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Effect of replacement of maize by animal fat on cost of production in Large White Yorkshire pigs*

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Abstract

The experiment was conducted to assess the effect of replacement of maize by different levels of animal fat on cost of production in Large White Yorkshire (LWY) pigs. Thirty weaned piglets were randomly divided into three groups and were allotted to the three dietary treatments, T1 (control ration as per NRC, 1998), T2 (50 per cent of maize of control ration replaced by animal fat) and T3 (100 per cent of maize of control ration replaced by animal fat) and maintained for 70 days. Cost of production per kg weight gain was calculated based on body weight gain, total feed intake and feed cost to arrive the economics of production. The body weight gain and total feed intake recorded were 56.91, 53.89, 47.49 kg and 159.28, 154.98, 145.98 kg, whereas cost per kg feed and cost of feed per kg body weight gain were Rs. 17.56, 17.13, 16.75 and Rs.49.09, 49.23, 51.54, respectively for T1, T2 and T3 rations. The result of this study revealed that 50 per cent of maize in the ration can be replaced by animal fat (T2 group) without affecting their growth performance and cost of production per kg weight gain in LWY pigs and comparable with control group, hence its preferred in time of scarcity of maize. Whereas 100 per cent replacement of maize by animal fat yielded reduced growth

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performance and increased cost of production and not economical to use in the ration of LWY pigs for maize.

Key words: Maize, Animal fat, Pigs, Cost of production.

1. Introduction

Animal husbandry is an important sub-sector of agriculture in India and among various animals piggery is directly influences the socio-economic status of the rural poor, more particularly the tribal population of the country as it acts as live insurance coverage for the downtrodden and socially weaker section of the society. There is a tremendous opportunities to use pig as a medium of poverty reduction in our country. Pork is an important source of high quality animal protein. Mutton, beef, chicken and fish alone cannot meet the animal protein requirements of the growing human population as per the ICMR (2009) recommendations of 10.8 kg meat/year. In this context, the fast growing multiparous pig having high feed conversion efficiency is one of the best choices to fill up the large gap between animal protein requirement and availability in India. The estimated pork requirement is 0.88 million MT for 1210 million human population (Banik *et al.*, 2011).

In swine rearing, feed alone forms more than 75 per cent of cost of production. Maize is major ingredient which provides energy and occupies 30 to 70 per cent in any of the pig ration. Though India produces more than 20 million MT of maize per year (Anon., 2012), more than 40 per cent deficiency in concentrate feed sources is a major threat to the pig industry which compete human for grains. Due to variable composition, reducing availability and increasing price of maize, alternative sources of energy have been considered, for example, the addition of animal fat.

Animal fat is a byproduct of meat industry and can be included as a source of dietary fat in swine ration. India produces 0.14 million MT of tallow and 0.02 million MT of lard per year (FAO, 2010). The use of fat as an energy source (7680 to 8205 kcal of metabolizable energy /kg) for pigs has been shown to increase digestibility of nutrients and (or) improve growth rate and also reduces dustiness of feeds, thereby increases palatability and decrease the cost of production (Cho and Kim, 2012). However, studies on the effect of replacing maize by animal fat on cost of production was not studied much in India, hence this work was carried out in Large White Yorkshire pigs.

2. Materials and Methods

Thirty weaned female Large White Yorkshire piglets were randomly divided into three groups with five replicates in each group. Each replicates were allotted with two piglets and housed in a single pen. All piglets were housed in the same shed and were maintained under identical management conditions throughout the experimental period of 70 days. Clean drinking water was provided *ad libitum* in all the pens throughout the experimental period.

2.1.Experimental rations:

The animals were fed with standard grower ration containing 18 per cent of CP and 3265 kcal of 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 three groups of piglets were randomly allotted to the three dietary treatments, T1 (control ration as per NRC, 1998), T2 (50 per cent of maize of control ration replaced by animal fat) and T3 (100 per cent of maize of control ration replaced by animal 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. The animal fat is a mixture of mainly beef fat (tallow), pig fat (lard) and little of poultry fat, obtained from rendering plant of Meat Technology Unit, College of Veterinary and Animal Sciences, Mannuthy, freshly as and when the feed was prepared.

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

Ingredients	Grower rations [1]			Finisher rations[1]		
	T1	T2	T3	T1	T2	T3
Yellow maize	70	35	0	74	37	0
Wheat bran	1.5	31	59.8	3.6	34.7	64.9
Soyabean meal	26.25	25.5	25.0	20.5	19.7	19.2
Animal fat	0	6.5	13	0	7	14
Salt	0.5	0.5	0.5	0.5	0.5	0.5
Dicalcium phosphate	0.9	0.4	0	*0.65*	0.10	0
Calcite	0.85	1.1	1.7	*0.75*	1.0	1.4
Total	100	100	100	100	100	100
Nicomix AB_2D_3K [1], g	25	25	25	25	25	25
Nicomix BE [2], g	25	25	25	25	25	25
Zinc Oxide[3], g	45	13	0	30	0	0
Oxylock antioxidant [4], g	10	10	10	10	10	10

