

The Rapeseed Oil Impact on Broiler Chicken Meat Quality

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Abstract

Consumer demand for healthy, qualitative poultry meat products continues to increase.

Safe, healthy and good quality broiler chicken meat has characteristics of high content of polyunsaturated fatty acids (omega-3 and omega-6), vitamins, antioxidants (carotenoids) and mineral substances and low levels of saturated fatty acids and cholesterol.

Rapeseed and soybean oils are almost equivalent according to omega-3 fatty acids content (9.0% and 8.0%), but rapeseed oil contains in comparison with soybean oil less amount of omega-6 fatty acids (20.0%, 54.0% correspondingly) of total lipids – difference by 34%.

Rapeseed oil contains the most balanced amount ratio of omega-3 and omega-6 fatty acids, i.e. 1:2.8, soybean oil 1:6.8. It is rapeseed oil is favourable for broiler chicken organism. In this aspect the research aim is to evaluate the rapeseed oil impact on broiler chicken meat quality.

The feeding trial carried out with cross ROSS 308 broiler chickens at the age from 1 to 42 days (n=300). Broiler chickens were divided into 2 groups: Group 1 – control and Group 2 – trial.

To broiler chickens of the control group was fed out with basic feed containing 4% soybean oil. To broilers of the trial group was fed out basic feed with 2% rapeseed oil and 2% soybean oil.

During the trial period broiler chickens productivity was high. The average live weight for broiler chickens of sales age ranged between 2609 and 2701 g, feed conversion 1.89 and 1.79 kg kg⁻¹. In trial group the live weight of broiler chickens was higher by 3.5% and feed conversion was less by 5.3% in comparison with control group.

The amounts of omega-3 and omega-6 fatty acids in trial group broiler chicken meat were higher by 2.8% and 6.2% of total lipids in comparison with control group. The content of fatty acids in broiler muscle tissue mass was positively influenced by the amount and composition of fatty acids in rapeseed oil.

Cholesterol level in broiler chickens meat has a close connection with the composition and amount of fatty acids in rapeseed oil. Cholesterol level in trial group broiler chicken meat was by 0.20 g kg⁻¹ less in comparison with control group.

By vegetable oil supplement in combination of 2% of rapeseed oil and 2% soybean oil to broiler chickens feed it is possible to increase the content of omega-3 and omega-6 fatty acids and decrease cholesterol level in broiler chicken meat.

Key words: rapeseed oil, soybean oil, fatty acids, broiler chicken, meat quality

Introduction

Poultry products are universally popular and in recent years the consumption of especially qualitative poultry meat has risen dramatically. Qualitative and healthy poultry meat is characteristic with high content of polyunsaturated fatty acids (omega-6 and omega-3), vitamins and mineral substances, and low levels of saturated fatty acids and cholesterol (Holub, 2002). Hence the current goal for poultry meat production is not to increase the quantity of poultry output, but to increase the production of qualitative and innovative poultry products. Innovative and qualitative food-stuff contains biologically active substances (omega group fatty acids, selen, carotenoids, et.al.), which favourably influence vital functions of human body, reduce risk factors of different diseases and promote health preservation (Haug, et al., 2007). Intake of omega group fatty acids with nutrients enables metabolism of cholesterol in human body, and averts risk factors causing cardiovascular, tumour, rheumatic, and other diseases (Zariņš, Neimane, 2002). The amount of fatty acids of feed has no proportional relation to the content of fatty acids in broiler chicken meat, as a certain transition stage of fatty acids from the amount of fatty acids in feed to the content of fatty acids in production output exists in an avian organism (Leskanich, Noble, 1997).

To produce broiler chicken meat with higher amount of fatty acids, enriched poultry feed with fatty acids containing feedstuffs: flaxseed and rapeseed oils (Harris, 2000).

The research aim is to evaluate the rapeseed oil impact on broiler chicken meat quality in combination with soybean oil.

Results

The production broiler chicken meat, which compared with conventional composition broiler chicken meat contains an increased omega-6 (linoleic acid) and omega-3 (linolenic acid) content requires avian feed that consists of fatty acid containing feeding stuff – seed oils (rapeseed, soya bean). Thus the content of omega-6 and omega-3 fatty acids was assessed in locally produced (in Latvia) rapeseed oil. The content of these fatty acids in imported soya bean oil frequently used in poultry farming was analysed comparatively (Table 1).

Table 1

Content and ratio of fatty acids in vegetable oils

Parameters	Omega-3 (ω -3) linolenic acid, %	Omega-6 (ω -6) linoleic acid, %	ω -3: ω -6 ratio
Rapeseed oil	9.0	20.0	1 : 2.8
Soya bean oil	8.0	54.0	1 : 6.8

The largest omega-3 fatty acid content was observed in rapeseed oil amounting to 9% while the largest omega-6 amount is observed in soya bean oil amounting to 54%, if calculated in per cent of the total lipid amount. The amount of omega 3 and omega 6 fatty acids ratio is better rapeseed oil. The evaluated feeding stuff may be included into the poultry feed (according to the standards) only in a certain amount. The standards determine and practical poultry farming applies optimum feeding stuff doses admissible for avian organism, including also the studied oils that are allowed to add to the poultry feed in the amount of 4%. In conventional poultry feeding used soya bean oil.

