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EFFECT OF UNSATURATED OILS ON LIPID COMPOSITION OF M. TRICEPS BRACHII IN FATTENED PIGS

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The inclusion of unsaturated alimentary fats in feedstuffs for fattening pigs is an easy way of intake of energy as well as of essential nutritional substances. Besides there is a necessity of tracing the influence of storige with different duration on the main polar and nonpolar lipids in m. Triceps brachii.

MATERIAL AND METODS: The trial has been carried out with hybrid male castrates, fattened up to 100 kg live weight, devided into control and trial groups, 6 animals in each group. The animals have been fed feedstuffs according to Bulgarian State Standard 1642-77 and to the mixture of the trials groups have been added 2% soy and 1% fich oil at the account of part of the carbohydrate component. The mixtures are isoproteinic and isocaloric. The pigs have been slaughtered at 100 kg live weight and the samples taken from m. Triceps brachii have been devided into three parts. The first sample has been examined upon slaughter (1st period), and the other two have been storage at -20°C for a month (2nd period) and for 5 months (3rd period) respectively.

The total tissue lipids have been extracted according to Bligh and Dyer (1959).The triacylglicerols (TG) and the free fatty acids (FFA) have been analysed quantitatively and qualitatively by combined use of thin layer and gas-liquid chromatography with the addition of inner standards triarachidin and arachidic acid (Cunnane et al,1986). A conventional column has been used with 10% SP-2340 on Chromosorb W. AW 100-120 mesh. The level of total phospholipids (Bartlett,1959) and cholesterol (Sperry and Webb, 1950) has been investigated.

RESULTS AND DISCUSSION: The fish oil contains a satisfactory quantity of long-chain unsaturated acids with 20 and 22 C-atoms with 1,4 and 5 double bonds. The soy oil is rich not only in linoleic acid (52,23 mol.%), but it also contains a satisfactory quantity of linolenic acid (7,16 mol.%). The added oils with their fatty acids spectrum provide the necessary energy content of the mixtures which are getting richer in essential components.

LIPID COMPOSITION OF MUSCULUS TRICEPS BRACHII IN PIGS **Table 1**

Lipid Classes, mg/100g	Control I Period	Control II Period	Control III Period	Trial I Period	Trial II Period	Trial III Period
Total Lipids	2100±140	2390±203	2241±186	2310±134	2296±133	2335±349
TG	1005±126	1376±165	1254±188	1566±237[e]	1208±130	1101±244
Cholesterol	39±3.6	38±1.1	45±2.1	45±1.9	45±2.7	46±2.9
Phospholipids	547±25	636±19[a]	556±33	540±32	746±18[c]	554±33
FFA,nEqv/g	474±98	1491±213	1930±151	334±33	2343±133	3277±223
Fatty Acid Composition of Triacylglicerols, mol. %						
14:0	1.56±0.30	1.22±0.26	2.15±0.64	1.87±0.09	1.53±0.09	1.32±0.22
16:0	28.35±0.93	26.72±0.25	27.60±0.82	28.26±0.73	28.09±0.87	28.30±1.05
16:1	4.71±0.23	5.09±0.15	4.81±0.39	4.71±0.15	4.41±0.36	4.27±0.21
18:0	12.25±0.45	10.95±0.44	11.15±0.23	12.82±0.28	12.60±0.41	12.62±0.41
18:1	46.91±1.55	50.08±0.29	47.69±1.14	44.45±0.98	45.14±0.84	45.57±1.90
18:2	4.86±0.38	3.56±0.23	4.02±0.34	6.41±0.67[e]	5.05±0.65	4.94±0.31
18:3	1.37±0.15	1.40±0.14	1.21±0.07	1.48±0.09	1.53±0.12	1.36±0.17
20:1	0.20±0.09	0.98±0.21	1.38±0.27	0.20±0.08	1.65±0.22	1.01±0.06
Fatty Acid Composition of Free Fatty Acid, mol.%						
14:0	0.85±0.05	1.05±0.19	0.67±0.07	2.42±0.61	0.84±0.17	0.79±0.07
16:0	34.46±0.56	26.58±1.47[a]	22.00±0.41[b]	34.39±1.32	25.28±1.89[c]	20.64±0.66[d]
16:1	2.73±0.66	3.45±0.19	3.03±0.16	2.45±0.26	3.79±0.26	2.49±0.07
18:0	19.33±1.47	11.90±0.36[a]	8.47±0.29[b]	22.56±0.44	10.53±1.02[c]	7.43±0.12[d]
18:1	29.36±2.15	29.53±1.55	24.76±1.23	21.29±1.33[e]	30.03±2.28	24.07±1.12
18:2	3.89±0.99	20.31±0.63[a]	31.05±1.49[b]	7.17±0.45[e]	24.92±0.69[c]	35.83±1.08[d]
18:3	1.98±0.23	1.35±0.10[a]	0.75±0.06[b]	1.67±0.12	1.53±0.15	1.23±0.06[d]
20:1	2.49±0.43	0.84±0.09[a]	0.58±0.05[b]	2.49±0.47	1.03±0.10	1.94±0.72
20:4	4.94±1.17	4.97±0.42	5.56±1.17	2.06±0.22	5.58±0.33	5.57±0.43

