

## EFFECT OF DIETARY OILS ON FATTY ACIDS CONTENT IN CHICKEN MEAT

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**Keywords:** chicken meat, diet, composition, fatty acids, PUFA  $\omega$ 6/ PUFA  $\omega$ 3 ratio**Background**

As energy source beside concentrated food, in diets for chicken animal fat or plant oils are added. By usage of fats and oils of different origin in broiler nutrition, content of fatty acids can be significantly changed (Hulan et al., 1989, Chanmugam et al., 1992, Kralik et al., 1996, 1997, Leskanich and Noble, 1997). Because of great significance of polyunsaturated fatty acids (PUFA) in human health issues, especially PUFA  $\omega$  3 such as  $\alpha$ -linolenic ( $\alpha$ LNA), eicosapentaenoic (EPH) and docosahexaenoic (DPH) acid, researches on enrichment of chicken fat with these fatty acids are currently often carried out. New knowledge from developed western countries points out the fact that excessive long term intake of linoleic acid (LA  $\omega$ 6) together with relative deficiency of PUFA  $\omega$ 3 is one of the main risk factors in occurrence of cancer, coronary and cerebrovascular diseases. For this reasons it is important to lower PUFA  $\omega$ 6 / PUFA  $\omega$ 3 ratio in chicken meat as much as possible (Okuyinama i Ikemoto, 1999).

**Objective**

This research was conducted in the aim of investigating the influence of sunflower, rape and fish oil in diet on the profile of fatty acids in the chicken meat. Samples of breast meat and meat of thighs with drumsticks were separately analysed to determine the PUFA  $\omega$ 6 / PUFA  $\omega$ 3 ratio in the most valuable parts of the carcass.

**Material and methods**

The research was conducted on three groups of Ross-208 chicken. Chicken from the first group were fed from the 1<sup>st</sup> until 21<sup>st</sup> day starter diet containing 21.6% crude proteins and 12.54 MJ ME. From 22<sup>nd</sup> until 42<sup>nd</sup> day of fattening period chicken were fed finisher diet balanced at 18.3% crude proteins and 12.43 MJ ME. The diet of the 1<sup>st</sup> group contained, beside other component, 3.5% animal fat, 2<sup>nd</sup> group had 3.5% rape oil and 3<sup>rd</sup> group had 3.5% fish oil added. From the muscles of breast and thighs with drumsticks the skin and visible adipose tissue were carefully removed. Fatty acids content was established by Folch (1957) using Chrompack CP-9000 chromatograph with flame ionisation detector. The content of following fatty acids was examined: C12:0, C14:0, C16:0, C17:0, C18:0, C20:0, C16:1, C18:1, C20:1, C24:1, C18:2 $\omega$ 6, C20:2 $\omega$ 6, C20:4 $\omega$ 6, C18:3 $\omega$ 3, C20:5 $\omega$ 3, C22:5 $\omega$ 3 and C22:6 $\omega$ 3. Statistical analysis was performed using SAS program ver. 6.12.

