

## Energy Efficiency and Nutrient Deposition in Early-Weaned Pigs, according to Fat Sources Containing Different Acidic Series<sup>a,b</sup>

P. Bosi<sup>1</sup>, H. J. Jung<sup>2</sup>, In K. Han<sup>2\*</sup>, J. A. Cacciavillani, L. Casini and S. Mattuzzi  
DIPROVAL - Sez. Allevamenti Zootecnici - Degree in Animal Production Science and Technology  
University of Bologna, 42100 Reggio Emilia, Italy

**ABSTRACT** : To evaluate energy efficiency and partition of nutrients, 32 piglets were weaned at 14 d of age and individually fed diets containing 15% fat from coconut oil (CO, medium chain saturated), high oleate sunflower oil (HOSO, n-9 series), soybean oil (SO, n-6 series), or linseed oil plus fish oil, (LF, n-3 series). After 4 weeks, the subjects were sacrificed to evaluate empty body composition and apparent ileal digestibility with the slaughter method. No statistical effect of dietary fat sources on growth was observed. The digestibility of fat from the coconut oil diet was higher than fats from the diets containing high levels of unsaturated fatty acids. The efficiency of use of metabolizable energy for growth averaged 63% and was not affected by the diet. Dietary fat composition was reflected strongly in backfat. Total body neutral and polar fatty acids were influenced too. For the whole body phospholipid fraction the ratio of n-6 to n-3 and the double bond index were 4.3, 5.8, 7.2, 0.78 and 69, 87, 89, 87 for CO, HOSO, SO, and LF respectively. These results show that for the coconut oil diet the degree of unsaturation of phospholipids in the body was lower and that, in the other diets, it did not differ, but double bond index was maintained with different n-6 to n-3 ratios in carcass fat. On the whole the data on body fat composition indicate that the dietary fat tended to be deposited in similar quantity in the body, whatever was the dietary fatty acid profile. (*Asian-Aus. J. Anim. Sci. 2000. Vol. 13, No. 7 : 995-1002*)

**Key Words** : Piglets, Fatty Acids, Fats, Energetic Efficiency, Phospholipids

### INTRODUCTION

Dietary fats can contribute as a fuel to sustain the high growth potential of early-weaned pigs (Aherne et al., 1982; Li et al., 1989), although high levels are not always economical (Tokach et al., 1989a, b). It is reasonable to ask if the profile of fatty acids in the dietary sources can affect the partition of fats between oxidation and deposition. Some research data on comparative metabolism of fatty acids show that in rats metabolic utilization can differ according to the fatty acid profile of fat sources, so in the whole body the C12:0, C18:1 and C18:3 fatty acids are more oxidized, whereas n-6 fatty acids are more deposited (Leyton et al., 1987). Furthermore, it has been shown that the fatty acid composition of the diet controls the activity of mitochondrial carnitine palmitoyltransferase I in rat heart and skeletal muscle, influencing the rate of  $\beta$ -oxidation (Power and Newsholme, 1997).

However, again in rat, the utilization of dietary fat differed between lard and some oils, but did not differ between oils differing in fatty acid composition (Takeuchi et al., 1995). This result contrast with the hypothesis of a different path for metabolic utilization between unsaturated fatty acids. In piglet, the medium-chain triglycerides were demonstrated to be useful for sparing carbohydrate oxidation and for supporting gluconeogenesis in the neonate pig (Odle, 1997, a review), due to their quicker delivery to the tissues and into the mitochondria, compared to longer-chain triglycerides. Other research demonstrated that the dominant presence of one fatty acid in the diet could modify the specific activity of enzymes: dietary linoleic acid inhibited  $\Delta^9$ -desaturase activity in pig adipose tissue (Kouba et al., 1997) and in rodent liver (Christiansen et al., 1991) and stimulated lipogenic enzymes in pig subcutaneous fat, but not in muscle (Mourot et al., 1994). Smith et al. (1996) observed that specific dietary fatty acids affected lipogenesis and insulin response in pigs.

