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Effect of dietary rapeseed and soybean oil on growth performance, carcass traits, and fatty acid composition of pigs

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ABSTRACT - The objectives of this investigation were to examine the impact of the dietary inclusion of rapeseed and soybean oil and the length of their feeding before slaughter on growth performance, quantitative and qualitative carcass traits, and fatty acid composition in *longissimus lumborum* muscle (LLM) of pigs. The experiment was conducted with 72 pigs (36 barrows and 36 gilts), divided into six oil-containing diet groups and one control group. Diets of the experimental groups were supplemented with 4% rapeseed (ROD) or soybean (SOD) oil for six, four, and two weeks before slaughter. Diet of the control group had no oil supplement. Animals were fed *ad libitum* and slaughtered at average body weight of 115.8 kg. The oil supplement and feeding duration had a significant effect on fatty acid composition in intramuscular fat of LLM. The diet with both rapeseed and soybean oil significantly increased the content of linoleic acid and α-linolenic acid (ALA) in intramuscular fat. Both types of oil significantly increased total PUFA, n-3 PUFA, and the PUFA:SFA ratio. The significant decrease of n-6:n-3 PUFA ratio was observed in groups fed rapeseed oil for four and six weeks. Dietary addition of oils did not have any significant effect on average daily gain, carcass traits, and physical characteristics of LLM of pigs. However, daily feed intake and feed conversion ratio were reduced in the groups with soybean oil supplement. The results show that rapeseed oil supplementation (two weeks before slaughter) has positive effect on n-6:n-3 PUFA ratio and increase of ALA without negative effect on meat and fat quality.

Keywords: fattening, feeding duration, *longissimus lumborum* muscle, MUFA, PUFA

Introduction

The amount of received fat and quality of the fat are significant elements affecting quality of human nutrition (Jasinska and Kurek, 2017). Excessive fat consumption brings, according to Ferguson et al. (2004), increased risk of developing obesity and cancer. High intake of saturated fatty acids (SFA) relates to increase in plasma LDL-cholesterol, which is one of the main causes of developing atherosclerosis and ischemic heart disease (Clarke et al., 1997). On the contrary, monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) are assessed positively with respect to human health.

Saturation of pig fat is significantly influenced by nutrition during fattening (Wood et al., 2008; Raj et al., 2010), and different types of received fats have a different effect on metabolic activities in animals (Cho and Kim, 2012). Compared with ruminants, the required composition of fatty acids in pig or chicken fat can be achieved easier, because in pigs unsaturated fatty acids are not hydrogenated by rumen microflora. However, in pig nutrition, which is based on feed mixtures with prevailing cereals, n-6 PUFA groups outweigh more favourable n-3 PUFA. To improve the n-6:n-3 fatty acids ratio, it is necessary to supply feed components rich in n-3 PUFA group (Wood et al., 2008; Leikus et al., 2018).

As opposed to the extensive research of soybean oil, only a few works (Pastorelli et al., 2003) have examined the possibility of using rapeseed oil in animal nutrition as a source of unsaturated fatty acids in the products. The cause of this finding may be that rapeseed oil seems to be an unpromising source for achieving the required increase in the proportion of PUFA in animal fat. Even though rapeseed oil is characterised by a high proportion of primarily oleic acid and, consequently, also the total of MUFA, a considerable proportion of total fatty acids is represented by a relatively high content α-linolenic acid.

Most of the published papers are focused on various oils as sources of fatty acids in feed during fattening. However, there are only a few papers (Warnants et al., 1999; Morel et al., 2013; Nuernberg et al., 2015) focused on different length of feeding with an oil source before slaughter. Warnants et al. (1999) stated that PUFA content in loin and backfat increased with feeding duration of a diet enriched with PUFA by soybean oil; however, according to the authors, the last several weeks of fattening with a PUFA source is sufficient for supplementation with PUFA in loin and backfat.

The objective of this study was to evaluate the impact of dietary inclusion of rapeseed and soybean oil and the length of their feeding before slaughter on growth performance, quantitative and qualitative carcass traits, and, in particular, on fatty acid composition in *longissimus lumborum* muscle of pigs.

Material and Methods

All procedures described in this study were conducted after obtaining the approval by the Local Ethics Commission, case number 08/2015; the experiment was conducted in CZ21038206.