[1]Nicomix A, B_2, D_3, K (Nicholas Piramal India Ltd, Mumbai) containing Vitamin A-82,500 IU, Vitamin B_2-50 mg, Vitamin D_3-12,000 IU and Vitamin K-10 mg per gram.
[2]Nicomix BE (Nicholas Piramal India Ltd, Mumbai) containing Vitamin B_1-4 mg, Vitamin B_6-8 mg, Vitamin B_{12}-40 mg, Niacin-60 mg, Calcium pantothenate- 40 mg and Vitamin E-40 mg per gram.
[3]Zinc oxide (Nice Chemicals Pvt. Ltd., kochi) containing 81.38% of Zn.
[4]Oxylock antioxidant (Vetline Ltd., Indore) contains Ethoxyquin, Butylated HydroxyToluene (BHT), Chelators and Surfactantant.

Table 2. Chemical composition*of grower and finisher rations

Parameters	Grower ration[1]			Finisher ration[1]		
	T1	T2	T3	T1	T2	T3
Dry matter, %	89.20±0.12	90.56±0.11	91.41±0.13	89.11±0.12	90.41±0.17	91.50±0.18
Crude protein, %	18.25±0.11	18.18±0.17	18.03±0.13	16.39±0.10	16.28±0.06	16.06±0.18
Ether extract, %	3.10±0.05	8.53±0.09	13.69±0.10	3.28±0.06	9.04±0.11	14.11±0.07
Crude fibre, %	3.72±0.11	6.58±0.13	9.42±0.10	3.73±0.07	6.54±0.10	9.40±0.03
Total ash, %	5.64±0.17	9.50±0.20	12.40±0.18	5.54±0.15	9.54±0.12	12.47±0.14
Nitrogen free extract, %	69.29±0.16	57.21±0.21	46.46±0.21	71.06±0.20	58.60±0.30	47.96±0.05
Acid insoluble ash, %	1.10±0.02	4.51±0.09	6.63±0.12	1.04±0.06	4.29±0.13	6.52±0.16
GE, kcal/kg	4132.18 ± 22.92	4134.95 ±14.98	4212.87 ±9.21	4165.18 ±22.24	4203.07 ±17.05	4448.30 ±36.74
Calcium, %	0.59±0.01	0.62±0.006	0.78±0.01	0.62±0.02	0.65±0.01	0.77±0.02
Phosphorus, %	0.58±0.01	0.71±0.01	0.85±0.01	0.55±0.02	0.72±0.02	0.83±0.01
Magnesium, %	0.14±0.006	0.24±0.009	0.40±0.007	0.13±0.008	0.25±0.01	0.37±0.02
Manganese, ppm	16.78±0.38	39.14±1.76	69.99±1.18	16.59±0.45	38.76±0.96	69.85±1.31
Copper, ppm	6.35±0.08	9.34±0.06	12.62±0.19	6.15±0.15	9.17±0.08	12.39±0.15
Zinc, ppm	71.52±1.29	67.19±2.23	88.52±1.15	71.39±1.36	64.95±1.47	88.50±1.62

* On DM basis; [1] Mean of four values with SE

2.2.Cost benefit analysis

Weighed quantities of feed were offered twice a day at 9.00 am and 3.00 pm. The feed intake was measured daily after collecting the left over feed if any and body weight of the individual animals were taken fortnightly in the morning hours before feeding. Cost of production per kg gain was calculated based on body weight gain, total feed intake and feed cost to arrive the economics of production. The cost of ingredients used for the study was as per the rate contract fixed by the College of Veterinary and Animal Sciences, Mannuthy for the year 2011-2012. Data collected on various parameters were statistically analyzed by Completely Randomized Design (CRD) method and means were compared by Duncan Multiple Range Test (DMRT) using Statistical Package for Social Studies (SPSS, 2008) 17.0.1V software.

3. Results and Discussion

Data on total feed intake, body weight gain, cost per kg feed and cost of feed per kg body weight gain of pigs maintained on the three dietary treatments are presented in Table 3. To reach body weight of 50 kg, T1 and T2 treatment groups took 4 weeks whereas T3 treatment group took 5 weeks period. The average weight gain, total feed intake and feed conversion efficiency of these pigs during growing stage were 27.10, 25.49, 26.86 kg; 64.45, 62.48, 73.82 kg; and 2.37, 2.45, 2.75, respectively for three

treatments. Cost per kg feed for three grower rations was Rs. 18.05, 17.66 and 17.30, and cost per kg feed per kg body weight gain of pigs maintained on the three dietary treatments was Rs.42.84, 43.33 and 47.61, respectively during grower stage. There was no significant difference in weight gain among these groups, whereas T1 and T2 groups recorded similar feed intake, feed cost and cost of feed per kg weight gain, but T3 group recorded significantly higher feed intake, feed cost and cost of feed per kg weight gain than that of other two groups.

