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EFFECTS OF FISH OIL CONTAINING HIGH LEVEL OF N-3 POLYUNSATURATED FATTY ACIDS ON FATTY ACID COMPOSITION, CHOLESTEROL LEVELS AND TASTY COMPOUNDS OF PORK LOIN

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Background: Polyunsaturated fatty acids (PUFA) can be divided into n-3 and n-6 PUFAs. Since the two groups of PUFA seem to antagonize the action of lipid metabolism in human (Kayama, 1995). it is important to maintain a certain balance between them when they are ingested. Animal products generally contain a large amount of n-6 PUFAs and recent study showed that younger people tended to consume excess amount of n-6 PUFAs (Okuyama, 1990). Enrichment of n-3 PUFAs in animal products is, therefore, beneficial to counterbalance the n-6 PUFAs.

Objectives: Two different fish oils containing high levels of n-3 PUFAs were supplemented to pig diets and the effects of these on fatty acid composition, cholesterol levels and tasty compounds (pH, total peptides, total free amino acids and inosinic acid) in the pork loin were investigated (M.ISHIDA et al, 1996.).

Materials and Methods:
thirty-six LWD pigs were divided into 6 groups (6 animals each). Experiment 1; The animals received 2.5% of purified fish oil added to the basic diet after they reached body weight of 85kg for group A and 75kg for group B, and group C was fed with the basic diet only (control). Experiment 2; The animals of group D and E received 0.8% of vitamin E, and 2.5% sardine oil as well as 0.8% vitamin E, respectively, with the basic diet after the animals reached 85kg of body weight. Group F was treated with the basic diet only (control). After slaughtering these pigs, samples of loin were cut out at the 12th dorsal vertebrae. Fatty acid composition and cholesterol levels were determined by GLC.

Results and discussion:
Total lipid concentration and cholesterol levels are shown in Table 1. There was no significant difference in lipid concentration among the groups in experiment 1 and 2. The cholesterol levels of loins from pigs fed with fish oil supplements (groups A, B and E) were significantly ($P<0.01$) lower than those from pigs that fed without fish oil (group C and F). High value of EPA and DHA in fish oil was estimated to effect to lipid metabolism in the pig body.

Table 1 Concentration of total lipid and cholesterol level in loin

	A group	B group	C group	D group	E group	F group
Total lipid(%)	2.55±0.98	2.90±0.76	3.10±1.20	2.50±0.70	3.06±0.72	1.76±0.44
Cholesterol(mg/100g)	58.21±2.75^a	45.32±7.80^a	83.55±9.80^b	54.24±5.70^a	34.55±4.45^b	62.10±4.80^a

a,b;Means with different superscripts letters between groups are significantly different at $P<0.01$.

Table 2 Fatty acid composition(%) of neutral lipids of loin

Fatty Acid	A group	B group	C group	D group	E group	F group
14:0	1.52±0.14	1.30±0.09	1.33±0.15	1.74±1.02	1.54±0.14	1.34±0.34
16:0	26.77±2.80	25.30±1.03	25.50±1.75	25.87±1.13	26.12±0.82	26.55±7.80
16:1	3.77±0.52	3.37±0.21	2.96±0.98	3.16±0.42	3.31±0.43	2.90±0.53
18:0	13.20±1.92	12.99±1.40	11.41±1.68	12.17±1.08	12.59±1.78	12.08±1.14
18:1	50.07±3.71	51.69±0.58	53.07±1.72	52.19±1.58	51.21±1.66	51.09±5.17
18:2	4.68±1.53	5.35±1.25	5.76±1.87	4.87±0.82	5.24±1.60	4.70±0.87
TUFA	58.52±4.65	60.41±1.55	61.67±2.70	60.22±1.83	59.75±2.51	58.82±6.25

TUFA:Total unsaturated fatty acids

Fatty acid composition and proportion of unsaturated fatty acids in neutral lipid were similar among the groups in both experiments (Table 2). The n-3 PUFAs (EPA,22:5 and DHA) composition in polar lipids in groups A, B and E were significantly ($P<0.01$) higher compared with that of groups C and F (Table 3) and groups A and B had significantly ($P<0.01$) lower 18:2 than group C. The results indicate that n-3 PUFAs contained in the fish oil were transferred to pig meat and the n-6/n-3 ratio became significantly ($P<0.01$) higher. There was no apparent effect of vitamin E on lipid metabolism.