The study was carried out with 72 pigs (36 barrows and 36 gilts) of hybrid combination Duroc × (Landrace × Large White). The animals were housed in the experimental station at the age of 69 days, with an average live weight of 29.2 kg, two pigs per pen and four and six replications (pens) per treatment. For the whole time of fattening, animals were fed complete feed mixtures (CFM) *ad libitum*. The composition of CFM was continually adjusted with respect to age and weight of the pigs. During growth, from 29 to 66 kg average live weight, all animals consumed CFM P1 (13.2 MJ ME). At 66 kg of live weight, pigs were divided into six oil-containing diet groups and one control group; 50% barrows and 50% gilts in each group. Oil-containing diet groups were fed CFM P2 (13.6 MJ ME) (Table 1) with 4% rapeseed (ROD) or soybean (SOD) oil for six (ROD6, n = 8; SOD6, n = 12), four (ROD4, n = 8; SOD4, n = 12), and two weeks (ROD2, n = 8; SOD2, n = 12) before slaughter. The control group (n = 12) was fed CFM P2 without oil supplements. The chemical composition and nutritive value of the feeds were analysed according to standard methods of AOAC (2005) (Tables 2 and 3).

In the course of fattening, pigs were weighed individually in weekly intervals and feed intake was daily monitored. Based on the obtained values, average daily weight gain (ADG), feed conversion ratio (FCR), and average daily feed intake (ADFI) were calculated. Age and average slaughter weight of pigs at

Table 1 - Experimental feeding design of the study

Weeks to slaughter	Diet group						
	Control	ROD2	ROD4	ROD6	SOD2	SOD4	SOD6
Six weeks	P2	P2	P2	P2 + rapeseed oil	P2	P2	P2 + soybean oil
Four weeks	P2	P2	P2 + rapeseed oil	P2 + rapeseed oil	P2	P2 + soybean oil	P2 + soybean oil
Two weeks	P2	P2 + rapeseed oil	P2 + rapeseed oil	P2 + rapeseed oil	P2 + soybean oil	P2 + soybean oil	P2 + soybean oil

P2 - complete feed mixture for the second fattening phase; ROD - rapeseed oil diet; SOD - soybean oil diet.

Table 2 - Diet ingredients and calculated chemical analyses

Indicator	Control		ROD, SOD	
	P1	P2	P1	P2
Average live weight (kg)	29-66	66-116	29-66	66-116
Age of pigs (days)	69-110	111-152	69-110	111-152
Components (g kg^{-1}) as fed				
Barley	500	270	500	620
Wheat	313	610	313	200
Soybean meal	150	90	150	110
Premix of vitamins and minerals[1]	30	30	30	30
Monocalcium phosphate	7	-	7	-
Oil[2]	-	-	-	40
Chemical composition (as fed)				
Dry matter (%)	87.6	87.3	87.6	88.1
Crude protein (%)	16.4	14.8	16.4	14.5
Crude fat (%)	1.8	1.8	1.8	5.7
Crude fibre (%)	3.7	1.8	3.7	3.8
Starch (%)	45.4	50.8	45.4	44.6
ME (MJ/kg)	13.2	13.6	13.2	13.9
Lysine:ME	0.73	0.60	0.73	0.62
Amino acids (g kg^{-1} as fed)				
Lysine	9.64	8.07	9.64	8.55
Methionine	2.95	2.81	2.95	2.67
Threonine	6.24	5.39	6.24	5.57
Tryptophan	2.06	1.74	2.06	1.86
Sulphur amino acids	6.01	5.80	6.01	5.38
Glycine	6.59	6.04	6.59	5.74

P1 - complete feed mixture for the first fattening phase; P2 - complete feed mixture for the second fattening phase; ROD - rapeseed oil diet; SOD - soybean oil diet; ME - calculated metabolizable energy.

[1] Premix of micro- and macrominerals, essential amino acids, and vitamin - 1 kg of premix provided: retinol, 400,000 IU; cholecalciferol, 66,000 IU; α-tocopherol, 3600 mg; menadione, 100 mg; thiamine, 60 mg; riboflavin, 150 mg; niacin, 800 mg; Ca pantothenate, 375 mg; vitamin B6, 100 mg; vitamin B12, 1 mg; choline Cl, 15,000 mg; folic acid, 15 mg; Fe, 3500 mg as $FeSO_4{\cdot}H_2O$; Zn, 3600 mg as ZnO; Mn, 3100 mg as MnO; Cu, 330 mg as $CuSO_4{\cdot}5H_2O$; I, 175 mg as $Ca(IO_3)_2$; Co, 15 mg as $2CoCO_3{\cdot}3Co(OH)_2{\cdot}H_2O$; Se, 13 mg as Na_2SeO_3; 6-phytase (EC 3.1.3.26), 25,000 FTU; Ca, 220 g; P, 20 g; Na, 50 g; Mg, 10 g; lysine, 85 g; methionine, 15 g; threonine, 15 g.

