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Effect of three types of oils on intramuscular fat composition of fattened cockerels

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Abstract: The aim of the study was to assess the effect of selected vegetable oils on the representation of dietary fatty acids in the muscle of broiler cockerels. The experiment included three groups of one-day-old cockerels of ROSS 308 genotype, 15 individuals each. The feed mixture and drinking water were fed to the cockerels, *ad libitum*. In accordance with the technological instructions for the hybrid combination ROSS 308, BR1 was fed to chickens up to 9 days of age with the same nutrient and oil (soybean) composition for all three groups. From day 10 to day 28 of fattening the chicks were fed BR2 and from day 29 to day 35 BR3. The components and composition of the BR2 and BR3 feeds were identical; feed mixtures differed only in oil, soybean oil was added to Group 1 (SBO), rapeseed oil to Group 2 (RSO) and sunflower oil to Group 3 (SFO). Cockerels were fed until 35 days of age and then slaughtered. Breast and thigh muscles were collected from 10 individuals from each group to determine total fat in which individual fatty acid (FA) analysis was performed. Based on the obtained results, rapeseed oil can be clearly recommended for broiler chickens in feed mixtures, for the reasons that the cockerels from the RSO group showed the highest live weight (35 days of fattening), had the lowest feed conversion ratio, had an increased n-3 FAs content in the intramuscular fat (breast and thigh), and the narrowest n-3 : n-6 FAs ratio in the intramuscular fat (breast and thigh).

Keywords: fatty acids; rapeseed oil; ROSS 308; soybean oil; sunflower oil

The world's human population is increasing linearly and so does the need for food. However, attention is not only paid to the quantity of food produced but also to the quality and healthiness, including the influence of the economy, which plays a significant role and influences food prices on the world market. For these reasons, agriculture focuses on those sectors that can produce quality food in a short period. In the area of livestock production, it is mainly fish and poultry farming (FAO 2021).

Animal health, as well as the quantitative and especially qualitative aspects of animal performance, can be affected up to 70% by nutrition (Zhaleh et al.

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2019). Feed quality is essential to ensure adequate growth and development of animals and obtain high-quality products intended for human consumption. Feed is one of the main costs in animal breeding, and understanding the impact of a nutrition strategy on the quality and marketability of animals and their products is essential for the profitability of livestock farming (Szollosi et al. 2021). The contemporary trend towards a healthy lifestyle offers new opportunities to find markets for foodstuffs whose content of specific substances prevents civilization diseases or at least reduces their incidence. Producers often focus on producing foods with increased levels of unsaturated fatty acids which are beneficial to human health. Unsaturated fatty acids have an anti-atherosclerotic effect (Rudel et al. 1998). Lunn and Theobald (2006) reported a positive effect of n-3 PUFA also in the treatment of other diseases such as arthritis, nephritis, multiple sclerosis, asthma and skin diseases. To prevent civilization diseases in humans, WHO (2003) recommended (with special emphasis on the ischemic disease of the heart, diabetes and cardiovascular disorders) that the share of fat in food be reduced to 15% to 30% of the overall daily energy intake. Out of this amount of fat, the saturated fatty acids should represent less than 10%, and the quantity of unsaturated fatty acids should keep between 6% and 10%. The quantities of PUFA n-3 and n-6 should range from 1% to 2%, or 5% to 8%, respectively, of the entire amount of fat ingested.

One way to increase the unsaturated fatty acid content of livestock meat is to add vegetable oils to feed pigs (Liu et al. 2018), rabbits (Morshedy et al. 2021), poultry (Kutlvasr et al. 2022) or fish (Zakes et al. 2010). As Mostafa et al. (2013) state, vegetable oils differ in their composition of unsaturated fatty acids. The oils selected for this study (soybean, rapeseed, sunflower) are those that are the most commercially available on the market in our conditions and are also favourable in price.

The aim of the study was to assess the effect of selected vegetable oils (soybean, rapeseed, sunflower), as an energy component of feed mixtures for broiler chickens, on the representation of dietary fatty acids in the muscle of broiler chickens, especially from the group of n-3 and n-6 fatty acids. The hypothesis was the expected variation in fatty acid concentrations in broiler chicken muscle according to different dietary oil sources (soybean, rapeseed, sunflower) in broiler chicken diets.