a-Control I/Control II; b-Control I/Control III; c-Trial I/Trial II;d-Trial I/Trial III
e-Control I/Trial I; I, II, III - Periods; $P < 0.01$

The values received for TG in m. Triceps brachii (Table 1) are typical for muscules with predominant fibres of oxidative kind. The fat added to the feed mixture of the trial animals increases the level of TG and total lipids, and for the last indise the quantity of phospholipids and cholesterol is of importance. The increased quantity (in certain limits) of TG, the predominant part of which represents intramuscular fat, is a factor with a favoulable effect on the taste and nutritional characteristics of the meat.
Too low is the content of total cholesterol in m. Triceps brachii of the control animals. Not ascertained is the cholesterol-lowering effect of the oils contained in the trial feed mixture. This result does not correspond with the studies of Garg et al. (1988), Huang et al. (1984), Hartog et al. (1987). It could be supposed that the cholesterol-lowering effect of the alimentary long -chain poliens could be manifested more clearly in the cases of higher original level of cholesterol in the tissues.
The fatty acid composition of the muscular TG (Table 1) during the 1st period shows a certain increase in the concentration of 18:2 parallel with a decrease in that of 18:1 for the trial animals in comparison to the control animals. The muscular TG are influenced to a lesser extent by the fatty acid composition of the alimentary fats compared to the adipose tissue TG and the long-chain fatty acids of the fish oil can participate more notably in the polar lipids (Dimitrov et al.,1994; Tsvetkova et al., 1994) as well as undergo "endogen processing".
After storage for 1 and 5 months (2nd and 3rd periods) in the muscular TG and cholesterol of the two groups of animals is observed a tendency towards quality changes due to possible changes in tissue moisture. This corresponds to a certain extent with the comparably small changes in the fatty acid spectrum of TG of the control and trial animals - the high concentration of 18:1 is retained, and the level of 18:2 does not undergo proven changes. This is ascribed to low triacylglicerol lipolitic activity.
The total quantity of FFA in the lipids of m. Triceps brachii of the control and trial animals (Table 1) during the 1st period shows a moderate level of formation and consumption of this metabollit. After storage (2nd and 3rd periods) is observed a reliable increase in the total quantity of FFA in the muscular tissue. The substantial increase in total FFA during storage is predominantly lipolitically based. This is supported by the fact that a vigorous lipase activity could lead to fatty acid spectrum of FFA (2nd and 3rd periods) approximating these of the corresponding TG. The observed proven increase in the share of 18:2 and 20:4 is an indication for the possible participation of muscular phospholipids as "suppliers" of fatty acid residia, having a certain importance for the quality and quantity composition of the muscular FFA. The total content of FFA increase considerably (2nd and 3rd periods) with a simultaneous increase in the degree of unsaturation, which could be attributed to the great participation of muscular phospholipids.

CONCLUSION: The unsaturated fats are of importance for the low quantitative increase in intramuscular TG and this, together with the increase in linoleic acid improves the taste properties of meat. The inclusion of long-chain poliens into the muscular TG is negligibly low. The changes which undergo TG and phospholipids contribute to improved taste properties and food value of m. Triceps brachii. At notably low original levels of cholesterol in the muscles the added fat does not manifest a cholesterol-lowering effect.
After storage, mainly for 5 months, in m. Triceps brachii, as a result of the hydrolysis taking place the content of FFA increases considerably bigger with the uptake in their total unsaturation. This favours the taste properties of meat.
The increase in the lipid content of the feed mixture by the addition of 3% unsaturated oils at the account of the carbohydrate component promotes the incorporation of alimentary lipids and the impact on muscular lipid composition in the desired direction. Changes of this kind can be considered favourable for the consumer, and they are not worsening the opportunities for technological pocessing and storage of the ready products.

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