**Results and discussion**

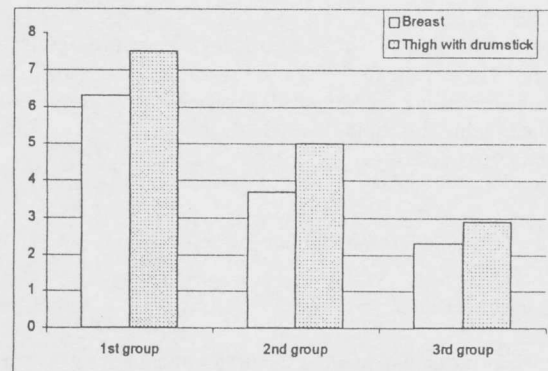
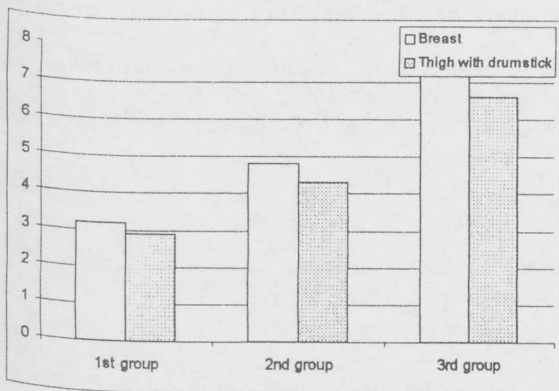
The results of the research are presented on Tables 1 and 2 as well as on Graphs 1 and 2. Statistical analysis of the results showed that breast muscles of all three chicken groups contain different ( $P < 0.05$ ) amounts of saturated fatty acids and that most present ones were palmitic (22.87%, 24.25% and 22.46%) and stearic acid (14.09%, 12.34% and 11.32%). In the group of monounsaturated fatty acids, oleic acid had the highest share (25.70%, 29.59% and 28.53%) while palmitoleic was present in significantly lower quantities (6.20%, 3.35% and 2.66%). Linoleic acid was the most present one in the meat of the chicken from the 1<sup>st</sup> group which was fed sunflower oil added in the diet, followed by 2<sup>nd</sup> group fed rape oil and 3<sup>rd</sup> group with fish oil added in the diet (17.98%, 16.68% and 15.10%, resp.). When viewed in total, the share of PUFA  $\omega$  6 acids in breast meat of 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> group was 20.28%, 18.04% and 17.49%, resp. Decreasing the PUFA  $\omega$  6 content led to increase in PUFA  $\omega$  3 content which was: 3.23%, 4.81% and 7.59%, resp. In PUFA  $\omega$  3 group of fatty acids in the meat of the 1<sup>st</sup> group of chicken dominated docosahexaenoic acid (1.34%), in the meat from 2<sup>nd</sup> group it was  $\alpha$ -linolenic acid (2.25%), and in 3<sup>rd</sup> group the shares of eicosapentaenoic and docosahexaenoic acid (2.18% and 2.76%) were increased. The analysis of fatty acids content in the meat of thighs with drumsticks shows that SFA were less present in this meat than in breast meat (by groups: 35.95%, 36.82% and 35.35%) and that palmitic (21.80%, 23.85% and 22.49%) and stearic acids (12.25%, 11.33% and 10.35%) dominate. MUFA were more present in the meat of thighs with drumsticks than in breast meat. The most present one was oleic acid (28.34%, 29.53% and 30.43%). The content of PUFA  $\omega$  6 was higher in the meat of thighs with drumsticks than in breast meat (22.02%, 21.35% and 19.01%), but PUFA  $\omega$  3 content was a little lower in this meat than in breast meat and by groups was: iznosio 2.91%, 4.27% and 6.63%. PUFA  $\omega$  6/ PUFA  $\omega$  3 ratio was different in the meat between groups of chicken, which demonstrated that used oils in the food had influence on fatty acids composition and their ratio in the meat of chicken. This ratio was in the breast meat as follows: 6.27, 3.75 and 2.30; while in the meat of thighs with drumsticks was 7.56, 5.00 and 2.87.

**Conclusions**

Usage of sunflower oil (1<sup>st</sup> group), rape oil (2<sup>nd</sup> group) and fish oil (3<sup>rd</sup> group) in the diets for broilers resulted in alteration of fatty acids profile in the chicken meat. PUFA  $\omega$  6 were deposited in greater amounts in the meat of thighs with drumsticks, while PUFA  $\omega$  3 in the breast meat. PUFA  $\omega$  6 / PUFA  $\omega$  3 ratio in the breast meat in 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> group was 6.27, 3.75 and 2.30 and in the meat of thighs with drumsticks 7.56, 5.00 and 2.87. Results show that usage of oils of different composition can influence the ratio of fatty acids in the chicken meat.

