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EFFECT OF SUPPLEMENTATION OF ANIMAL FAT IN THE DIET OF LARGE WHITE YORKSHIRE PIGS ON CARCASS AND SENSORY PARAMETERS

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ABSTRACT

The experiment was conducted to study the effect of supplementation of animal fat in the diet of Large White Yorkshire pigs on carcass and sensory parameters. Twenty weaned Large White Yorkshire piglets were randomly divided into two groups and allotted to the two dietary treatments, T1-control ration as per NRC (1998) and T2-control ration supplemented with five per cent of animal fat. Five animals from each treatment were slaughtered at the end of the experiment to study various carcass parameters, weight of internal organs, physico-chemical parameters and sensory evaluation of meat. There was no significant difference in any of the parameters between two treatments except backfat thickness. The statistical analysis of data showed, that the back fat thickness was higher ($P<0.01$) in T2 than that of T1. There was no difference between the treatments for any of the weight of internal organs except for lungs and kidneys, which were higher ($P<0.05$) for T1 than that of T2. The water holding capacity was lower ($P<0.05$) in T1 compared to T2. On sensory evaluation, there was no difference in colour, whereas flavor, juiciness, tenderness but overall acceptability of meat was better in fat supplemented (T2) group compared to control (T1) group. The results obtained in this study indicated that diet of growing pigs supplemented with five per cent animal fat produced better carcass and sensory characteristics.

Key words: animal fat, pigs, carcass characteristics. Sensory evaluation

INTRODUCTION

The use of animal fat as an energy source for pigs has been shown to increase digestibility of nutrients, improve growth rate and also reduces dustiness of feeds and increases palatability. However, supplementation of fat may leads to fat deposition and changes in carcass and sensory characteristics. The present work was aimed to study the effect of supplementation of animal fat on carcass and sensory characteristics of weaned Large White Yorkshire female piglets.

Liao and Venum (1994) recorded higher backfat thickness in pigs fed diet containing 22 per cent lard than that at 5 per cent level. Lee *et al.* (2011b) observed improvement in pork quality (pH, colour, marbling and firmness) in pigs fed diet supplemented with three per cent of tallow. There was no significant difference in carcass parameters of pigs fed diet containing tallow at 5 and 7.5 per cent (Nichols *et al.*, 1991), choice white grease at 1.5 and 6 per cent (Smith *et al.*, 1996), beef tallow at zero and five per cent (Eggert *et al.*, 1998a), tallow at zero, four and eight per cent (Reis *et al.*, 2000) and lard and partially hydrogenated lard at three per cent level (Bochicchio *et al.*, 2005). Bee *et al.* (2002) conducted experiment in pigs

using five per cent of tallow or soyabean oil with low and high energy diets (8.8 and 13.8 MJ of DE/kg) and stated that carcass characteristics was improved by energy concentration but not by dietary fat sources. Gatlin *et al.* (2002) replaced soyabean oil with animal fat in pig diet and could not observe any change on carcass weight, loin depth, colour, drip loss and dressing percentage. Dugan *et al.* (2004) fed canola oil or tallow at two and five per cent levels in the diet of gilts and barrows and found no difference in drip loss, marbling, colour, pH and intramuscular fat. Carcass traits did not differ in pigs fed five per cent of either beef tallow or sunflower oil in the diet (Janik *et al.*, 2005; Mitchaothai *et al.*, 2007; Mitchaothai *et al.*, 2008). Apple *et al.* (2007) concluded that fat source did not affect the belly colour, thickness and firmness in pigs fed diet containing five per cent tallow or soyabean oil. No significant effect on carcass characteristics and carcass fat content was observed in pigs fed tallow at 0.5 and 4 per cent in the diet (Beaulieu *et al.*, 2009). Apple *et al.* (2009c) stated that carcass composition was not altered by the fat source (five per cent of beef tallow, poultry fat or soyabean oil) included in the diets of growing-finishing pigs. Realini *et al.* (2010) formulated a

