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Backfat Characteristics of Barrows and Gilts Fed on Tuna Oil Supplemented Diets during the Growing-finishing Periods

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ABSTRACT : This study was conducted to evaluate the effect of supplementing tuna oil to diets of growing-finishing pigs (barrows and gilts) on backfat characteristics when slaughtered at different weights. Four hundred and eighty crossbred (Large White×Landrace× Duroc) pigs averaging 30 kg were allotted to 12 treatment combinations (40 pigs/treatment combination) in a completely randomized design with a 2×2×3 factorial arrangement of treatments. The treatments were: dietary tuna oil supplementation (0 and 2%); sex (barrows and gilts); and slaughter weight (90, 100 and 110 kg). As pigs reached their slaughter weight, they were randomly selected (8 pigs/treatment combination; 96 pigs in total) and slaughtered. Backfat colour, hardness and fatty acid profile were assessed. There were significant ($p<0.05$) differences in colour (L* and a* values) among treatments. Backfat of the control group was harder than on the tuna oil ($p<0.001$) and that of barrows was harder than of gilts ($p<0.05$). In addition, the thiobarbituric acid reactive substances (TBARS) values of fat from the tuna oil group stored for 3 days were higher ($p<0.001$) than the control group. The TBARS values of gilts tended to be higher than those of barrows and increased with increasing slaughter weight in the tuna oil group. The cholesterol and triglyceride levels were not affected by diet and sex but the triglyceride level increased with increasing slaughter weight ($p<0.01$). The tuna oil group had higher polyunsaturated fatty acid (PUFA) content, ratio of PUFA: saturated fatty acid (SFA) and total n-3 fatty acids but lower monounsaturated fatty acids content and n-6:n-3 fatty acids than the control group ($p<0.01$). Gilts had higher PUFA and n-6 fatty acids in backfat than barrows ($p<0.05$). The backfat from both 90 and 100 kg slaughter-weight groups had a lower ratio of n6:n3 fatty acid than the 110 kg slaughter-weight group ($p<0.05$). However, this was more pronounced in the tuna oil group. The PUFA: SFA was also increased while the n-6:n-3 ratio tended to reach the recommended levels for healthy eating in human beings of <5. However, due to oxidative susceptibility, barrows should not be slaughtered at more than 100 kg for the meat to be acceptable to consumers. (**Key Words :** Tuna Oil, Backfat, Fatty Acid, Pig)

INTRODUCTION

Worldwide, people are concerned of the danger of developing atherosclerosis and coronary heart diseases when consuming food of animal origin. Nutritionists recommend that fat content in the diet should not contribute more than 30% of energy intake and saturated fatty acids should not exceed 10% of the total fat content (Gupta and Khosla, 2000). The ratio of n-6:n-3 fatty acid in food is recommended at 5.0 (Simoupoulos, 1991; Wood and Enser, 1997; Raes et al., 2004). Significant research studies have been conducted with the objective of increasing the omega-3 fatty acid in foods of animal origin so as to minimise the risk of heart diseases (Harris, 1997; Holub, 2002). Fatty acid composition in pig meat can be mediated in pork through backfat quality. Marine fish oils are rich in omega-3 fatty acids. These are presumed to reduce the risk of coronary heart diseases and atherosclerosis (Harris, 1997; Simopoulos; 2001; Holup, 2002; Morel et al., 2006). Earlier work by Jaturasitha et al. (2002) demonstrated the feasibility of enriching pork and pork products with omega-3 fatty acids by feeding tuna oil to pigs. Adoption of this feeding strategy by the pig producers would be better, however, if tuna oil could be supplemented over a limited period during fattening only. Previous research work has also established that fatty acid pattern of backfat depends on the pig diet (Fontanillas et al., 1998; Hoz et al., 2003). The

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goal of the present study was, therefore, to test the hypothesis that polyunsaturated fatty acids (PUFA), once consumed and deposited in the body of the animal, will remain there as was shown earlier for C18 PUFA (Wenk et al., 1990; Bee and Wenk, 1994; Morel et al., 2006). This should improve the omega-6: omega-3 fatty acid ratio in backfat from a given amount of tuna oil in feed, irrespective of the time when the tuna oil is supplemented. The objective of this study was to evaluate the effect of increasing omega-3 fatty acid content through tuna oil inclusion in pig diets on growing-finishing pigs backfat characteristics. Opportunity was also taken to evaluate if barrows and gilts were affected differently.