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Graph 1. Content of PUFA ω3 in chicken meat

Graph 2. PUFA ω6 / PUFA ω3 ratio in chicken meat

Table 1. Fatty acids content in breast meat

Fatty acids*	1 <sup>st</sup> group $\bar{x} \pm s\bar{x}$	2 <sup>nd</sup> group $\bar{x} \pm s\bar{x}$	3 <sup>rd</sup> group $\bar{x} \pm s\bar{x}$
Lauric (C12:0)	0.49 <sup>a</sup> ±0.10	0.34 <sup>b</sup> ±0.12	0.21 <sup>a</sup> ±0.10
Myristic (C14:0)	0.76 <sup>b</sup> ±0.04	0.54 <sup>a</sup> ±0.08	1.53 <sup>c</sup> ±0.06
Palmitic (C16:0)	22.87 <sup>a</sup> ±0.18	24.25 <sup>b</sup> ±0.13	22.46 <sup>b</sup> ±0.12
Heptadecanoic(C17:0)	0.15 <sup>a</sup> ±0.02	0.23 <sup>b</sup> ±0.05	0.35 <sup>c</sup> ±0.03
Stearic (C18:0)	14.09 <sup>b</sup> ±0.53	12.34 <sup>a</sup> ±0.38	11.32 <sup>a</sup> ±0.48
Arachidic (C20:0)	0.30 <sup>b</sup> ±0.02	0.47 <sup>c</sup> ±0.02	0.17 <sup>a</sup> ±0.01
Σ SFA	38.66	38.17	39.04
Palmitoleic (C16:1)	6.20 <sup>b</sup> ±0.15	3.35 <sup>a</sup> ±0.18	2.66 <sup>a</sup> ±0.14
Oleic (C18:1)	25.70 <sup>a</sup> ±0.90	29.59 <sup>b</sup> ±0.80	28.53 <sup>b</sup> ±0.91
Eicosenoic (C20:1)	0.31 <sup>a</sup> ±0.02	0.56 <sup>b</sup> ±0.02	0.51 <sup>b</sup> ±0.02
Nervonic (C24:1)	0.21 <sup>b</sup> ±0.01	0.18 <sup>a</sup> ±0.01	0.45 <sup>c</sup> ±0.03
Σ MUFA	32.42	33.68	32.15
Linoleic (C18:2ω6)	17.98 <sup>b</sup> ±0.55	16.68 <sup>b</sup> ±0.45	15.10 <sup>a</sup> ±0.33
Eicosadien.(C20:2ω6)	0.15 <sup>a</sup> ±0.01	0.18 <sup>b</sup> ±0.01	0.67 <sup>c</sup> ±0.03
Arachidonic (C20:4ω6)	2.15 <sup>b</sup> ±0.02	1.18 <sup>a</sup> ±0.01	1.72 <sup>c</sup> ±0.02
Σ PUFA ω6	20.28	18.04	17.49
Linolenic (C18:3ω3)	0.74 <sup>a</sup> ±0.04	2.25 <sup>b</sup> ±0.03	0.85 <sup>b</sup> ±0.05
Eicosapent.(C20:5ω3)	0.32 <sup>a</sup> ±0.03	0.31 <sup>a</sup> ±0.02	2.18 <sup>b</sup> ±0.03
Docosapent.(C22:5ω3)	0.83 <sup>a</sup> ±0.18	0.79 <sup>a</sup> ±0.21	1.80 <sup>b</sup> ±0.21
Docosahex.(C22:6ω3)	1.34 <sup>a</sup> ±0.22	1.46 <sup>a</sup> ±0.25	2.76 <sup>b</sup> ±0.15
Σ PUFA ω3	3.23	4.81	7.59
PUFA ω6 / PUFA ω3	6.27	3.75	2.30
PUFA / SFA	0.61	0.47	0.45
PUFA / MUFA	0.72	0.68	0.78
MUFA / SFA	0.84	0.88	0.82