MATERIAL AND METHODS

The experiment included three groups of one-day-old cockerels of the ROSS 308 breed, 15 individuals each. When calculating the number of individuals per unit area, the standard of 15 individuals/1 m^2 or 30 kg/1 m^2 area was respected. The cockerels were fattened on deep litter in accordance with the technological instructions for fattening ROSS 308 chickens. Wood shavings were chosen for the deep bedding. The light regime was 23 h of light and 1 h of darkness at the beginning of the fattening, and 18 h of light and 6 h of darkness during the growing phase. The feed mixture and drinking water were fed to the cockerels, *ad libitum*. In terms of nutrition, three pelleted commercially produced complete feed mixtures (BR1, BR2, BR3) were fed. In accordance with the technological instructions for the hybrid combination ROSS 308, BR1 was fed to chickens up to 9 days of age with the same nutrient and oil (soybean) composition for all three groups. From day 10 to day 28 of fattening the chicks were fed BR2 and from day 29 to day 35 BR3. The components and composition of the BR2 and BR3 feeds were identical; feed mixtures differed only in oil, soybean oil was added to Group 1 (SBO), rapeseed oil to Group 2 (RSO) and sunflower oil to Group 3 (SFO). Vegetable oil was added to the feed mixtures in the following amounts: 4.2%/kg (SBO), 5.5%/kg (RSO) and 5.3 %/kg (SFO). The feed conversion was calculated from the *ad libitum* consumption of feed mixtures for each group and from the data on the live weight achieved by broiler monitoring. See Table 1 for the representation of each FA group in particular feed mixtures. Cockerels were fed until 35 days of age and then slaughtered. Breast and thigh muscles were collected from 10 individuals from each group to determine total fat in which individual fatty acid (FA) analysis was performed. The selection of cockerels in the study groups prior to slaughter was random due to the low variability within a particular group.

The left pectoral and femoral muscles were chosen for analysis, which was performed on each part separately. In the breast and thigh muscles, total fat was determined by the extraction procedure using the Ankom XT10 Fat Analyzer (O.K. SERVIS BioPro). Fatty acid content was determined by gas chromatography using a GC 2010 Gas Chromatograph Shimadzu instrument (Shimadzu company, Japan) with an automatic injection sys-

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Table 1. Mean values of FA groups in feed mixtures BR1, BR2, BR3 (g/kg)

g/kg	ΣSFA	ΣUFA	SFA : UFA	ΣMUFA	ΣPUFA	Σn-6 FA	Σn-3 FA	n-3 FA : n-6 FA
BR1 (SBO)	6.8	33.8	1 : 4.9	9.9	24.0	21.8	2.2	1 : 9.8
BR2 (SBO)	8.6	45.3	1 : 5.3	13.1	32.2	29.7	2.5	1 : 11.8
BR2 (RSO)	6.4	49.4	1 : 7.7	29.7	19.6	17.1	2.5	1 : 6.8
BR2 (SFO)	7.0	48.7	1 : 6.9	13.0	35.7	34.8	0.9	1 : 38.3
BR3 (SBO)	8.0	46.1	1 : 5.8	14.7	31.3	28.1	3.2	1 : 8.7
BR3 (RSO)	6.8	48.0	1 : 7.1	24.9	23.1	20.0	3.1	1 : 6.5
BR3 (SFO)	6.6	44.2	1 : 6.7	13.7	30.5	28.5	2.0	1 : 14.1

BR1-3 = types of feed mixtures; RSO = group with the addition of rapeseed oil; SBO = group with the addition of soybean oil; SFO = group with the addition of sunflower oil

tem, flame ionization detector. A 60 mVB WAX capillary separation column was used for the determination of fatty acids, the internal diameter of the column was 0.25 mm and the thickness of the polyethylglycolene film was 0.25 µm, with the addition of an internal standard (methyl pentadecanoate). The retention time of the peak and the peak area of the internal standard were used to express fatty acids. These particular FA were determined: saturated fatty acids (SFA) – C4:0, C6:0, C8:0, C10:0, C11:0, C12:0, C13:0, C14:0, C15:0, C16:0, C17:0, C18:0, C20:0, C21:0, C22:0, C23:0, C24:0; monounsaturated fatty acids (MUFA) – C14:1, C15:1, C16:1, C17:1, C18:1n9t, C20:1n9, C22:1n9, C24:1; n-6 polyunsaturated fatty acids (n-6 PUFA), C18:2n6c, C18:3n6, C20:2n6, C20:3n6, C20:4n6, C22:2n6, C22:4n6; n-3 polyunsaturated fatty acids (n-3 PUFA), C18:3n3, C20:3n3, C20:5n3, C22:6n3, C22:5n3. The content of each FA was calculated and expressed as their sum (ΣFA) in dry matter of breast and thigh muscle, according to the individual groups: ΣSFA, ΣUFA, ΣMUFA, ΣPUFA, Σn-6 PUFA) and Σn-3 PUFA) and SFAs : UFAs and n-3 : n-6 FAs ratios.