A strong relationship between the fatty acid profile of the diet and of fatty acid composition of backfat is observed in growing-fattening monogastrics (Madsen et al., 1992; Morgan et al., 1992). These observations suggest the hypothesis that a differential use of absorbed individual fatty acids is not relevant in practical terms, at least for the fatty acid composition of body triglyceride stores. This may not be true for very young subjects or for body phospholipids. Otherwise, the finding that the composition of body fat is maintained when different fat sources are fed

\* Address reprint request to In K. Han. Tel: +82-2-502-0757, Fax: +82-2-502-0758, E-mail: inkhan@kornet.net.

<sup>1</sup> Corresponding Author: P. Bosi. Tel: +39-0522-290522, Fax: +39-0522-290523, E-mail: paolo.bosi@stpa.unibo.it.

<sup>2</sup> Department of Animal Science and Technology, College of Agriculture and Life Sciences, Seoul National University, Suweon 441-744, Korea.

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could be an indirect evidence of a differential use of different dietary fatty acids.

Our first aim was to verify if dietary triglycerides with different fatty acid composition but with similar digestibility could affect the energy efficiency for growth and the partition between protein and fat deposition of piglets weaned at 14 days of age. Secondly, we wanted to assess if the fatty acid content of backfat and of the polar and neutral fraction from body fat was influenced.

## MATERIALS AND METHODS

From 8 sows a total of 38 pigs (Large White × Landrace × Duroc) were weaned at 14 days of age. Six pigs, from different litters, were taken and sacrificed before the start. The others were allotted to 4 dietary treatments. One pig from each litter was distributed to each dietary group for a total of 8 pigs per dietary group. There were 2 male and 2 female pigs from each litter; the sexes were balanced across the dietary group. The diets contained 15% of the one of the following 4 different lipid sources: coconut oil (CO, medium chain saturated), high oleate sunflower oil (HOSO, n-9 series), soybean oil (SO, n-6 series), linseed oil plus fish oil, (LF, n-3 series). In the case of LF treatment, the mixture linseed oil plus fish oil was used to reach a ratio  $\alpha$ -linolenic acid: (eicosapentaenoic acid+docosahexaenoic acid) near to the value proposed by Leskanic and Noble (1999) for the piglet requirements of n-3 essential fatty acids. The ingredient composition and the nutrient composition of the diets are presented in table 1 and the fatty acid composition of the dietary oils are in table 2. Chromic oxide (0.3% wt/wt) was included in the diet as an indigestible marker for determination of protein and dry matter digestibilities.

Procedures for this study were approved by the Ethical Committee of the University of Bologna. The subjects were individually penned in cages with expanded plastic coated mesh floor and solid sidewalls. The temperature in the nursery was decreased gradually from 30°C at the start to 24°C at the end of the trial.

The piglets were given *ad libitum* access to feed. For three subsequent days in the 2nd and 3rd week, 6 fecal samples per subject were collected after the morning meal to calculate total tract digestibility by chromium indirect method. The trial lasted 4 weeks. Then the subjects were sacrificed with a 0.5 ml/kg live weight intracardiac injection of Tanax® (A. I. C. Hoechst Roussel Vet GmbH, Weisbaden, Germany), after sedation with sodium thiopental (10 mg/kg live weight). A sample of backfat was obtained at the middle of lumbar area, the gut was removed, emptied and then added to the rest of the body. The empty

**Table 1.** Formula and chemical composition of the experimental diets (% as fed)

Formula	%
<b>Ingredients</b>	
Rice flakes	35.00
Dried skimmed milk	25.00
Spray-dried porcine plasma	8.00
Spray-dried milk whey	10.00
Fish meal	2.00
Potato protein concentrate	2.00
Oil <sup>a</sup>	14.70
Emulsifiers	0.30
Pectins	0.25
DL-Methionine	0.25
Threonine	0.10
Lysine chloride	0.05
Choline chloride	0.12
Monocalcium phosphate	1.00
Chromium oxide	0.30
Protected acidifiers	0.50
Premix (vit., minerals)	0.43
<b>Chemical composition</b>	
Lysine	1.65
Ca	0.7
P	0.7

<sup>a</sup> Coconut oil or high oleate sunflower oil or soybean oil or a 50/50 mixture of linseed oil and fish oil.

body was milled, minced and sampled for the determination of body composition and the calculation of energy deposition. The dry matter content of feces was determined on oven-dried samples (80°C, 24 hours), whereas the dry matter content of empty body samples was obtained by freeze-drying to constant weight. The dried samples were analyzed for ash, nitrogen, fat (AOAC, 1995) and energy (by Ika Calorimeter C400 Adiabatic, Janke & Kunkel, Staufen, Germany). The chromium contents of the diets, feces and ileal digesta were determined by the method of Fenton and Fenton (1979).