[2] Rapeseed or soybean oil depending on experimental group.

Table 3 - Fatty acid composition of diets (g 100 g^{-1} of fatty acids)

Fatty acid	Oil		Diet		
	Rapeseed	Soybean	Control	ROD	SOD
C14:0 (myristic)	0.06	0.11	0.00	0.06	0.17
C16:0 (palmitic)	5.59	12.6	19.8	9.36	14.2
C16:1 (palmitoleic)	0.24	0.11	0.00	0.20	0.10
C18:0 (stearic)	1.70	3.85	2.38	1.82	3.33
C18:1n-9 (oleic)	54.5	21.9	15.0	45.7	20.5
C18:2n-6 (linoleic)	23.8	52.6	53.1	30.7	51.7
C18:3n-3 (α-linolenic)	11.3	7.43	6.17	9.62	7.15
SFA	8.51	17.6	23.5	12.2	19.4
MUFA	56.3	22.4	15.8	47.4	21.3
PUFA	35.1	60.1	59.3	40.4	59.3
n-6 PUFA	23.8	52.6	53.1	30.7	51.8
n-3 PUFA	11.3	7.43	6.17	9.62	7.38

ROD - rapeseed oil diet; SOD - soybean oil diet; SFA - saturated fatty acids; MUFA - monounsaturated fatty acids; PUFA - polyunsaturated fatty acids.

the end of fattening was 152 days and 115.8 kg, respectively. Pigs were slaughtered using electrical stunning at a small commercial abattoir, and parameters of carcass traits, carcass weight, lean meat percentage (by FOM method), and backfat thickness were measured. After chilling, each right half-carcass was weighed, dissected, and the *longissimus lumborum* muscle (LLM) was used for sampling according to Scheper and Scholz (1985).

From the qualitative parameters, the pH value (45 min *p.m.*), electrical conductivity (50 min *p.m.*), meat colour values (CIE L*, a*, b*), drip loss, and Warner-Bratzler shear force (WBSF; N) of cooked LLM were measured. All measurements were made according to Okrouhlá et al. (2013).

Fatty acid methyl esters were determined by extraction of total lipids according to Folch et al. (1957). The obtained records were analysed using Clarity software, version 5.2, and quantified on the basis of known retention times from a standard Food Industry FAME Mix (Restek Co., Bellefonte, USA). The atherogenic index was calculated according to Chilliard et al. (2003).

Data were subjected to Shapiro-Wilk and Levene's tests to verify homogeneity of variances and normality and were analysed as a completely randomised design using the General Linear Models procedure of SAS (Statistical Analysis System, version 9.4), according to the following model:

$$Y_{ij} = \mu + d_i + s_j + e_{ij},$$

in which μ is an overall mean; d_i is the effect of the *i*-th diet (i = control, n = 12; ROD2, n = 8; ROD4, n = 8; ROD6, n = 8; SOD2, n = 12; SOD4, n = 12; SOD6, n = 12); s_j is the effect of the *j*-th sex (j = barrows, n = 36; gilts, n = 36); and e_{ij} is the residual error assumed ij. The fixed effect of diet × sex interaction was initially tested but dropped from the model since it was not significant; only the effect of the diet was determined by Scheffe's test (P<0.05).

Results

The results for growth performance and selected carcass (Table 4) show that final live weight, ADG, lean meat content, backfat thickness, and intramuscular fat content did not differ significantly among groups (mean 115.7 kg, 1147 g, 58.8%, 19.8 mm, 2.8%, respectively). Groups ROD2, SOD2 and SOD4 had significantly lower carcass weight than group ROD6, which had the highest carcass weight (97.6 kg).