The obtained results were processed by statistical methods using Unistat v5.6 for Excel. Evaluation of mean values and their differences was performed by multiple comparisons using the Tukey-HSD test at a significance level $P \leq 0.05$ (^{ab}). Each indicator is characterized by the average value (x) and standard deviation (±).

Welfare statement

The experiment was carried out in an accredited stable of VETUNI Brno in accordance with current legislative rules and approved by the Ethics Committee of the Central Commission for Animal Welfare at the Ministry of Agriculture of the Czech Republic.

RESULTS

Production parameters

At the end of the fattening period, the average weight of the group SBO was 2.26 ± 0.18 kg, RSO 2.32 ± 0.16 kg and the group SFO 2.19 ± 0.21 kg (see Table 2). The SFO group also had the highest feed conversion ratio (1.86 kg.kg^{-1}) compared to SBO (1.77 kg.kg^{-1}) and RSO (1.75 kg.kg^{-1}) groups. There was zero mortality in all groups throughout the experiment.

FAs in the feed mixture

Different FA content of the added oils also influenced the FA content of the feed mixtures. The feed mixtures (BR2 and BR3) with soybean oil (group

Table 2. The average weight of cockerels on the 35th day of fattening, n = 15

Group	Mean weight (kg)	FCR (kg.kg^{-1})	Mortality (individuals)
SBO	2.26 ± 0.18	1.77	0
RSO	2.32 ± 0.16	1.75	0
SFO	2.19 ± 0.21	1.86	0

FCR = feed conversion ratio; RSO = group with the addition of rapeseed oil; SBO = group with the addition of soybean oil; SFO = group with the addition of sunflower oil

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SBO) contained the highest values of SFA. No organic acids (C4:0, C11:0, C15:0 and C21:0) were detected in the feed mixtures (or their content was below the detection limit). The other SFAs, C16:0 (ranging from 72.0% to 76.9%) and C18:0 (ranging from 16.2% to 21.8%) were the most abundant in all the feed mixtures. The sum of C16:0 and C18:0 was ranging between 90.9% to 93.4%.

FAs from the MUFA group were also significantly represented in the diets (Table 1). FAs C14:1 and C15:1 were not detected (or were below the detection limit) in all three feed mixtures. The highest values of MUFA were present in the feed mixtures in which rapeseed oil (group RSO) was used 29.7 g/kg (BR2) and 24.9 g/kg (BR3). Among the MUFAs, C18:1n9 was the most abundant acid (ranging from 97.1% to 98.3% of the ∑MUFAs).

Regarding the n-6 PUFA group, the highest content of these acids was found in feed mixtures (BR2 and BR3) with the addition of sunflower (34.8 g/kg and 28.5 g/kg) and soybean oil (29.7 g/kg and 28.1 g/kg), Table 1. On the other hand, the n-6 PUFAs content was significantly lower in feed mixture containing rapeseed oil (BR2 and BR3 17.1 g/kg and 20.0 g/kg, respectively). PUFA C18:3n6, C20:3n6, C22:2n6 and 22:4n6 were not detected (or were below the detection limit). C18:2n6 was the most abundant n-6 PUFA in the feed mixture.

FAs from the n-3 PUFA group were the least represented in the diets (Table 1). The results show that the most suitable sources of n-3 PUFAs in feed mixtures are soybean oil (2.5 g/kg and 3.2 g/kg) and rapeseed oil (2.5 g/kg and 3.1 g/kg) compared to sunflower oil (0.9 g/kg and 2.0 g/kg). Only C18:3n3 FA was detected in the feed mixtures BR2 and BR3, the others n-3 PUFAs (C20:3n3, C20:5n3, C22:6n3 and C22:5n3) were not detected (or were below the detection limit).

The ratio of n-3 : n-6 FAs varied widely among groups of fed cockerels but the most appropriate ratio was in the both SFO group (1 : 6.8 and 1 : 6.5) BR2 and BR3 groups.