For whole body fatty acid composition, on 1.0 g of sample from the minced body, total lipids were extracted with a methanol and chloroform mixture (2:1) according to the modified method (Christie, 1989). Then the extract was fractionated using a 1 mL solid phase extraction tube with silica-based packing (SPE-LC NH<sub>2</sub>-Aminopropyl, Supelco, Bellefonte, PA); the fraction containing neutral lipid was recovered with chloroform:isopropanol (2:1) and the fraction containing phospholipids was recovered with methanol 100% according to Garcia-Regueiro et al. (1994).

For fatty acid (FA) analysis of oil and fats, samples were prepared according to the 2.0001. IUPAC standard method (IUPAC, 1979). The FA were saponified with a methanolic sodium hydroxide

Table 2. Fatty acid profiles of oils in each diet

Oils	Diet				
	CO	HOSO	SO	LF <sup>a</sup>	
	Coconut	High oleate sunflower	Soybean	Linseed	Fish
	----- % -----				
C6	0.74	-	-	-	-
C8	8.47	-	-	-	-
C10	7.25	-	-	-	0.01
C12	42.52	-	0.01	-	0.10
C14	18.95	0.04	0.08	0.04	8.25
C16	9.26	4.43	11.27	5.32	13.05
C16:1(n-7)	0.02	0.12	0.01	0.07	7.42
C18	2.78	3.16	3.46	3.14	1.06
C18:1	7.40	77.08	23.61	17.75	9.00
C18:2	2.04	13.00	53.38	15.28	2.62
C18:3(n-3)	-	0.21	6.63	55.53	2.12
C18:3 (n-6)	0.30	-	-	-	0.36
C18:4 (n-3)	-	-	-	1.95	5.37
C20:1(n-9)	-	0.25	0.24	0.31	12.23
C20:4	-	0.01	0.03	0.03	0.27
C20:5 (n-3)	-	-	-	-	7.13
C22:1(n-11)	-	-	-	0.08	19.08
C22:6 (n-3)	-	0.31	-	-	9.57
Saturated	90.19	8.96	15.9	8.77	22.91
n-3	0	0.52	6.63	57.56	24.53
n-6	2.34	13	53.42	15.36	3.3
n-7	0.02	0.16	0.06	0.11	7.77
n-9	7.43	77.35	23.88	18.09	21.23
n-11	0	0	0	0.08	19.08

<sup>a</sup> The oil in LF diet consisted of a 50/50 mixture of linseed oil and fish oil.

solution 0.5 N and then esterified in the presence of boron trifluoride, according to the 2.301 IUPAC. The methyl esters of FA were determined by gas chromatography according to 2.302. IUPAC, using a capillary column Carbowax 20M (Supelco, Bellefonte, PA).

Per each subject, metabolizable energy intake (ME) was calculated from digestible energy intake (DE) as:

$$ME \text{ (MJ/d)} = DE \text{ (MJ/d)} \times ME/DE$$

where ME/DE was following the predicting equation of May and Bell (1971):

$$ME/DE = 1.012 - 0.00019 \text{ CP (g/kg diet)}$$

Daily energy retention (NE<sub>g</sub>) was calculated as:

$$NE_g \text{ (MJ/d)} = (E - E_0 \times \text{starting weight, kg}) / \text{days in trial}$$

where E is the total energy (MJ) of the final empty body and E<sub>0</sub> is the average energy content (MJ/kg) of the body of the subjects sacrificed at the start of the

trial.