In the summer of 2009 a feeding trial was carried with cross ROSS 308 broiler chicken (n=300) in the vivarium of Physiology Block of the Research Institute of Biotechnology and Veterinary Medicine "Sigrā", Latvia University of Agriculture. The trial with broiler chickens lasted for 42 days. Broiler chickens were divided into 2 groups: Group 1 – control and Group 2 – trial. Broiler chickens from the two groups were fed with the basic feed (BF) of the same content. Feed content for production of especially qualitative - innovative composition (increase amount of ω -3 and ω -6 group fatty acids, decrease amount of cholesterol) broiler chicken meat is shown in Table 2.

Table 2

Trial scheme for rapeseed oil impact on broiler chicken meat quality (content of fed feed for chicken from 1 to 42 days of age)

Group	Feeding programme	Linoleic acid content in feed
Group 1-control	BF – Basic feed	1.50
Group 2 - trial	BF+2% soya bean oil+2% rapeseed oil	1.93

The content of basic feed for broiler chickens of all groups is balanced in compliance with the requirements of cross ROSS 308 standards.

Productivity of broiler chickens during the trial period was evaluated by accounting:

- live weight of broilers, weighting each bird individually at the age of 7, 14, 21, 28, 35 and 42 days;
- feed consumption – weighting feed every day by groups;
- survival – dead birds were counted every day.

The analysis comprised the amount of omega-3 and omega-6 fatty acids in broiler meat of 42 days old (sales age) broiler chickens. The analysis was carried at the accredited biochemistry research laboratory of the Research Institute of Biotechnology and Veterinary Medicine "Sigrā", Latvia University of Agriculture by means of a gas chromatograph (HP 6890).

During the trial period broiler productivity was high. The average live weight for broilers of sales age ranged between 2609-2701 g.

Table 3
Productivity of a broiler chicken

Parameters	Group 1 - control	Group 2 - trial
Broiler chicken live weight at the age of 42 days, g	2609 ±33.14	2701±37.17
% to control	100	103.5
Feed consumption for production of 1 kg live weight, kg	1.89	1.79
% to control	100	94.70

p<0.001

By using rapeseed oil in combination with soya oil increase live weight by 3.5% and decrease feed conversion by 5.3% in comparison with control group.

By feeding broiler chicken with feed contained rapeseed oil it is possible to increase the content of omega-3 and omega-6 fatty acids and decrease cholesterol level in broiler chicken meat.

The obtained data from broiler chicken meat with increased amount of omega-3 and omega-6 fatty acids are shown in Table 4.

Table 4
Quality indices of broiler chicken meat

Parameters	Group 1 - control	Group 2 - trial	± to control
∑ omega-6 (ω-6) fatty acids, % of total lipids	10.0±0.05	16.2±0.07	+6.2
∑ omega-3 (ω-3) fatty acids, % of total lipids	2.6±0.01	5.4±0.02	+2.8
Cholesterol, gkg ⁻¹	0.66±0.82	0.46±0.37	-0.20

Feeding broiler chicken with feed of conventional amount of 4% soya bean oil (Group 1) broiler chicken meat contains 10.0% of omega-6 and 2.6% of omega-3 fatty acids as calculated in per cent of total lipids and 0.66 g kg⁻¹ cholesterol. Adding 2% of rapeseed oil in combination with 2% of soya bean oil in the trial broiler chicken feed (Group 2), the level of omega-6 fatty acids increases to 16.2% (by 6.2% more than for Group 1) and the level of omega-3 fatty acids grows up to 5.4% (by 2.8% more than for Group 1). Cholesterol level in trial group broiler chicken meat decreases to 0.46 g kg⁻¹ – by 0.20 g kg⁻¹ less in comparison with control group.

Conclusions

1. Rapeseed oil contains the most balanced amount ratio of omega-3 and omega-6 fatty acids, i.e. 1:2.8 in comparison with soya bean oil. The rapeseed oil is favourable for broiler chicken organism.
2. By vegetable oil supplement in combination of 2% of rapeseed oil and 2% soybean oil to broiler chickens feed to increase the content of omega-3 and omega-6 fatty acids by 2.6% and 6.2% of total lipids and decrease cholesterol level in broiler chicken meat by 0.2 g kg⁻¹.
3. By using rapeseed oil in combination with soya bean oil the live weight of broiler chickens was higher by 3.5% and feed conversion was less by 5.3% in comparison with soya bean oil.

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