FAs in the intramuscular fat

SFA C4:0, C11:0, C13:0, C15:0, C21:0, C23:0 and C24:0 were not detected (or were below the limit of detection) in cockerel muscle. Within ∑SFAs

Table 3. Mean values of ∑SFAs, ∑UFAs, ∑MUFAs, ∑PUFAs, ∑n-6 FAs, ∑n-3 FAs in breast and thigh muscle of ROSS 308 broiler cockerels (g/kg), including standard deviation (±), $P \leq 0.05$ (^{ab}), $n = 10$

Group	∑SFAs	∑UFAs	SFAs : UFAs	∑MUFAs
Breast muscle				
SBO	12.6 ± 3.2	31.3 ± 9.0	1 : 2.5	17.9 ± 5.8
RSO	13.4 ± 7.0	29.5 ± 11.8	1 : 2.2	19.6 ± 7.9
SFO	12.1 ± 5.0	28.6 ± 11.9	1 : 2.4	16.4 ± 7.9
Thigh muscle				
SBO	70.4 ± 11.5	190.7 ± 35.3	1 : 2.7	112.3 ± 24.9
RSO	61.9 ± 13.1	177.7 ± 36.8	1 : 2.9	125.9 ± 26.4
SFO	72.6 ± 12.4	189.3 ± 30.6	1 : 2.6	114.2 ± 22.1
Group	∑PUFAs	∑n-6 FAs	∑n-3 FAs	n-3 : n-6 FAs
Breast muscle				
SBO	13.3 ± 3.6	12.1 ± 3.3	1.3^{a} ± 0.3	1 : 9.3
RSO	9.9 ± 6.0	8.6 ± 5.5	1.3^{a} ± 0.5	1 : 6.9
SFO	12.2 ± 4.7	11.4 ± 4.4	0.8^{b} ± 0.3	1 : 14.5
Thigh muscle				
SBO	78.4^{a} ± 14.6	69.8^{a} ± 10.7	8.6^{a} ± 6.4	1 : 8.1
RSO	51.8^{b} ± 11.4	45.5^{b} ± 10.0	6.3 ± 1.5	1 : 7.2
SFO	75.1^{a} ± 12.1	71.1^{a} ± 11.4	3.9^{b} ± 0.7	1 : 18.1

RSO = group with the addition of rapeseed oil; SBO = group with the addition of soybean oil; SFO = group with the addition of sunflower oil

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(Table 3), there were no statistically significant differences between the mean values of their content in either breast or thigh muscle. SFA C16:0 and C18:0 were the most abundant in both breast and thigh muscles. In a dry matter of breast muscle were the average C16:0 values 9.6 g/kg (SBO), 8.1 g/kg (RSO) and 9.0 g/kg (SFO); and in thigh muscle 54.9 g/kg (SBO), 48.9 g/kg (RSO) and 56.4 g/kg (SFO). The content of C18:0 in dry matter of breast muscle was 2.8 g/kg (SBO), 4.8 g/kg (RSO) and 2.8 g/kg (SFO); and in thigh muscle 13.9 g/kg (SBO), 11.5 g/kg (RSO) and 14.5 g/kg (SFO).

In the ∑MUFA group, there were no statistically significant differences in either breast or thigh intramuscular fat between the groups (Table 3). In the fat of the cockerel muscle, C15:1 acid was not detected (or was below the detection limit). Contrarily the most abundant acids in the fat of breast and thigh muscle were C16:1 and C18:1. In the dry matter of the muscle, the mean values of C16:1 in the breast muscle were 1.9 g/kg (SBO), 1.5 g/kg (RSO), and 1.8 g/kg (SFO), and in the thigh muscle, 16.6 g/kg (SBO), 12.9 g/kg (RSO) a 14.2 g/kg (SFO). The dominant C18:1 acid contents were 15.8 g/kg, 16.3 g/kg and 14.3 g/kg in breast muscle and 97.2 g/kg, 111.2 g/kg and 98.6 g/kg in thigh muscle (in order SBO, RSO, SFO).

In the n-6 FAs group, there were no statistically significant differences in the fat of the breast muscle of the cockerels between the groups. In the thigh fat of cockerels (Table 3), the mean ∑n-6 FA were conclusively ($P \leq 0.05$) highest in cockerels fed SBO and SFO diets during fattening. C22:2n6 acid was not detected in the intramuscular fat of the cockerels. Within the groups of studied cockerels, C18:2n6 acid was dominant in intramuscular fat (breast and thigh), in breast fat (10.4 g/kg, 7.1 g/kg and 9.3 g/kg) and in thigh fat (63.7 g/kg, 41.2 g/kg and 64.7 g/kg) in order SBO, RSO, SFO). The mean C18:2n6 value (41.2 g/kg) in the thigh muscle of the RSO group was significantly ($P \leq 0.05$) lower compared to groups SBO and SFO.