Energy for maintenance according to Jentsch et al. (1992):

$$ME_m \text{ (MJ/d)} = LW \text{ (kg)}^{0.75} \times 0.451$$

was subtracted from ME intake to obtain metabolizable energy for growth and calculate the efficiency for growth (k<sub>g</sub>):

$$k_g = NE / (ME - ME_m)$$

The data were analyzed by means of a linear model (procedure GLM, SAS, 1989) considering the effects of dietary lipid source and of the litter. Three orthogonal contrasts were evaluated: CO vs others, HOSO vs SO + LF, SO vs LF.

## RESULTS AND DISCUSSION

### Growth efficiency

No statistical effect of dietary fat sources on growth was observed (table 3). Cera et al. (1989, 1990) showed that weaned pigs fed coconut oil

**Table 3.** Growth performance<sup>a</sup>

	Oil in the diet				SEM
	CO	HOSO	SO	LF	
Starting live weight, kg	4.31	4.45	4.30	4.36	0.21
Final live weight, kg	11.66	11.48	11.38	11.09	0.31
Daily live weight gain, g	267	252	254	242	11
Daily feed intake, g	316	305	310	295	8
Feed/gain	1.20	1.21	1.23	1.23	0.04

<sup>a</sup> No statistically significant effect of oil source ( $p>0.10$ ).

performed better than the ones fed corn oil or soybean, but Fackler et al. (1992) and Tokach et al. (1995), did not observe any difference. Li et al. (1989) demonstrated that a combination of soybean oil and coconut oil improved growth compared to diets with only one of these oils.

The chemical contents of the empty body were not affected by the diet (table 4). An average empty body protein to fat ratio of 1.48 was found in the piglets. This value is higher than the one that can be observed in piglets of the same age, but after traditional weaning (>32 days) (Close and Stanier, 1984). A higher protein to fat ratio could result from a higher lean deposition capacity, typical of modern genotypes, or from insufficient available energy, as it can be when a dry weaning diet is compared to the mother diet. In any case, high levels of fat in the diet

did not bring about high fatness in the piglet carcass.

The data on nutrients and energy balance and deposition are reported in table 5. The digestibility of fat in the coconut oil diet was higher than the average value of the diets containing unsaturated FA sources. Other research demonstrated higher digestibility of coconut oil versus other oils in piglets, after weaning. During the first two weeks Cera et al. (1992) found that coconut oil digestibility was higher than soybean oil, but not than corn oil. However, in another trial by Cera et al. (1989), the fecal digestibility of fat from coconut oil was only 4 percent higher than that of fat from corn oil, in the first three weeks. The greater digestibility of coconut oil contrasts with the observation by Powles et al. (1994) that digestibility decreases with the degree of saturation of fats, particularly in the young pig compared to the growing-fattening pig. In this case, however, the saturated fat did not contain high amounts of medium chain FA, as in coconut oil does. Earlier findings demonstrate the interaction of age on fat digestibility (Frobish et al., 1970). In older pigs (35 kg l.w.), ileal and fecal fat digestibilities did not differ depending on the oil source (coconut, fish or rapeseed), but a very high digestibility was observed for C10 to C14 in the coconut oil diet (Jensen et al., 1997).

Conversely, the fat digestibility of HOSO diet was lower than that of the SO and LF diets containing great amounts of polyunsaturated FAs. No report was

**Table 4.** Total empty body composition<sup>a</sup>

	Oil in the diet				SEM
	CO	HOSO	SO	LF	
	%				
Moisture	70.66	70.44	69.86	69.74	0.54
Protein	15.16	15.05	15.23	14.92	0.15
Fat	10.30	9.81	10.19	10.53	0.37
Ash	2.90	3.11	2.71	2.79	0.27

<sup>a</sup> No statistically significant effect of oil source ( $p>0.10$ ).

**Table 5.** Energy and nitrogen balance and deposition

	Oil in the diet				SEM
	CO	HOSO	SO	LF	
Digestibility:					
- Crude protein, %	91.7	90.1	89.1	91.1	0.92
- Crude fat <sup>a</sup> , %	93.2	84.8	88.8	90.9	1.68
ED intake, MJ/d	5.47	5.15	5.29	5.06	0.16
EM intake, MJ/d	5.30	5.00	5.13	4.91	0.15
EM for maintenance <sup>b</sup> , MJ/d	2.14	2.14	2.11	2.09	0.46
Nitrogen deposition, g/d	6.52	6.22	6.24	5.83	0.35
Fat deposition, g/d	26.60	23.34	24.61	25.12	1.96
Retained energy, MJ/d	1.99	1.80	1.87	1.83	0.15
Efficiency of ME for growth (kg)	0.63	0.63	0.62	0.65	0.03

<sup>a</sup> C vs others:  $p<0.01$ , HOSO vs SO and LF:  $p<0.01$ .