swine diet with 10 per cent of tallow, sunflower oil or linseed oil and found no difference in carcass characteristics among the treatment groups. Similarly Benz *et al.* (2011) used five per cent choice white grease or soyabean oil and found that dietary fat source did not affect backfat depth, loin depth or lean percentage in pigs. Browne (2011) also found that there was no significant effect of including beef tallow (three and five per cent) on colour, cooking loss and sensory characters of pork. Lee *et al.* (2011a) found no significant effects of diet on carcass weight, dressing percentage, backfat thickness or fat free lean percentage by feeding three per cent tallow with other energy sources (corn germ, palm kernel oil or glycerol). In view of the varied observations recorded earlier by various workers on fat supplementation in the diet of finishing pigs the present study was conducted with the objective, to study the effect of supplementation of animal fat in the diet of Large White Yorkshire pigs on carcass and sensory parameters.

piglets were randomly divided into two groups with five replicates in each group. Each replicates were allotted with two piglets and housed in a single pen. All piglets were maintained under identical management conditions throughout the experimental period of 70 days. Restricted feeding was followed by allowing them to consume as much as they could, within a period of one hour and the balance feed was collected and weighed after each feeding. Daily feed intake was recorded. The animals were fed with standard grower ration containing 18 per cent of crude protein (CP) and 3265 kcal of metabolizable energy (ME)/kg of feed up to 50 kg body weight and finisher ration with 16 per cent CP and 3265 kcal of ME /kg of feed from 50 kg body weight as per NRC (1998). The four groups of piglets were randomly allotted to the two dietary treatments, T1-control ration as per NRC (1998) and T2-control ration supplemented with five per cent of animal fat (containing mainly tallow, lard and little of poultry fat). Ingredient and chemical composition of pig grower and finisher ration were given in the Table 1 and 2. The ration used in this study had similar nutrients as per NRC (1998; 2012) recommendations.

MATERIALS AND METHODS

Twenty weaned female Large White Yorkshire

Table 1- Ingredient composition of pig grower and finisher rations, %

Ingredients	Experimental grower rations ¹		Experimental finisher rations ¹	
	T1	T2	T1	T2
Yellow maize	70	70	74	74
Wheat bran	1.5	1.5	3.6	3.6
Soyabean meal	26.25	26.25	20.5	20.5
Animal fat	0	5	0	5
Salt	0.5	0.5	0.5	0.5
Dicalcium phosphate	0.9	0.9	0.65	0.65
Calcite	0.85	0.85	0.75	0.75
Total	100	105	100	105
Nicomix AB ₂ D ₃ K ¹ , g	25	25	25	25
Nicomix BE ² , g	25	25	25	25
Zinc Oxide ³ , g	45	45	30	30
Oxylock antioxidant ⁴ , g	10	10	10	10
Cost per kg feed ⁵ , Rs.	18.05	19.37	17.23	18.30

¹Nicomix A, B₂, D₃, K (Nicholas Piramal India Ltd, Mumbai) containing Vitamin A- 82,500 IU, Vitamin B₂-50 mg, Vitamin D₃-12,000 IU and Vitamin K-10 mg per gram.

²Nicomix BE (Nicholas Piramal India Ltd, Mumbai) containing Vitamin B₁-4 mg, Vitamin B₆-8 mg, Vitamin B₁₂-40 mg, Niacin-60 mg, Calcium pantothenate- 40 mg and Vitamin E-40 mg per gram.

³Zinc oxide (Nice Chemicals Pvt. Ltd., kochi) containing 81.38% of Zn.

⁴Oxylock antioxidant (Vetline Ltd., Indore) contains Ethoxyquin, Butylated HydroxyToluene (BHT), Chelators and Surfactantant.

Table 2- Chemical composition*of grower and finisher rations

Parameters	Treatments (grower ration) ¹		Treatments (finisher ration) ¹	
	T1	T2	T1	T2
Dry matter, %	89.20±0.12	89.10±0.13	89.11±0.12	89.10±0.06
Crude protein, %	18.25±0.11	17.88±0.17	16.39±0.10	15.76±0.12
Ether extract, %	3.10±0.05	7.75±0.06	3.28±0.06	8.05±0.04
Crude fibre, %	3.72±0.11	3.41±0.07	3.73±0.07	3.52±0.13
Total ash, %	5.64±0.17	5.45±0.24	5.54±0.15	5.23±0.10
Nitrogen free extract, %	69.29±0.16	65.51±0.31	71.06±0.20	67.44±0.12
Acid insoluble ash, %	1.10±0.02	1.05±0.05	1.04±0.06	0.93±0.06