The results on the n-3 FAs content in cockerel muscle may be considered the most interesting. In intramuscular fat (breast and thigh), the mean ∑n-3 FAs content was statistically significant ($P \leq 0.05$) the lowest in cockerels from the SFO group, compared to the other two groups (Table 3). C18:3n3 acid was found to be the predominant FA in breast and thigh muscle, representing 65.4%, 55.8%, and 53.5% of the total n-3 FA content in breast muscle (SBO, RSO, SFO) and 85.3%, 79.3%, 79.4% in thigh muscle. The second most abundant n-3 FA was C22:5n3 in breast muscle (16.2% 19.8% and 21.4%) and thigh muscle (7.6%, 10.9% and 11.5%) and the third most abundant was C22:6n3 FA 9.8%, 13.6% and 15.1% in breast muscle and 3.6%, 5.1% and 4.8% in thigh muscle of the ∑n-3 FAs content (group order SBO, RSO, SFO again).

The ratio of n-3 : n-6 FAs differed the most noticeably between groups RSO and SFO (both breast and thigh intramuscular fat) and by contrast very slight difference was between SBO and RSO groups (1 : 9.3 and 1 : 6.9 respectively in breast muscle and 1 : 8.1 and 1 : 7.2 thigh muscle).

DISCUSSION

The results on the yield of the fattened cockerels show that the highest performance was achieved by the cockerels in the group RSO. The cockerels in this group had the highest live weight (35th day of fattening) compared to the cockerels from the SBO and SFO groups. Nguyen et al. (2003) also proved that feeding a diet with rapeseed oil did not significantly affect body weight gain or feed conversion ratio negatively. The overall evaluation shows that the cockerels from group RSO achieved the highest performance.

Furthermore, the results show that the type of oil used in the feed mixtures also influenced the content of the different fatty acid groups in the mixtures. The highest levels of SFAs were in group SBO (8.6 g/kg BR2) and 8.0 g/kg of the blend (BR3). The results show that the feed mixtures (BR2 and BR3) in which rapeseed oil was used as the main source of fat contained significantly higher MUFA content (twice as high) compared to the feed mixtures containing soybean or sunflower oil. The same conclusions were reached by Abbasi et al. (2020) in the trial with 480 male broiler chicks. Their results indicated that at 1–42 days of age, growth performance and carcass yield of birds were not influenced by dietary plant oils and moreover dietary rapeseed oil supplementations decreased saturated fatty acid ($P < 0.01$) and increased unsaturated fatty acid and unsaturated to saturated fatty acids ratio ($P < 0.01$). From this point of view, rapeseed oil can be considered as an important source of MUFA in feed mixture, especially C18:1n9, which is the dominant MUFA. This acid accounted for 97.1% to 98.3% of the ∑MUFA.

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The n-6 FAs group formed the largest proportion of the total FAs content in all types of diets. The dominant acid was C18:2n6, which accounted for more than 99% of the n-6 FAs. The results indicate that the oils tested represent a significant source of n-6 FA, especially sunflower and soybean oils. Not only the addition of oil, but also a change in the protein source can affect the final product.

Essential nutrients often deficient in feed mixtures are n-3 FA. Their significantly higher content was observed in mixtures containing soybean and rapeseed oil compared to mixtures with sunflower oil. C18:3n3 was the only acid found in the compound feed. From these results it can be concluded that soybean and rapeseed oil are important sources of n-3 FA in compound feed, which was also mentioned by Skrivanova et al. (2017) studying the impact of the method of rearing and in combination with the use of rapeseed oil in the diet. They found out that a higher content of n-3 FA in chicken was affected by rapeseed oil in the diet. From a dietetic point of view, the quality of fats in feed mixture cannot be evaluated solely based on the content of individual fatty acid groups, but primarily based on their relative proportions, for example the ratio n-3 : n-6 FAs. As an optimum ratio Jankowski et al. (2012) presented 1 : 5. Based on this assessment, the most dietetically suitable fat has been the diets containing rapeseed oil with ratios of 1 : 6.8 (BR2) and 1 : 6.5 (BR3) as mentioned also Nguyen et al. (2003) and Stanacev et al. (2014); less suitable with diets containing soybean oil with ratios of 1 : 11.8 (BR2) and 1 : 8.7 (BR3); and the least suitable fat can be considered to be in diets containing sunflower oil with ratios of 1 : 38.3 (BR2) and 1 : 14.1 (BR3).