Table 3 Fatty acid composition(%) of polar lipids of loin

Fatty Acid	A group	B group	C group	D group	E group	F group
14:0	1.80±1.11	1.68±0.89	1.67±0.84	1.61±1.06	2.13±0.50	1.91±1.19
16:0	23.82±1.90	23.18±0.69	21.89±2.37	19.91±1.46	21.37±2.35	22.03±2.60
16:1	0.64±0.16	0.91±0.46	0.65±0.33	0.63±0.27	0.65±0.31	0.69±0.37
18:0	15.68±1.54	20.21±1.63	18.83±3.66	16.49±0.96	18.87±1.76	14.70±3.11
18:1	15.16±1.46	14.10±1.62	17.76±2.33	16.75±1.05	14.68±0.69	17.35±1.05
18:2(n-6)	25.45±1.84[a]	23.04±2.25[a]	28.00±1.29[b]	33.10±1.81	26.48±2.32	32.70±2.73
20:4(n-6)	5.78±0.98	5.51±0.73	6.44±1.16	8.99±0.95	6.06±1.49	6.13±1.63
20:5(n-3)	4.32±1.53[a]	5.19±1.44[a]	0.86±0.12[b]	1.58±1.00[a]	3.89±2.46[b]	0.73±0.27[a]
22:5(n-3)	4.96±3.55[a]	2.63±1.11[a]	1.47±0.18[b]	0.36±0.09[a]	1.99±1.18[b]	2.04±1.51[a]
22:6(n-3)	2.47±0.70[a]	3.76±1.55[a]	1.62±0.36[b]	0.59±0.39[a]	3.89±2.72[b]	1.73±0.96[a]
TUFA	58.77±1.85	54.75±0.87	56.81±3.52	61.99±1.79	57.64±3.02	61.39±5.34
PUFA	42.98±2.64	39.93±2.38	38.40±4.60	44.62±1.90	42.31±3.25	43.32±6.10
P/S	1.08±0.14	0.89±0.07	0.92±0.16	1.18±0.10	1.01±0.16	1.12±0.30
n-6/n-3	2.89±0.99[a]	2.73±0.93[a]	8.75±0.85[b]	19.49±8.35[a]	3.83±1.59[b]	11.85±2.55[a]

TUFA:Total of unsaturated fatty acid PUFA:Polyunsaturated fatty acids P/S:Polyunsaturated fatty acid/Saturated fatty acid n-6/n-3:Total n-6 fatty acids/ Total n-3 fatty acids
a,b;Means with different superscripts letters between groups are significantly different at $P<0.01$.

No major differences were observed for pH, total peptides, total free amino acids and inosinic acid among the groups (Table 4). Supplementing with fish oil or vitamin E did not affect flavor of the pork according to the sensory score.

Table 4 Tasty compounds of loin

Tasty Compounds	A group	B group	C group	D group	E group	F group
pH	5.5 ± 0.1	5.5 ± 0.1	5.5 ± 0.1	5.6 ± 0.1	5.7 ± 0.1	5.3 ± 0.1
Total Peptides*	8.06± 2.48	13.55± 3.19	14.41± 4.74	10.93± 3.25	11.62± 3.87	8.96± 1.68
Free amino acids*	110.42±36.41	167.59±43.60	125.49±17.05	111.85±27.56	184.29±53.55	139.26±24.51
IMP(μmol/g)	0.09± 0.02	0.10± 0.01	0.09± 0.01	0.07± 0.01	0.08± 0.02	0.09± 0.01

*Index value of total peptides and total fatty acids value of bovine serum albumin as 100
A group; Addition of 2.5% purified fish oil to basic diet from 85kg body wt.
B group; Addition of 2.5% fish oil to basic diet from 75kg body wt.
C group; Basic diet only(Control)
D group; Addition of 0.8% Vitamin E to basic diet from 85kg body wt.
E group; Addition of 2.5% fish oil and 0.8% Vitamin E to basic diet from 85kg body wt.
F group; Basic diet only(Control)

Conclusion: n-3 polyunsaturated fatty acids contained in the diet were transferred into the polar lipids in pork and this provides nutritional value to pork.

Literniture:

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