GE, kcal/kg	4132.18 ± 22.92	4436.27 ± 10.62	4165.18 ±22.24	4390.61 ±31.34
Calcium, %	0.59±0.01	0.58±0.006	0.62±0.02	0.60±0.007
Phosphorus, %	0.58±0.01	0.64±0.06	0.55±0.02	0.54±0.02
Magnesium, %	0.14±0.006	0.14±0.004	0.13±0.008	0.13±0.01
Manganese, ppm	16.78±0.38	15.92±0.25	16.59±0.45	15.91±0.01
Copper, ppm	6.35±0.08	6.30±0.10	6.15±0.15	6.10±0.20
Zinc, ppm	71.52±1.29	65.56±0.91	71.39±1.36	67.45±2.18

* On DM basis, ¹ Mean of four values with SE

Five animals from each treatment were slaughtered at the end of the experiment to study various carcass parameters, weight of internal organs, physico-chemical parameters and sensory evaluation of meat. Data on carcass weight, carcass length (anterior edge of 1st rib to anterior edge of pelvic bone), back fat thickness (between 10-11th ribs), loin eye area (between 10-11th ribs) and weight of the internal organs such as liver, kidney, heart, spleen, diaphragm, stomach and intestine were recorded. Dressing percentage and weight of internal organs as percentage of body weight were calculated. Marbling of meat was judged based on USDA (1985) grade chart. The pH (μ pH system-Systronics, India), Water holding capacity (WHC) (Wardlaw *et al.* (1973), Colour (Hunterlab Miniscan XE plus Spectrophotometer-Virginia, USA) and drip loss (Lawrie, 1998) were estimated. Taste panel assessment of the longissimus muscle of pigs fed three experimental rations was done with ten semi trained panelists using Nine point Hedonic scale score card. Data collected were statistically analyzed using Statistical Package for Social Studies (SPSS. 17.0.1V, 2008) software.

RESULTS AND DISCUSSION

Data on carcass weight, dressing percentage, carcass length, loin eye area, back fat thickness, marbling and weight of internal organs of the pigs maintained on the two dietary treatments are shown in Table 3. The dressing percentage of pigs belonging to the two treatment groups was 74.94 and 75.78, carcass length was 30.20 and 29.88 inch, loin eye area was 31.14 and 33.53 cm², back fat thickness was 2.32 and 3.10 cm, respectively. The marbling observed was moderate for both the groups of pigs. There was no significant difference in any of the parameters between two treatments except backfat thickness. The statistical analysis of data shows that the backfat thickness was higher ($P < 0.01$) in T2 than that of T1 treatment. In agreement to the results obtained in the present study, Liao and Venum (1994) recorded higher backfat thickness in pigs fed diet containing 22 per cent lard compared to five per cent level. Dugan *et al.* (2004) found no significant difference in the marbling and colour in the meat of pigs fed diet containing tallow at two and five per cent. Bhar *et al.* (2000) observed no significant difference in carcass traits of crossbred pigs fed diet with 0, 50 and 100 per cent replacement of maize by wheat bran. Gatlin *et al.* (2002) and Lee *et al.* (2011a) could not

observe any change in dressing percentage due to animal fat supplementation.

In contrast to these present findings, Apple *et al.* (2007) did not observe any difference in backfat thickness when pigs are fed with tallow or lard at five percent levels than control. Lee *et al.* (2011b) observed an improvement in marbling in pigs fed diet supplemented with three per cent of tallow.

There was no difference between treatment for any of the weight of internal organs except for lungs and kidneys, which was higher ($P < 0.05$) for T1 than that of T2.