Table 4 - Growth performance and parameters of carcass and meat quality traits of pigs

Item	Control	ROD			SOD			SEM	Significance
		Two weeks	Four weeks	Six weeks	Two weeks	Four weeks	Six weeks		
Carcass weight (kg)	92.9	89.8B	93.8	97.6A	88.8B	90.9B	94.2	2.25	*
Final live weight (kg)	115.8	114.2	117.7	119.3	113.6	114.9	115.6	2.71	NS
Average daily gain (g)	1138	1137	1165	1183	1128	1143	1148	27.5	NS
Feed conversion ratio (kg)	2.54A	2.51	2.49	2.43	2.34B	2.30B	2.45	0.075	*
Daily feed intake (kg)	2.88A	2.78A	2.90A	2.85A	2.63B	2.60B	2.81A	0.043	*
Lean meat (%)	59.0	57.9	58.5	58.2	59.1	59.3	58.6	0.57	NS
Backfat (mm)	19.0	20.6	19.7	20.1	18.6	20.1	20.8	1.18	NS
Intramuscular fat (%)	2.92	2.34	2.95	2.72	2.82	3.19	2.73	0.295	NS
pH_{45}	6.25	6.31	6.27	6.20	6.43	6.28	6.24	0.087	NS
EC50 (mS)	3.50	3.42	3.42	3.51	3.36	3.47	3.50	0.100	NS
Lightness (L*)	48.0	48.4	49.3	49.2	50.3	49.1	49.2	1.29	NS
Redness (a*)	−0.52	−0.94	−1.15	−1.14	−1.43	−1.01	−0.85	0.217	NS
Yellowness (b*)	7.83	7.83	7.71	7.31	8.07	7.96	7.67	0.446	NS
Shear force (N)	36.7	29.4	37.5	34.0	35.5	34.4	37.1	3.23	NS
Drip loss (%)	3.91	3.70	3.84	2.94	3.55	3.41	3.54	0.527	NS

ROD - rapeseed oil diet (for two, four, or six weeks before slaughter); SOD - soybean oil diet (for two, four, or six weeks before slaughter); SEM - standard error of the mean; NS - nonsignificant.
A-B - values with different letters differ significantly at least at P<0.05.
* P<0.05.

Groups SOD2 and SOD4 had also lower FCR than control group and ADFI was lower in comparison with all other groups. Physicochemical parameters of meat were evaluated, and no significant differences among the groups were observed (mean of pH_{45}, 6.28; EC_{50}, 3.46; drip loss, 4.26%; WBSF, 34.95 N), and we did not observe any meat abnormalities.

Rapeseed oil and soybean oil supplements had significant effect on fatty acid content of intramuscular fat (Table 5). Linoleic acid (LA) increased significantly (P<0.01) in all oil-containing diet groups, as did α-linolenic acid (ALA) and eicosapentaenoic acid (EPA). The content of LA and ALA in intramuscular fat increased with the length of oil feeding. A significant increase in ALA was observed between ROD4 and ROD2 (P<0.01), between ROD6 and ROD2 (P<0.01), and between ROD6 and ROD4 (P<0.05). Within the SOD groups, a similar trend in ALA was seen; however, the difference between the SOD6 and SOD4 groups was not significant (P>0.05). A statistically significant decrease of oleic acid was observed in groups with soybean oil supplement. The lowest level was observed in the ROD6 group.

Both rapeseed and soybean oil significantly increased (P<0.01) the content of total PUFA in the intramuscular fat. A higher increase was demonstrated in groups with the addition of soybean oil. The content of PUFA increased (P<0.05) with the length of oil feeding. The highest PUFA content was in SOD6 and SOD4 groups (17.9 and 16.1 g/100 g, respectively). On the other hand, the content of MUFA was statistically significantly (P<0.05) lower in the groups with soybean oil supplement, and their level decreased again with the length of oil feeding. The content of PUFA n-3 and PUFA n-6 was significantly

Table 5 - Fatty acid profile (g 100 g^{-1} of fatty acids) of intramuscular fat in *longissimus lumborum* muscle of pigs