<sup>b</sup> Calculated as  $EM (MJ/d) = LW (kg)^{0.75} \times 0.451$ , according to Jentsch et al. (1992).

found in the literature on HOSO digestibility in piglets.

No effect of diet was observed for protein digestibility.

Metabolizable energy intake tended to be higher for the CO diet, than that for the other diets ( $p < 0.10$ ), mainly in consequence of the higher fat digestibility. However, the nitrogen and fat depositions were not affected by the oil source in the diet. The overall mean values for nutrient deposition were similar to the ones of Close and Stanier (1984) obtained in piglets weaned at the same weight and age. The energy retention and the efficiency of use of ME were not changed by the dietary treatment. This result agrees with the absence of differences for the carcass composition and for the increments of whole-body oxygen consumption by rats after a meal based on n-3, n-6 and n-9 oil sources (Takeuchi et al., 1995).

#### Body lipid composition

In table 6 the effect of dietary oil on FA profiles of whole body neutral lipids of piglets is presented.

The values for all the considered fatty acids of the neutral fraction of fat from the subjects fed the

coconut oil diet, differed to the values observed for the other diets ( $p < 0.01$ ). Mainly due to the increase of C12, C14 and C16, the CO group showed a total content of saturated fatty acids 24 percent higher than the other groups.

The neutral lipid fraction contained increased amounts of the predominant fatty acids of the dietary oil. Pigs fed HOSO had 55% C18:1, those fed SO had 32% C18:2 and those fed LF had 14% C18:3 (n-3) plus 0.84% C20:5 (n-3) and 1.76% C22:6 (n-3). It is also notable that C18:3 (n-3) concentration was elevated in the SO-fed group, the C18:2 (n-6) concentration was decreased in the CO-fed group and the C22:1 (n-11) concentration was increased in the LF-fed group.

The values of fatty acid content of backfat (data not shown in table) were highly correlated ( $p < 0.001$ ) with the ones for the same fatty acids in the neutral lipids and the correlation coefficients ranged from 0.80 for C18 to 0.99 for C22:6. Only in the case of arachidonic acid no correlation was found. For this FA the value (0.8%) observed for the CO was higher ( $p < 0.01$ ) than the values of the other treatments (0.6%).

**Table 6.** Effect of dietary oil on fatty acid profiles of whole body neutral lipids of piglets reared from 2 to 6 weeks of age

	Oil in the diet				SEM	p-value of contrasts		
	CO	HOSO	SO	LF		CO vs others	HOSO vs SO+LF	SO vs LF
	----- % -----							
C12	6.22	0.11	0.10	0.12	0.18	**	NS <sup>a</sup>	NS
C14	10.91	1.95	1.28	2.44	0.46	**	NS	0.08
C16	25.18	16.79	17.70	19.24	0.54	**	*	0.053
C16:1 (n-7)	4.81	2.96	2.59	4.55	0.12	**	**	**
C18	8.67	5.79	7.08	7.40	0.28	**	**	NS
C18:1	30.64	55.23	32.61	29.65	1.29	**	**	NS
C18:2	9.41	13.17	31.70	12.07	0.66	**	**	**
C18:3 (n-3)	0.67	0.73	3.07	13.60	0.23	**	**	**
C18:3 (n-6)	nd	nd	nd	nd				
C20:1 (n-9)	0.84	0.96	0.71	4.07	0.06	**	**	**
C20:4	0.94	0.88	0.89	0.52	0.09	0.09	NS	*
C20:5 (n-3)	0.02	0.02	0.05	0.84	0.02	**	**	**
C22:1 (n-11)	0.13	0.02	0.12	1.53	0.04	**	**	**
C22:5 (n-3)	0.05	0.05	0.20	0.71	0.04	**	**	**
C22:6 (n-3)	0.06	0.04	0.05	1.76	0.05	**	**	**
Saturated	51.63	25.10	26.64	29.77	1.33	**	0.07	NS
Mono-unsaturated	36.59	59.31	36.17	40.07	1.28	**	**	**
Poli-unsaturated	11.79	15.58	37.19	30.16	0.84	**	**	**
n-3	0.80	0.82	3.38	16.92	0.29	**	**	**
n-6	10.99	14.76	33.82	13.24	0.74	**	**	**
n-7	4.97	3.09	2.73	4.80	0.12	**	**	**
n-9	31.48	56.19	33.32	33.73	1.30	**	NS	NS
n-11	0.13	0.02	0.12	1.53	0.04	**	**	**