Table 3- Carcass characteristics and weight of internal organs as percentage of live weight of pigs maintained on the two experimental rations

Parameters	Treatments	
	T1	T2
Live weight, kg	74.70±2.80	78.30±3.86
Carcass weight, kg	55.98±2.15	59.34±2.92
Dressing percentage	74.94±0.79	75.78±0.15
Carcass length, inch	30.20±0.11	29.88±0.80
Loin eye area, cm ²	31.14±1.90	33.53±1.99
*Back fat thickness, cm	2.32±0.31 ^a	3.10±0.45 ^b
Marbling	Moderate	Moderate
Heart, %	0.32±0.02	0.34±0.03
*Lungs, %	1.23±0.06 ^b	0.97±0.05 ^a
Liver, %	1.94±0.07	1.84±0.06
*Kidneys, %	0.46±0.07 ^b	0.35±0.01 ^a
Spleen, %	0.22±0.01	0.19±0.009
Diaphragm, %	0.42±0.02	0.39±0.03
Stomach and intestine, %	11.28±0.67	10.66±0.18

¹ Mean of 5 observations of slaughtered animals with SE

a, b - Means with different superscripts within the same row differ significantly ($P < 0.05$).

Physico-chemical parameters and sensory evaluation of meat of pigs maintained on the two experimental rations T1 and T2 are presented in Table 4. The pH of meat recorded within two hours of slaughter was 5.63 and 5.61, respectively for the two dietary treatments and the values were statistically similar. The water holding capacity on an average was 14.0 and 26.80 per cent, drip loss was 7.26 and 7.73 and colour of the meat was 63.39 and 69.23 for lightness (L), 6.72 and 10.89

for redness (a) and 14.12 and 16.55 for yellowness (b) and the values were statistically similar except for water holding capacity and lightness of colour, in which T2 was higher than T1.

Table 4-Physico-chemical parameters and sensory evaluation of meat of pigs maintained on the two experimental rations

Parameters	Treatments	
	T1	T2
Physico-chemical parameters		
pH ¹	5.63±0.06	5.61±0.05
*WHC ¹ , %	14.0±1.90 ^a	16.80±1.85 ^b
Drip loss ¹ , %	7.26±0.75	7.73±0.52
Colour ¹	*l	63.96±3.95 ^a
	a	9.60±2.26
	b	15.04±0.70
Sensory evaluation		
Colour ²	6.30±0.42	6.70±0.40
*Flavour ²	5.50±0.43 ^a	6.90±0.28 ^b
*Juiciness ²	5.20±0.47 ^a	6.40±0.45 ^b
*Tenderness ²	5.70±0.42 ^a	6.90±0.31 ^b
*Overall acceptability ²	5.40±0.50 ^a	6.90±0.31 ^b

Note: WHC-water holding capacity; l-lightness; a-redness; b-yellowness

¹Mean of 5 observations with SE

²Mean of 10 observations with SE

a, b - Means with different superscripts within the same row differ significantly Significant (P<0.05)

The observation made in the present study agrees with the findings of Gatlin *et al.* (2002), Dugan *et al.* (2004) and Lee *et al.* (2011a). Bee *et al.* (2002) stated that carcass characteristics were significantly differed by energy concentration but not by dietary fat sources in pigs fed diet with five per cent of tallow or soyabean oil.

Lee *et al.* (2011b) observed an improvement in pork quality (pH, colour, and firmness) in pigs fed diet supplemented with three per cent of tallow, which disagrees with the present findings.

Sensory evaluation of meat of pigs was 6.30 and 6.70 for colour, 5.50 and 6.90 for flavor, 5.20 and 6.40 for juiciness, 5.70 to 6.90 for tenderness and 5.40 and 6.90 for overall acceptability in the Nine point Hedonic scale score card. There was no difference regarding colour between the treatments. Fat supplemented group (T2) had higher (P<0.05) flavor, juiciness, tenderness and overall acceptability compared to control (T1) group. These observed values are in agreement with that of Lee *et al.* (2011b) who reported an improvement in overall acceptability of meat in fat supplemented group compared to non-supplemented group. Lack of significant effect on colour by level of fat in the diet was also reported by Gatlin *et al.* (2002), Dugan *et al.* (2004), Apple *et al.* (2007) and Browne (2011).

CONCLUSION

An evaluation of the results obtained in this study indicate that diet of growing pigs supplemented with five per cent animal fat produced better carcass and sensory characteristics.

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