Table 2. Fatty acids content in meat of thighs and drumsticks

Fatty acids*	1 <sup>st</sup> group $\bar{x} \pm s\bar{x}$	2 <sup>nd</sup> group $\bar{x} \pm s\bar{x}$	3 <sup>rd</sup> group $\bar{x} \pm s\bar{x}$
Lauric (C12:0)	0.45±0.10	0.32±0.08	0.23±0.10
Myristic (C 14:0)	0.94±0.05	0.65±0.06	1.75 <sup>b</sup> ±0.09
Palmitic (C16:0)	21.80 <sup>a</sup> ±0.22	23.85 <sup>c</sup> ±0.12	22.49 <sup>b</sup> ±0.01
Heptadecanoic (C17:0)	0.16 <sup>a</sup> ±0.01	0.22 <sup>b</sup> ±0.04	0.34 <sup>c</sup> ±0.02
Stearic (C18:0)	12.25 <sup>c</sup> ±0.52	11.33 <sup>b</sup> ±0.40	10.35 <sup>a</sup> ±0.39
Arachidic (C20:0)	0.35 <sup>c</sup> ±0.01	0.49 <sup>b</sup> ±0.02	0.19 <sup>a</sup> ±0.01
Σ SFA	35.95	36.82	35.35
Palmitoleic (C16:1)	6.35 <sup>c</sup> ±0.15	4.58 <sup>b</sup> ±0.16	3.98 <sup>a</sup> ±0.14
Oleic (C18:1)	28.34 <sup>a</sup> ±0.90	29.53 <sup>b</sup> ±0.75	30.43 <sup>b</sup> ±0.63
Eicosenoic (C20:1)	0.45 <sup>a</sup> ±0.02	0.59 <sup>b</sup> ±0.04	0.60 <sup>c</sup> ±0.02
Nervonic (C24:1)	0.65 <sup>c</sup> ±0.01	0.63 <sup>c</sup> ±0.03	0.49 <sup>a</sup> ±0.02
Σ MUFA	35.79	34.33	35.50
Linoleic (C18:2ω6)	19.65 <sup>b</sup> ±0.31	18.95 <sup>b</sup> ±0.43	16.81 <sup>a</sup> ±0.32
Eicosadien.(C20:2ω6)	0.32 <sup>b</sup> ±0.01	0.25 <sup>a</sup> ±0.01	0.67 <sup>c</sup> ±0.09
Arachidonic (C20:4ω6)	2.05 <sup>b</sup> ±0.02	2.15 <sup>c</sup> ±0.03	1.53 <sup>a</sup> ±0.02
Σ PUFA ω6	22.02	21.35	19.01
Linolenic (C18:3ω3)	0.83 <sup>a</sup> ±0.04	2.35 <sup>b</sup> ±0.03	0.89 <sup>a</sup> ±0.05
Eicosapent.(C20:5ω3)	0.30 <sup>a</sup> ±0.01	0.29 <sup>a</sup> ±0.02	2.19 <sup>b</sup> ±0.12
Docosapent.(C22:5ω3)	0.75 <sup>b</sup> ±0.02	0.53 <sup>a</sup> ±0.02	1.59 <sup>c</sup> ±0.21
Docosahex.(C22:6ω3)	1.03 <sup>a</sup> ±0.02	1.10 <sup>a</sup> ±0.02	1.96 <sup>b</sup> ±0.19
Σ PUFA ω3	2.91	4.27	6.63
PUFA ω6 / PUFA ω3	7.56	5.00	2.87
PUFA / SFA	0.69	0.69	0.72
PUFA / MUFA	0.69	0.75	0.72
MUFA / SFA	0.99	0.93	1.00

\*% in total fatty acids; SFA - saturated fatty acids; MUFA - monounsaturated fatty acids; PUFA - polyunsaturated fatty acids  
<sup>a, b, c</sup> Means in the same row with different superscripts differ (P<0.05)

\*% in total fatty acids; SFA - saturated fatty acids; MUFA - monounsaturated fatty acids; PUFA - polyunsaturated fatty acids  
<sup>a, b, c</sup> Means in the same row with different superscripts differ (P<0.05)