MATERIALS AND METHODS

Animals, housing and diets

A total of 480 crossbred pigs (Large White×Landrace× Duroc; 240 each of barrows and gilts) with average initial weight of 30 kg were selected for the study. Ten pigs each were housed in pens with concrete floors measuring 3×5 m. The pens were equipped with feed troughs and nipple drinkers.

Three types of diets were compounded. These varied in crude protein content from starter (fed from 30 to 46.5 kg), grower (46.5 to 81.5 kg) to finisher (81.5 to slaughter weight of 90, 100 or 110 kg) stages. For the three phases, the crude protein contents were 18, 16 and 14 percent, respectively. The gross energy content averaged 3.9 Mcal/kg DM across diets as recommended by NRC (1998). Within each feeding phase, tuna oil was included either at 0 (control) or 2% of the whole diet. Tuna oil was added as a premix using a filler (3% of bone meal) and then mixed with ground maize. The ingredient and chemical compositions of the diets are given in Table 1.

Experimental design

The pigs were randomly divided into 12 groups balanced for sex. There were 40 pigs per group, 20 each of barrows and gilts. The treatments were: tuna oil in diet (0 and 2%), sex (barrows and gilts) and slaughter weight (90, 100 and 110 kg). The treatments were therefore arranged in a 2×2×3 factorial arrangement in a completely randomised design.

Feeding, slaughter and data collection

Feed intake per pen was recorded daily and individual pigs were weighed once every two weeks. Within treatment combination group, 8 pigs (4 barrows and 4 gilts) per treatment were slaughtered as they reached their slaughter weight (either 90, 100 or 110 kg). Prior to slaughter, pigs were fasted for 12 h before being transported for 7 km to the abattoir of the National Meat Technology and Training Centre (Chiang Mai). The pigs were slaughtered after 2 hours of resting. The carcasses were chilled for 24 h at 4°C and the backfat over the 10^{th}-14^{th} rib was collected. The backfat located on top of the 10^{th} and 11^{th} rib was removed and sealed in polythene bags and chilled at 4°C for 24 h. Following 1 h after removal of polythene bags and at refrigerator temperature, the backfat colour (luminosity, redness, and yellowness) measurements were carried out using the Chroma Meter (CR-300, Minolta Camera Co., LTD., Osaka, Japan).

Shear force of backfat was determined using a Warner-Bratzler shear force device attached to an Instron universal testing machine (model 5565, Instron Ltd., Buckinghamshire, UK). A crosshead speed of 200 mm/minute and a 5 kN load cell calibrated to read over the range of 0 to 50 N were applied for that purpose.

Chemical and physical analysis

Feed samples were analysed for dry matter, nitrogen, ether extract, ash, neutral detergent fibre and gross energy as outlined in AOAC (1990) procedures.

The backfat was analysed for fatty acid profile using gas chromatography (GC 14B, Shimadzu, Tokyo, Japan) according to Neumann and Basler (1983). Fatty acid methyl esters (FAME) were prepared according to Morrison and Smith (1964). Thiobarbituric acid reactive substances (TBARS), cholesterol and triglyceride contents were analysed from backfat stored for 0, 3, 6 and 9 days at 4°C according to Rossell (1994), Jung et al. (1975) and Biggs et al. (1975), respectively.

Statistical analysis

Data were analysed by fitting a completely randomised design model allowing for two-way interactions. Means were separated using the Tukey's test in SAS version 8.2 for windows (SAS, 2001).

RESULTS

Diets

The diets within each phase did not differ in dry matter, organic matter, crude protein and crude fibre contents (Table 1). As intended, adding tuna oil to the basal diet increased the ether extract and energy contents and influenced the profile of fatty acids (Table 1). The most notable increases were in the proportions of C20:4n-6, C20:5n-3 and C22:6n-3 and a decrease in the proportion of C18:2n-6 when tuna oil was included in the diet. The n-6:n-3 ratio was also reduced significantly by the inclusion of tuna oil in the diet in each phase.