When evaluating fat content in muscles, it can be noted that the dry matter of the thigh muscle contained more FAs compared to the breast muscle. This finding can be related to the significantly higher average intramuscular fat content in dry matter of thigh muscle (up to five times) 293.7 g/kg, compared to breast muscle 58.5 g/kg. Bardzardi et al. (2014) in a study with myrtle oil and broiler chickens came to the same conclusion that thigh muscle tissues had higher content of fat but at the same time they were more susceptible to fat oxidation than breast muscle tissues. This is due to the significantly higher energy requirements of thigh muscle in relation to the locomotor system of chickens.

For SFAs in breast and thigh muscle, there were no statistically significant differences between the groups, demonstrating that the oils used in the diets did not conclusively affect the content of total SFAs in chicken intramuscular fat. Similarly, the MUFA content of the breast or thigh intramuscular fat was not affected. The most abundant of the ∑MUFA in both breast and thigh muscle was C16:1 and especially C18:1ntc, which accounted for more than 97% of the total ∑MUFA content even in the compound feed. In particular, high concentrations of C18:1 were found in the fat of thigh muscle, compared to fat in breast muscle. Bolukbasi et al. (2006) demonstrated that the addition of thyme oil to the diet of broilers led to a significant reduction in the SFAs and PUFAs concentrations of the leg and breast tissues while the MUFA concentrations in these tissues increased. In this study, the lowest mean ∑n-6 FA in the fat of the cockerels (breast and thigh) was recorded in the muscle of the cockerels (8.64 g/kg and 45.47 g/kg) fed the rapeseed oil diet, which corresponded with the rapeseed oil-based diet, which also contained significantly lower levels of total n-6 FA (BR2 and BR3) compared with the rapeseed or sunflower oil-based diets.

FAs from the n-3 FA group, which can be considered to be mostly deficient in feeds and foods, are the most nutritionally important. C18:3n3 was the most abundant in the muscle meat of cockerels. In contrast to feed, where this acid represented as the only n-3 FA compared to muscle meat, in which C22:6n3 and C22:5n3 acids were also demonstrated. This difference between feed and muscle is due to the fact that these are vegetable diets that contain vegetable oils that do not contain higher n-3 FAs than C18:3n3 acid (the same is true for n-6 FAs at C18:2n6). Feeding strategies are being incorporated to increase the n-3 FAs content of chicken meat and eggs. Cherian et al. (1996) researched the effect of dietary oils (flax, palm, and sunflower oils) with added tocopherols on the fatty acid composition of eggs or tissues. They found out that flax oil with the addition of tocopherol resulted in a significant incorporation of C20:5 n-3 and C22:6 n-3 in liver, egg, white meat, and dark meat. In animal organisms, FAs with a longer carbon chain and a higher number of double bonds are synthesized by elongases (lengthening the carbon chain) and desaturases (increasing the number of double bonds in the carbon chain). The results show that conclusively ($P \leq 0.05$), the content of ∑n-3FA was the lowest in the muscle of cockerels fattened on a sunflower oil-based diet

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compared with soybean and rapeseed oil-based diets, which corresponds with the lowest content of ∑n-3FA in the sunflower oil-based diet. From this perspective, sunflower oil can be considered a less suitable source of n-3 FA.

From the point of view of the quality of breast and thigh muscle of cockerels (as food) in relation to the ratio of n-3 : n-6 FAs, the most nutritionally suitable muscle of cockerels fed rapeseed oil-based diet (1 : 6.9 and 1 : 7.2) compared with the muscle of chickens fed a soybean oil (1 : 9.3 and 1 : 8.1) or sunflower oil (1 : 14.5 and 1 : 18.1) diet.

CONCLUSION

Based on the results obtained, rapeseed oil can be clearly recommended for broiler chickens in feed mixtures, for the reasons that the cockerels fed feed mixtures containing exclusively rapeseed oil showed the highest live weight (35 days of fattening), had the lowest feed conversion ratio, did not show signs of clinical disease throughout the fattening period, had an increased n-3 FA content in the intramuscular fat (breast and thigh), and the narrowest n-3 : n-6 FAs ratio in the intramuscular fat (breast and thigh). From the point of view of broiler chicken fattening, the use of rapeseed oil in complete feed mixtures can be recommended to achieve high performance, good health and nutritional quality of the muscle, based on the results obtained and the price.

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Conflict of interest

The authors declare no conflict of interest.

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