I	87.15	5.44	81.71	14.72	2.51	9.85	54.63	
	100.00	6.24	93.76	16.89	2.88	11.30	62.69	10.94
II	88.10	5.13	82.97	14.46	6.00	9.97	52.54	
	100.00	5.82	94.18	16.41	6.81	10.86	60.10	11.50

TABLE 2. Rearing performance of rabbits.

Item	Group		SEM
	I	II	
Body weight at 24 h (g)	63.2	61.5	1.003
Body weight at 21 days (g)	312.8^{a}	342.0^{b}	12.43
Body weight at 35 days (g)	810.2^{A}	886.5^{B}	11.87
Body weight at 90 days (g)	2503.5	2536.5	23.94
Daily gains (g)	30.60	30.00	1.002
Feed conversion (kg/kg gain)	4.22^{a}	3.75^{b}	0.395

^{a,b} – means with different letters differ significantly at $p<0.05$, ^{A,B} at $p<0.01$

TABLE 3. Rabbit carcass muscling and fatness traits, dressing percentage, and total cholesterol content of leg muscles.

Trait	Group		
	I	II	SEM
Preslaughter weight (g)	2575.00	2570.00	31.004
Carcass weight after chilling (g)	1243.34	1265.83	37.003
Muscle weight in carcass (g)	941.67	974.16	32.663
Proportion of muscles in carcass (%)	75.74	76.95	0.515
Weight of bones in carcass (g)	236.67	226.67	5.203
Proportion of bones in carcass (%)	19.03	17.91	0.563
Weight of fat in carcass (g)	65.00	65.00	4.205
Proportion of fat in carcass (%)	5.23	5.14	0.274
Dressing percentage (%)	53.43	57.85	4.308
Total cholesterol (mg/100g)	64.26	60.55	1.300

raphy (determination of free fatty acids) and total cholesterol using the colorimetric method and colour reaction with a 10% $FeCl_3$ solution diluted 100-fold by sulphuric acid.

The results were analysed statistically using an analysis of variance and Duncan's D-test in the Statgraphics Plus 4.0 package.

RESULTS AND DISCUSSION

The addition of a 4% fish oil supplement to the feed increased the energy value and changed the profile of higher fatty acids in the experimental diets. Table 1 shows the results of basic analysis of the complete pelleted diets used in the experiment.

Adding the fish oil supplement increased the amount of crude fat from 2.88% to 6.81%. Partridge (1986) reported that adding 3-5% fat to the diet increases the energy level from 11.0 to 11.5 MJ/kg without reducing the content of fibre, the appropriate level of which is necessary for the health of females and the weaned litter.

Analysis of the results showed a significant and highly significant effect of the fish oil supplement on the average body weight at 21 and 35 days of age (Table 2). Fish oil has no

TABLE 4. Sensory traits of meat (x pts.).

Trait	Group I/score	Group II/score
Aroma intensity	4.8	3.6
Aroma quality	4.2	4.0
Tenderness	4.4	3.8
Juiciness	3.6	3.8
Taste intensity	3.6	1.4
Taste quality	4.8	1.8
Sensory score of total quality	4.23	3.06

TABLE 5. Determinations of the profile of higher fatty acids in the rear leg muscle tissue (% of total acids).

Item	Group		
	I	II	SEM
C18:2 n-6	38.488	35.133	1.191
C18:2 *cis*9 *trans*11	0.052	0.057	0.003
C18:2 *trans*10 *cis*12	0.004^{A}	0.087^{B}	0.100
C18:2 *cis*9 *cis*11	0.010	0.000	0.001
C18:2 *trans*9 *trans*11	0.501^{A}	1.323^{B}	0.110
C18:3	2.123	5.478	1.200
EPA	0.133^{A}	1.707^{B}	0.199
DHA	0.931^{A}	6.389^{B}	0.769
SFA	30.704^{a}	28.098^{b}	1.066
UFA	69.296^{a}	71.902^{b}	1.066
MUFA	25.133^{a}	22.225^{b}	0.598
PUFA	44.163^{a}	49.677^{b}	1.477
PUFA-6	40.407	36.160	1.246
PUFA-3	3.187^{A}	12.050^{B}	1.273
DFA	74.756	76.383	0.995
OFA	25.244	23.617	0.995
UFA/SFA	2.260	2.578	0.162
DFA/OFA	2.968	3.254	0.238
MUFA/SFA	0.817	0.794	0.33
PUFA/SFA	1.443^{a}	1.783^{b}	0.136

^{a,b} – means with different letters differ significantly at $p<0.05$, ^{A,B} – at $p<0.01$

effect on higher final body weights. Compared to the control group, rabbits of the experimental group used significantly lower amounts of complete pelleted diet ($p<0.05$).

Postslaughter analysis of the carcasses showed that the dietary factor had no significant effect on dressing percentage. There was a tendency towards better muscling and lower level of total cholesterol in animals from group II (Table 3).

Table 4 gives the results of sensory evaluation of rabbit meat. A higher score for total sensory quality was found in group I.

Analysis of the composition of fatty acids of rear leg muscle lipids showed that the fish oil supplement had a beneficial effect on the dietetic properties of rabbit meat (Table 5). The amount of *n-3* PUFA increased highly significantly in relation to that found in the control group. The largest differences concerned EPA and DHA acids. As reported by Simopoulos [1999], enriching meat with these acids is important for prevention of cardiovascular diseases in humans. The content of t10-c12 and t9-t11 isomers increased highly significantly in the leg muscle lipids of the experimental group. The *n-6* to *n-3* PUFA ratio was observed to decrease.

Similar results were obtained by Xiccato & Trocino [2003], who showed a positive effect of increasing the amount of oils in rabbit feeds on the level of desirable fatty acids and on reducing the level of cholesterol in rabbit meat.

CONCLUSIONS

It is concluded that fish oil supplemented to rabbit diets had a beneficial effect on performance of young rabbits reared with mothers. The body weight of the animals was found to increase significantly and highly significantly at 21 and 35 days of age.

The use of fish oil in rabbit feeding caused a highly significant increase in the level of *n-3* PUFA, especially EPA and DHA acids in the lipid fraction of rabbit leg muscles. The level of cholesterol in the experimental group showed a downward tendency. The beneficial effect of the experimental factor on the lipid profile of muscle tissue and cholesterol content was paralleled by a deterioration in the sensory quality of meat.

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WPŁYW DODATKU OLEJU RYBNEGO W PASZY NA WYNIKI ODCHOWU KRÓLICZĄT I JAKOŚĆ POZYSKIWANEGO OD NICH MIĘSA

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Celem podjętych badań była ocena wpływu NNKT zawartych w oleju rybnym dodawanym do dawki pokarmowej dla samic na odchów króliczą oraz jakość pozyskiwanego od nich mięsa po zakończeniu wzrostu w 90. dniu życia.

Skarmianie mieszanki granulowanej z 4% udziałem oleju rybnego miało zróżnicowany wpływ na wyniki odchowu królicząt. Pozwalało na uzyskanie lepszych przyrostów masy ciała w 21 i 35 dniu życia, nie wpływając jednocześnie na uzyskanie wyższej masy końcowej w dniu uboju. Dodatek oleju rybnego zmieniał profil kwasów tłuszczowych tłuszczu śródmięśniowego, zwiększając zawartość PUFA *n*-3, a szczególnie kwasów EPA i DHA.