Fat colour and hardness

Backfat colour in terms of luminosity, redness and

Table 1. Composition (as-fed basis) and nutrient content of experimental diets (%)

Fattening period (kg)	30-46.5		46.5-81.5		81.5-slaughter	
Tuna oil addition	-	+	-	+	-	+
Ingredients (g/kg)						
Tuna oil[1]	-	20	-	20	-	20
Maize	407	338	528	531	419	417
Extruded maize	133	133	-	-	-	-
Wheat bran extract	38	38	87	28	223	199
Wheat bran	133	166	166	173	232	232
Soybean meal	236	247	169	194	777	79
Molasses	10	10	10	10	13	13
Monodicalciumphosphate	11	11	7	8	0	2
Limestone	18	23	19	22	23	25
Sodium chloride	4	4	4	4	4	4
Vitamin-mineral premix	9	9	9	9	8	8
L-lysine HCl[2]	1	1	1	1	1	1
Analyzed chemical composition (g/kg)						
Dry matter	891	896	897	895	890	875
Organic matter	940	932	939	936	926	935
Ether extract	47	57	49	64	43	60
Crude protein	187	181	162	167	147	141
Crude fibre	31	36	40	37	48	39
Gross energy (Mcal/kg)	3.9	4.0	3.9	4.0	3.8	3.9
Fatty acids (% of total analyzed fatty acids)						
C14:0	0.23	2.07	0.29	2.01	0.49	1.66
C16:0	17.87	15.76	18.54	13.86	21.79	19.77
C16:1	0.32	2.36	0.34	2.01	0.35	1.90
C18:0	3.07	3.71	2.93	3.64	3.02	3.17
C18:1n-9 *cis*	28.61	24.86	28.62	25.37	28.87	25.05
C18:1n-9 *trans*	0.83	1.39	0.92	1.23	0.79	1.22
C18:2n-6	45.83	34.88	44.74	38.01	41.83	37.55
C18:3n-3	2.45	2.38	2.73	2.89	1.88	2.54
C20:4n-6	ND	0.68	ND	0.64	ND	0.37
C20:5n-3	ND	2.45	ND	2.23	ND	1.17
C22:6n-3	ND	5.99	ND	4.76	ND	3.43
Short chain fatty acids	21.64	23.51	22.24	21.57	25.82	26.37
MUFA	30.08	30.11	30.29	29.90	30.47	28.57
PUFA	48.28	46.38	47.47	48.53	43.71	45.06
PUFA:SFA	2.23	1.97	2.13	2.25	1.69	1.71
Total n-6	45.83	35.56	44.74	38.65	41.83	37.92
Total n-3	2.45	10.82	2.73	9.88	1.88	7.14
n-6:n-3	18.71	3.29	16.39	3.91	22.25	5.31

[1] Added as a premix using a filler (3% of bonemeal) and then mixed with ground maize.
[2] Additionally 0.3 g DL-methionine/kg; ND = Not detected; MUFA = Monounsaturated fatty acids; PUFA = Polyunsaturated fatty acids.

yellowness values were significantly ($p<0.05$) affected by feeding regime and slaughter weight (Table 2). Luminosity tended to be highest at a slaughter weight of 100 kg. Redness increased with increasing slaughter weight while yellowness did not vary with diet and slaughter weight. There was significant ($p<0.05$) interaction between diet and slaughter weight on yellowness of meat only.

Backfat of tuna oil supplemented group was significantly ($p<0.05$) softer than the control group. This was the same whether measured in terms of penetration or adhesive forces. Backfat of the gilts was softer than that of barrows ($p<0.05$) and heavier pigs resulted in harder backfat as well. There were significant ($p<0.01$) interaction effects between diet and slaughter weight and diet and sex for softness, energy of penetration and energy for adhesion.

Thiobarbituric acid reactive substances number, cholesterol and triglyceride contents in backfat

The TBARS data from backfat stored for 0, 3, 6 and 9 days at 4°C is shown in Table 2. After 3, 6 and 9 days of storage, the TBARS from the backfat of pigs fed diets supplemented with tuna oil was significantly ($p<0.05$) higher than the control group. Over the same period, this was more pronounced at 100 and 110 kg slaughter weight. Gilts had lower TBARS compared to barrows in every period of storage except only at 3 days post-storage.