nd=Not detected; <sup>a</sup> NS=Not significant,  $p > 0.05$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

Generally, dietary fat composition was strongly reflected in the composition of backfat and of total body neutral FAs. This agrees with what is observed in growing-fattening pigs fed very high levels of fats (Madsen et al., 1992). In our piglets however, a relevant change in the neutral body fat composition is achieved in a very short period. In fact, in the experimental period, the total content of fat in the body was nearly tripled, notwithstanding that only about 2/3 of the digested fat was deposited. It is presumable that the residual was used to satisfy the energetic requirement for maintenance or for protein synthesis. Allee et al. (1972) observed that with the addition of 10% fat to the diets, such as corn oil, coconut oil, lard or tallow, the enzymatic activities for the synthesis of FAs did not differ and were inhibited compared to a control diet. The absence of a different efficiency of use of ME and the presence of a strong relationship between the contents of each FA series in the diet and in the body fats, are consistent with the data of Allee et al. (1972). However Smith et al. (1996) found that the depression of lipogenesis with 10% fat diets compared to a cornstarch diet differed with the length and the unsaturation of FAs fed. But in this experiment, the greatest depression of lipogenesis was observed for C16-enriched diets, whereas the effect of C18, C18:1 and C18:2 was similar and moderate. In our diets the content of C16 was always low and did not differ greatly between the diets, so we can not speculate about the specific effect of this fatty acid, but nevertheless the results for C18:1 and C18:2 do not contrast with the different composition of the deposited fats and equal efficiency of deposition observed for our HOSO and SO diets. On the whole, these data contrast with the observations that in rat C18:2 depresses the fatty acids synthesis more than C18:1 does (Musch et al., 1974). Furthermore Leyton et al. (1987) found that C18:1, C18:3 (n-3) and C12 had a similar rate of oxidation, but higher than C18:2. However in rat Takeuchi et al. (1995) found the same postprandial increment of whole-body oxygen consumption between rats fed high oleic safflower oil, safflower oil or linseed oil. According to the referenced research and to our results, a homogenous response to different oils is more probable in pig than in rat.

In table 7 the effect of dietary oil on FA profiles of whole body polar lipids of piglets is presented.

The content of C12 ( $p < 0.05$ ), C14 ( $p < 0.01$ ) and C16 ( $p < 0.05$ ) was greater in the lipid polar fraction from subjects fed coconut oil than in the others, while the total polyunsaturated content was reduced ( $p < 0.01$ ).

With the diet containing HOSO, C18:1 content was 72% higher than with the polyunsaturated diets ( $p < 0.01$ ), while the C18:2 content was lower than with the SO diet ( $p < 0.01$ ) and C22:5 than the LF diet

( $p < 0.01$ ).

Compared to SO subjects, the LF ones presented a higher content in the polar body fraction of C18 (n-3), C20:1 and C20:5 ( $p < 0.01$ ) and a lower content of C20:4 and n-6 fatty acids ( $p < 0.01$ ). These data are in keeping with the composition of the diets. However, it is interesting to note that the content of arachidonic acid and of total n-6 fatty acids in LF subjects was also lower compared to the ones from CO ( $p < 0.01$ ), notwithstanding the LF diet had a higher linoleic acid and n-6 acid content. It can be hypothesized that the high presence of n-3 in LF could have inhibited the elongation of dietary linoleic acid to arachidonic acid and/or its net deposition in body phospholipids. In rats fed the same level of n-3 fatty acids, Pan and Storlien (1992) showed that with a diet supplemented with n-6, more n-3 fatty acids were oxidized and less n-3 were deposited in quadriceps muscle phospholipids, than with an isocaloric diet supplemented with tallow. This report and our results support the presence of a metabolic competition between n-3 and n-6 fatty acids.