Fatty acid	Control	ROD			SOD			SEM	Significance
		Two weeks	Four weeks	Six weeks	Two weeks	Four weeks	Six weeks		
C14:0 (myristic)	2.04A	1.74	1.91	1.81	1.91	1.90	1.73B	0.122	*
C16:0 (palmitic)	31.7A	30.9A	30.7A	30.3BC	30.5B	29.9BC	29.3C	0.43	*
C16:1 (palmitoleic)	5.43A	4.41B	4.52B	4.37B	4.69	4.54B	4.04B	0.296	*
C17:0 (margaric)	0.23	0.22	0.23	0.24	0.22	0.24	0.24	0.014	NS
C17:1(heptadecenoic)	0.32A	0.26B	0.26B	0.27	0.26B	0.29	0.26B	0.018	*
C18:0 (stearic)	12.0B	11.8B	12.0B	12.3B	13.1	12.9B	14.5A	0.60	*
C18:1n-9 (oleic)	36.4A	36.4A	35.8AB	35.6AB	33.4BC	32.6CD	30.6D	0.87	*
C18:2n-6 (linoleic)	7.37E	9.79CD	9.54D	10.2CD	11.2C	12.9B	14.3A	0.52	*
C18:3n-3 (α-linolenic)	0.37E	0.76CD	1.08B	1.30A	0.66D	0.86C	0.91BC	0.070	*
C20:0 (arachidic)	0.20	0.17	0.24	0.21	0.29	0.20	0.21	0.038	NS
C20:1 (eicosenoic)	0.94	0.79	1.05	0.93	0.93	0.88	0.83	0.081	NS
C20:2 (eicosadienoic)	0.39C	0.39BC	0.42BC	0.40BC	0.46	0.51A	0.49AB	0.031	*
C20:3 (eicosatrienoic)	0.25	0.25	0.22BC	0.19C	0.25AB	0.24BC	0.30A	0.022	*
C20:4 (arachidonic)	1.19	1.26	1.13	1.10	1.20	1.16	1.33	0.116	NS
C20:5 (eicosapentaenoic)	0.044D	0.086	0.132A	0.081BCD	0.076CD	0.111ABC	0.117AB	0.0155	*
C21:0 (heneicosanoic)	0.079C	0.130AB	0.137A	0.123	0.084BC	0.086BC	0.119AB	0.0155	*
C22:0 (behenic)	0.0615A	0.0077	0.0082B	0.0034B	0.0010B	0.0023B	0.0081B	0.0187	*
C22:2 (docosadienoic)	0.028A	0.005B	0.018AB	ND	0.011B	0.006B	0.006B	0.0049	*
C22:6 (docosahexaenoic)	0.29AB	0.22BC	0.18BC	0.13C	0.26B	0.30AB	0.38A	0.045	*
SFA	46.8	45.3	45.6	45.4	46.5	45.6	46.4	0.69	NS
MUFA	43.2A	41.9A	41.6A	41.2AB	39.3BC	38.3C	35.7D	0.72	*
PUFA	10.0D	12.8C	12.8C	13.5C	14.2C	16.1B	17.9A	0.69	*
n-6	8.64E	11.1CD	10.7D	11.4CD	12.5C	14.1B	15.7A	0.59	*
n-3	0.71D	1.07BC	1.39A	1.52A	1.00C	1.27AB	1.41A	0.092	*
PUFA:SFA	0.22C	0.28B	0.28B	0.30B	0.31B	0.36A	0.39A	0.018	*
n-6:n-3	13.1A	11.6A	7.91B	7.64B	13.1A	11.4A	11.2A	0.885	*

ROD - rapeseed oil diet (for two, four, or six weeks before slaughter); SOD - soybean oil diet (for two, four, or six weeks before slaughter); SFA - saturated fatty acids; MUFA - monounsaturated fatty acids; PUFA - polyunsaturated fatty acids; SEM - standard error of the mean; ND - not determined; NS - nonsignificant.
A-E - values with different letters differ significantly at least at P<0.05.
* P<0.05.

higher (P<0.05) in all oil-containing diets groups against the control group, and the content increased with feeding duration. Groups ROD2 and SOD2 had a significantly lower share of n-3 PUFA compared with ROD4, SOD4 (P<0.05) and ROD6, and SOD6 (P<0.01).

The PUFA:SFA ratio increased significantly (P<0.01) in all oil-containing diets groups. A higher increase was recorded for groups SOD4 and SOD6 (P<0.01). The PUFA:SFA ratio significantly increased in oil-containing diet groups compared with the control, even after two weeks of supplementation. Length of oil feeding did not affect the PUFA:SFA ratio in ROD groups, whereas in SOD groups, significant differences were seen. There was a significant difference (P<0.01) between SOD2 and SOD4, and similarity between SOD2 and SOD6 (P<0.01). The n-6:n-3 PUFA ratio significantly decreased (P<0.01) in groups ROD4 and ROD6 compared with the control group and all SOD groups.