Table 2. Effects of tuna oil (TO) on quality traits of backfat in barrows and gilts slaughtered at different weights

Tuna oil / Slaughter weight/sex	-			+			-		+		SEM	p-values[1]		
	90	100	110	90	100	110	Barrows	Gilts	Barrows	Gilts		TO	TO×SW	TO×Sex
Color														
Luminosity	79.24^{ab}	80.09^{a}	79.01^{b}	79.06^{b}	79.34^{ab}	79.09^{b}	79.25	79.64	79.18	79.15	0.124	0.25	0.11	0.47
Redness	4.80^{ab}	4.40^{b}	4.97^{ab}	4.35^{b}	4.93^{ab}	5.50^{a}	4.61	4.84	4.87	4.98	0.118	0.40	0.06	0.75
Yellowness	5.92^{a}	5.89^{a}	5.49^{ab}	4.87^{b}	5.80^{a}	6.14^{a}	5.68	5.86	5.50	5.71	0.103	0.43	0.01	0.70
Hardness														
Force (N)	2.93^{bc}	3.75^{ab}	4.47^{a}	1.18^{cd}	1.49^{d}	2.11^{cd}	4.21^{e}	3.22^{e}	2.04^{f}	1.47^{f}	0.184	0.001	0.001	0.001
Energy 1 (MJ)	39.97^{bc}	50.47^{ab}	59.39^{a}	19.79^{d}	21.47^{d}	27.98^{cd}	56.89^{e}	42.99^{e}	27.00^{f}	19.13^{f}	2.477	0.001	0.001	0.001
Energy 2 (MJ)	10.68^{a}	11.34^{a}	13.71^{a}	5.23^{b}	5.51^{b}	6.52^{b}	13.44^{e}	10.38^{f}	6.95^{g}	4.60^{g}	0.445	0.001	0.001	0.001
Thiobarbituric acid reactive substances number (mg of malondialdehyde/kg fat)														
Day 0	2.13	2.03	2.62	2.77	2.58	2.11	2.48	1.97	2.82	2.49	0.210	0.17	0.74	0.75
Day 3	2.68^{b}	2.52^{b}	2.61^{b}	5.36^{a}	5.29^{a}	5.28^{a}	2.74^{g}	2.33^{g}	4.55^{f}	5.93^{e}	0.174	0.001	0.001	0.01
Day 6	2.77^{c}	3.44^{c}	3.42^{c}	5.28^{b}	6.07^{ab}	7.33^{a}	4.06^{f}	2.37^{g}	6.22^{e}	5.96^{e}	0.161	0.001	0.001	0.01
Day 9	3.93^{c}	3.71^{c}	3.46^{c}	4.78^{bc}	6.20^{b}	8.30^{a}	4.18^{f}	3.22^{f}	6.42^{e}	5.86^{e}	0.200	0.001	0.001	0.01
Triglycerides (g/kg)	86.48^{ab}	89.59^{a}	90.90^{a}	78.50^{b}	88.50^{a}	93.12^{a}	89.74	88.24	88.73	84.68	1.190	0.34	0.05	0.51
Cholesterol (mg/100 g)	75.59	79.77	80.30	75.21	76.82	82.23	80.13	77.43	79.11	77.81	1.102	0.89	0.31	0.83

[a-d] Means of tuna oil×slaughter weight without common superscript row are significantly different at $p<0.05$).

[e-g] Means of tuna oil×sex without common superscript row are significantly different at $p<0.05$).

[1] TO×SW = Tuna oil×slaughter weight interaction; TO×Sex = Tuna oil×sex interaction.

Energy 1 = Energy of penetration. Energy 2 = Energy of adhesion.

Table 3. Effects of tuna oil (TO) on fatty acid profile in backfat (% of total analyzed fatty acids) in barrows and gilts slaughtered at different weights