For the whole body phospholipid fraction the ratio of n-6 to n-3 and the double bond index were 4.3, 5.8, 7.2, 0.78 and 69, 87, 89, 87 for CO, HOSO, SO, and LF, respectively. These calculations suggest that for the coconut oil diet the degree of unsaturation of phospholipids in the body could not be preserved. The inference is that the requirements for essential fatty acids were not satisfied, but the performance up to 11 kg live weight was not affected, compared to the other diets. Babatunde et al. (1968) observed that with a fat-deprived diet, pig growth up to slaughter was not affected and a net increase of linoleic acid over initial body content was indeed found.

In the other diets, containing oil with predominantly unsaturated fatty acids, the double bond index did not change, but was maintained with different n-6 to n-3 ratios. This may be attributed again to a direct competition between FA classes.

On the whole, the data on fatty acid of both phospholipid and neutral oils of the empty body composition indicate that dietary fatty acids were transferred to similar extent to the body, independently of its typical FA profile.

## CONCLUSION

Early-weaned pigs fed high-fat diets containing coconut oil, high oleate sunflower oil, soybean oil, or linseed oil plus fish oil perform equally and the efficiency of use of energy for growth does not differ.

Beside the main and well demonstrated transfer of dietary fatty acids from the diet to body stores, an interaction of different fatty acid classes in the diet on fatty acid composition of neutral and polar body fat was suggested.

**Table 7.** Effect of dietary oil on fatty acid profiles of whole body polar lipids of piglets reared from 2 to 6 weeks of age

	Oil in the diet				SEM	p-value of contrasts		
	CO	HOSO	SO	LF		CO vs others	HOSO vs SO+LF	SO vs LF
	----- % -----							
C12	0.40	0.15	0.32	0.25	0.05	*	0.09	NS <sup>a</sup>
C14	2.56	1.26	0.94	1.96	0.25	**	NS	*
C16	30.60	27.75	28.67	29.78	0.78	*	NS	NS
C16:1 (n-7)	1.30	1.32	0.74	1.26	0.24	NS	NS	NS
C18	27.18	22.48	25.93	29.36	1.63	NS	*	NS
C18:1	17.63	23.44	14.63	12.66	1.15	NS	**	NS
C18:2	7.26	8.81	14.25	5.83	0.70	**	NS	**
C18:3 (n-3)	0.38	0.26	0.52	2.52	0.14	**	**	**
C18:3 (n-6)	0.22	0.25	0.16	0.20	0.09	NS	NS	NS
C20:1 (n-9)	0.53	0.68	0.38	1.50	0.07	**	**	**
C20:4	4.17	6.47	5.80	1.71	0.48	NS	**	**
C20:5 (n-3)	0.37	0.17	0.35	4.22	0.53	*	**	**
C22:1 (n-11)	0.27	0.16	0.29	0.23	0.07	NS	NS	NS
C22:5 (n-3)	0.51	0.53	0.83	1.03	0.10	**	**	NS
C22:6 (n-3)	1.21	1.42	1.57	2.36	0.35	NS	NS	NS
Saturated	62.78	53.24	57.22	63.68	2.21	*	*	0.07
Mono-unsaturated	20.10	25.83	16.21	16.07	1.21	NS	**	NS
Poli-unsaturated	17.03	20.87	26.41	20.12	1.85	**	NS	*
n-3	2.95	2.90	3.51	10.83	1.0	*	**	**
n-6	14.08	17.97	22.90	9.30	1.12	*	NS	**
n-7	1.68	1.55	0.90	1.67	0.26	NS	NS	0.075
n-9	18.15	24.13	15.02	14.16	1.15	NS	**	NS
n-11	0.27	0.16	0.29	0.23	0.07	NS	NS	NS

<sup>a</sup> NS= Not significant, p>0.05; \* p<0.05; \*\* p<0.01.

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