Discussion

In our study, we did not observe any significant differences in growth performance, carcass, and meat quality parameters among the groups, except from FCR, ADFI, and carcass weight. Soybean oil decreased ADFI by about 6.5% against control and ROD, as well as FCR (about 7% less than in control, and 4.8% against ROD). Azain et al. (1992) described a lower ADFI of fat-supplemented diet as one of the most significant effects of fat supplement in feed. Benz et al. (2011) stated that addition of soybean oil in nutrition for fattening pigs improves FCR. According to Lewis (2001), lower ADFI and improved FCR can be related to reduced passage rate and thus increased digestibility of other nutrients from feed. However, Warnants et al. (1999) and Sousa et al. (2010) stated that soybean or soybean oil addition has no effect on feed efficiency. Similarly, Raj et al. (2010) and Skiba et al. (2012) did not find any effect of other oil sources on feed efficiency.

In the present study, the effect of feeding duration on feed conversion ratio was not observed. However, Benz et al. (2011) also observed that the extension of the period of feeding with soybean oil in nutrition leads to improved feed conversion ratio. Similar results were published by Park et al. (2009), who found that soybean oil supplementation caused lower ADFI during the first weeks after inclusion, whereas in the following weeks, there was compensation of ADFI.

In this study, PUFA increased significantly in oil-containing diet groups, but physicochemical parameters were not significantly affected by the oil addition. It can be concluded that the addition of soybean or rapeseed oil to the feed mixture does not affect the technological parameters of pork and does not affect its further processing. On the other hand, Jasinska and Kurek (2017) described the negative effect of a higher content of PUFA on the technological parameters of pork.

Fatty acid content in LLM reflected different FA composition of the oils used in the diet and agrees with other studies (Raj et al., 2010; Skiba et al., 2012; Čítek et al., 2015). Total PUFA increased significantly in all oil-containing diet groups. A higher increase was seen in SOD groups. Addition of oil did not increase MUFA in intramuscular fat. From individual FA, under the effect of rapeseed oil, the most significant increase was in ALA, while in soybean oil, the most significant increase was in LA. This is in consistent with results presented by Alonso et al. (2012).

The content of LA in feed mixture was about 21 g higher in SOD than in ROD, whereas in intramuscular fat, it was only about 3 g higher. This indicates the limited utilisation of LA from SOD and corresponds with Clark et al. (1990), who stated that feed oil significantly reduced endogenous synthesis of FA. Although rapeseed oil did not have such a significant effect on the increase of PUFA as soybean oil did, increase in PUFA was achieved most significantly by ALA. Similar results are reported by Rossi and Corino (2002) and Corino et al. (2002), who demonstrated that rapeseed oil significantly increased ALA in backfat compared with corn oil, which is also characterised by a higher proportion of PUFA such as soybean oil. Thus, rapeseed oil is a suitable source of MUFA (with prevailing oleic acid) as well as PUFA with dominant ALA. Increase in total PUFA in intramuscular fat is accompanied by a higher PUFA:SFA ratio, which was also observed in this study, in both soybean and rapeseed oil. Čítek et al. (2015) in their study reached similar conclusions.

The n-6:n-3 ratio was higher in SOD than in ROD groups in our study. The results show that oil supplementation, even for a short period (two weeks), has a positive effect on the fatty acid composition of pork, and this is without negative effect on technological parameters of meat. In the groups with soybean oil, PUFA increased along with feeding duration, which was a reflection of increasing LA, ALA, and DHA. An increase of ALA is often accompanied by a change in another significant indicator – the n-6:n-3 PUFA ratio. Foodstuffs of animal origin are often criticised for an unfavourable n-6:n-3 PUFA ratio (10:1 - 25:1), although for human nutrition, the maximal ratio of 5:1 is recommended (Weill et al., 2002). The n-6:n-3 PUFA ratio may be decreased through increasing ALA acid and decreasing of LA, using rapeseed oil (Rossi and Corino 2002; Raj et al., 2010). Benz et al. (2011) observed an increase of PUFA through increasing LA and ALA with duration of feeding. There were no significant differences in PUFA among the groups with two-week, four-week, and six-week supplementation of rapeseed oil in the diet in the present study.

From the viewpoint of economic efficiency, further studies should focus on the appropriate feeding duration of oil supplements. In addition, the effect of oil supplement to the energy value of the feed in the various stages of fattening should be studied. The usability and digestibility of the feed is important for the farming economy (Noblet, 2007).

Conclusions

Both oil supplements have significant effect on fatty acid composition in intramuscular fat of *longissimus lumborum* muscle of pigs. Fatty acid composition is influenced by the type of oil and by length of oil feeding before slaughter as well. Rapeseed oil supplement in diets for minimally four weeks favourably decreases the PUFA n-6:n-3 ratio compared with soybean oil. Oil supplements in feed do not affect technological parameters of pork.

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