Tuna oil / SW/Sex	-			+			-		+		SEM	p-values[1]		
	90	100	110	90	100	110	Barrows	Gilts	Barrows	Gilts		TO	TO×SW	TO×Sex
C14:0	1.62	1.61	1.64	1.65	1.56	1.62	1.74	1.51	1.63	1.59	0.034	0.84	0.99	0.12
C16:0	25.12	26.05	26.09	24.72	24.47	24.94	26.64^{e}	24.85^{f}	25.16^{f}	24.16^{f}	0.232	0.05	0.25	0.01
C16:1	2.14	2.18	2.28	2.41	2.22	2.15	2.25	2.15	2.31	2.21	0.034	0.63	0.28	0.52
C18:0	15.37	12.06	11.27	11.90	12.19	12.20	11.96	13.78	12.27	11.89	0.523	0.41	0.29	0.56
C18:1n-9 cis	33.45^{abc}	35.51^{a}	34.81^{ab}	32.84^{bc}	32.28^{c}	33.49^{abc}	35.08^{e}	34.13^{ef}	33.08^{f}	32.58^{f}	0.270	0.01	0.05	0.05
C18:1n-9 trans	1.65^{bc}	1.45^{c}	1.75^{ab}	1.95^{a}	1.89^{a}	1.94^{a}	1.65^{f}	1.57^{f}	1.94^{e}	1.92^{e}	0.030	0.001	0.001	0.001
C18:2n-6 cis	17.77	17.83	18.96	19.43	19.14	18.05	17.60^{f}	18.82^{ef}	18.01^{f}	19.95^{e}	0.229	0.12	0.23	0.01
C18:3n-3	0.92	0.85	0.88	0.92	0.92	0.88	0.86^{f}	0.90^{ef}	0.88^{ef}	0.95^{e}	0.012	0.26	0.48	0.09
C20:4n-6	0.12^{bc}	0.13^{abc}	0.09^{c}	0.19^{ab}	0.21^{a}	0.21^{a}	0.10^{f}	0.13^{f}	0.19^{e}	0.22^{e}	0.011	0.001	0.01	0.001
C20:5n-3 (EPA)	0.00^{b}	0.00^{b}	0.00^{b}	0.27^{a}	0.23^{a}	0.28^{a}	0.00^{g}	0.00^{g}	0.24^{f}	0.29^{e}	0.007	0.001	0.001	0.001
C22:6n-3 (DHA)	0.01^{b}	0.04^{b}	0.03^{b}	1.18^{a}	1.24^{a}	1.29^{a}	0.01^{f}	0.05^{f}	1.22^{e}	1.25^{e}	0.016	0.001	0.001	0.001
Total SFA	27.44	28.59	28.66	27.82	27.90	28.14	29.26^{e}	27.19^{f}	28.49^{ef}	27.32^{f}	0.251	0.59	0.75	0.05
Total MUFA	36.18^{abc}	38.41^{a}	37.77^{ab}	36.05^{bc}	35.33^{c}	36.45^{abc}	37.97^{e}	36.97^{ef}	36.20^{ef}	35.61^{f}	0.283	0.05	0.05	0.05
Total PUFA	19.36^{b}	19.49^{b}	20.55^{ab}	22.00^{a}	22.45^{a}	20.99^{ab}	19.16^{g}	20.49^{fg}	20.87^{f}	22.97^{e}	0.259	0.001	0.01	0.001
PUFA:SFA	0.71^{bc}	0.69^{c}	0.72^{abc}	0.80^{ab}	0.82^{a}	0.75^{abc}	0.66^{g}	0.76^{f}	0.74^{f}	0.86^{e}	0.013	0.01	0.05	0.001
Total n-6	17.89	17.98	19.05	19.33	19.66	18.26	17.70^{f}	18.95^{ef}	18.19^{f}	20.18^{e}	0.235	0.09	0.22	0.01
Total n-3	0.93^{b}	0.92^{b}	0.91^{b}	2.38^{a}	2.42^{a}	2.48^{a}	0.88^{c}	0.96^{c}	2.35^{f}	2.51^{e}	0.028	0.001	0.001	0.001
n-6:n-3	19.27^{b}	19.63^{b}	21.20^{a}	8.14^{c}	8.24^{c}	7.46^{c}	20.21^{e}	19.89^{e}	7.85^{f}	8.11^{f}	0.154	0.001	0.001	0.001

[a-d] Means of tuna oil×slaughter weight without common superscript row are significantly different at $p<0.05$.

[e-g] Means of tuna oil×sex without common superscript row are significantly different at $p<0.05$.

[1] TO×SW = tuna oil×slaughter weight interaction; TO×Sex = tuna oil×Sex interaction.

EPA = Eicosapentaenoic acid; DHA = Docosahexanoic acid; SFA = Saturated fatty acids; MUFA = Monounsaturated fatty acids; PUFA = Polyunsaturated fatty acids.

Heavier pigs also tended to have higher TBARS compared to lighter pigs, but this was not significant ($p>0.05$). On the tuna oil dietary treatment this was only significant ($p<0.05$) at 110 kg slaughter weight. Interaction effects were significant ($p<0.05$) between diet and slaughter weight and between diet and sex only. Triglyceride content increased with increasing slaughter weight ($p<0.05$) on the tuna oil treatment. Cholesterol content was not significantly ($p>0.05$) different across treatments.

Fatty acid profile

The fatty acid profile by treatment combination is presented in Table 3. Pigs offered diets supplemented with tuna oil resulted in higher omega-3 fatty acid especially eicosapentaenoic acid (EPA; c20:5n3) and docosahexaenoic acid (c22:6n3) compared to those on the control diet. The omega-6 in terms of c18:2n6 and c20:4n6 was similar across slaughter weights and sex. Therefore, the ratio of n-6:n-3 decreased on average 2.5 times within sex across diets.

In addition, gilts had lower subcutaneous adipose tissue but higher polyunsaturated fatty acids and the ratio of n-6:n-3 fatty acid of heavier pigs was higher than those slaughtered at a lighter weight.

DISCUSSION

The main objective of the present study was to establish whether feeding long-chain n-3 fatty acids from tuna oil to barrows and gilts slaughtered at different weights would result in changes in backfat characteristics and composition. The diets fed changed substrate supply to the animal. Supplementing diets with tuna oil increased the n-3 polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

The long chain n-3 polyunsaturated fatty acids (PUFA), EPA and DHA have a wide range of biological effects which are believed to be beneficial to human health (Kromhout, 1989; Barlow et al., 1990). These fatty acids are found in significant amounts in fish oil, fish meal and some algae products (Nettleton, 1991; Givens et al., 2000).

The backfat colour of pigs on tuna oil diet was significantly lighter, redder and less yellow than from the pigs on the control group. The higher slaughter weight led to an increase in colour intensity. Results from this study are in agreement with those obtained by Karrick (1990) who found that supplemental fish oil in pig feed would produce slightly darker fat and that gilt backfat resulted in higher values of luminosity, redness and yellowness than barrows. The redness value increased with increasing slaughter weight. Backfat of tuna oil supplemented group in the current study was significantly ($p<0.05$) softer than the control group in terms of penetration and adhesive force. These results are similar to those reported by Irie and Sakimoto (1992). In their work, inclusion of tuna oil in feed of growing-finishing pigs increased the polyunsaturated fatty acids and as a result affected the hardness and melting point of the backfat. Backfat of the gilts was softer than that of barrows and heavier pigs resulted in softer fat tissue as well. This can be explained by the fatty acid composition in backfat (Wood et al., 2003; Lo Fiego et al., 2005). Similarly in the work of Morel et al. (2006), inclusion of a mixture of soybean and linseed oils which contain PUFA in pork diets, led to a more favourable ratios of SFA and PUFA and C18:2 to C18:3 in the pork in terms of human health considerations.

Gilts had lower TBARS than barrows and heavier pigs also resulted in higher TBARS compared to lighter pigs. This is because of the polyunsaturated fatty acids in backfat that are easily oxidised (Jaturasitha et al., 2002; Lo Fiego et al., 2005). Work by Sun Jin Hur et al. (2007) show that TBARS value of belly in pork could also be meditated through inclusion of dietary glycine betaine, an amino acid which serves as a methyl donor. In addition to increasing TBARS value, glycine betaine also increased the ratio of SFA and decreased unsaturated fatty acids in loins of pork meat. Glycine betaine could also therefore be used to achieve the same results as those obtained through tuna oil inclusion in the current study. Triglyceride content increased with increasing slaughter weight. The cholesterol content was not affected by feeding regime, sex and slaughter weight because cholesterol does not depend on fat deposits but increases with age. Since fat accretion is mostly influenced by energy intake and not by dietary fat type. These results are in agreement with those of Bragagnolo and Rodriguez-Amaya (2002).

Pigs offered tuna oil resulted in higher omega-3 fatty acids. The omega-6 in terms of c18:2n6 was lower but c20:4n6 was higher. This can be explained through the replacement of saturated fatty acids with polyunsaturated fatty acids in tuna oil (Jaturasitha et al., 2002; Kouba et al., 2003). In addition, gilts had lower subcutaneous adipose tissue but higher polyunsaturated fatty acids and the ratio of n-6:n-3 fatty acid of heavier pigs was higher than those slaughtered at a lighter weight. Mourot et al. (1995) explained this effect as being due to the increase in lipogenic enzymes with increasing age.

CONCLUSION

The present study demonstrated that the ratio of omega-6:omega-3 fatty acid of the backfat of pigs decreased with inclusion of 2% tuna oil in their feed by a magnitude of 2.5 times tending to ratios which would be more favourable in meeting consumer requirements. At higher slaughter weight however, the backfat showed superior fatty acid profile but also higher TBARS, cholesterol and triglyceride contents which lower the quality. Therefore, the results indicate that feeding 2% tuna oil and slaughtering the pigs at about 90 kg will be beneficial in meeting the consumer requirements.

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