The pigs were maintained till the T3 group reaches 70 kg body weight. The average weight gain, total feed intake and feed conversion efficiency of these pigs during finisher stage were 29.81, 28.40, 20.63kg; 94.83, 92.50, 72.16 kg; and 3.18, 3.26, 3.50, respectively for three treatments. Cost per kg feed for three finisher rations was Rs. 17.23, 16.77 and 16.38, and cost of feed per kg body weight gain of pigs maintained on the three dietary treatments was Rs.54.78, 54.66 and 57.37, respectively during finisher stage. T1 and T2 groups recorded similar weight gain, feed intake, feed cost and cost of feed per kg weight gain, whereas T3 group recorded significantly lower weight gain, feed intake and feed cost but higher cost of feed per kg weight gain than that of other two groups.

Table 3. Cost of production of LWY pigs maintained on the three experimental rations

Parameters	T1	T2	T3
Grower period			
Total weight gain, kg	27.1±0.89	25.49±0.92	26.86±0.80
Total feed intake, kg	64.45±3.50^{a}	62.48±2.01^{a}	73.82±1.70^{b}
Cost per kg feed, Rs.	18.05	17.66	17.30
Total feed cost, Rs.	1163.32±63.22^{a}	1103.36±35.46^{a}	1277.12±29.37^{b}
Cost of feed per kg weight gain, Rs.	42.84±1.17^{a}	43.33±0.57^{a}	47.61±0.82^{b}
Finisher period			
Total weight gain, kg	29.81±0.72^{b}	28.40±0.29^{b}	20.63±0.53^{a}
Total feed intake, kg	94.83±3.27^{b}	92.50±2.50^{b}	72.16±1.64^{a}
Cost per kg feed, Rs.	17.23	16.77	16.38
Total feed cost, Rs.	1633.92±56.35^{b}	1551.23±41.89^{b}	1181.98±26.94^{a}
Cost of feed per kg weight gain, Rs.	54.78±0.97^{a}	54.66±1.74^{a}	57.37±1.38^{b}
Overall period			
Total weight gain, kg	56.91±1.48^{b}	53.89±0.85^{b}	47.49±1.26^{a}
Total feed intake, kg	159.28±6.54^{a}	154.98±4.42^{a}	145.98±3.30^{b}
Cost per kg feed, Rs.	17.56	17.13	16.75
Total feed cost, Rs.	2797.24±115.53^{b}	2654.59±75.85^{b}	2444.96±54.94^{a}
Cost of feed per kg weight gain, Rs.	49.09±0.89^{a}	49.23±0.78^{a}	51.54±0.95^{b}

[1]Mean of 5 observations with SE

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

The final weight gain, total feed intake and overall feed conversion efficiency for three treatment groups were 56.91, 53.89, 47.49 kg; 159.28, 154.98, 145.98 kg; and 2.80, 2.88, 3.08, respectively. Overall cost per kg feed for three rations was Rs. 17.56, 17.13 and 16.75, and cost of feed per kg body weight gain of pigs maintained on the three dietary treatments was Rs.49.09, 49.23 and 51.54, respectively. T1 and T2 groups recorded similar weight gain, feed intake, feed cost and cost of feed per kg weight gain, whereas T3 group recorded significantly lower weight gain, feed intake and feed cost but higher cost of feed per kg weight gain than that of other two groups. **In T3 (100 per cent maize replacement) group the level of wheat bran was 64.9 per cent, compared to 34.7 per cent in T2. The level of crude fibre and acid insoluble ash in the three rations were 3.73 and 1.04; 6.54 and 4.29 and 9.4 and 6.52, respectively for T1, T2 and T3. The higher levels of crude fibre and acid insoluble ash might have contributed to the lowered digestibility of all nutrients, hence lower growth performance.** Bhar *et al*. (2000) also observed decreased nutrient digestibility and growth rate with increased level of wheat bran (0, 50 and 100 per cent maize replacement) in the diet of crossbred pigs. The digestive tract enlarges to accommodate a larger volume of feed rich in crude fibre and the rate of passage of ingesta increases, resulting in reduction in digestibility of nutrients and weight gain (Ewan, 2000; Sikka, 2007; Lentle, 2008; Sheikh, 2011).

The result of this study indicated that 50 per cent of maize in the ration can be replaced by animal fat (T2 group) without affecting their growth performance and cost of production per kg weight gain in LWY pigs and comparable with control group, whereas 100 per cent replacement of maize by animal fat yielded reduced growth performance and increased cost of production and is not economical to use in the ration of LWY pigs.

In agreement to the results of present study Anuraj (2011) obtained similar cost of feed/kg live weight gain (Rs 45.05 to 50.84) in Large White Yorkshire pigs fed diet with different levels of dried tuna waste silage. Sreeparvathy (2011) on the other hand recorded lower (Rs. 40.71 to 45.25) cost of feed/kg live weight gain in crossbred pigs fed different levels of spent brewers yeast.

In contrast to these present findings higher cost of feed/kg live weight gain was observed by Shyama (2009) (Rs. 59.15 to 63.53) in crossbred pigs fed diet supplemented with phytase and Jisha (2012) (Rs. 61.45 to 65.62) in crossbred pigs fed diet supplemented with zinc.

4. Conclusion

The result of this study revealed that 50 per cent of maize in the ration can be replaced by animal fat (T2 group) without affecting their growth performance and cost of production per kg weight gain in LWY pigs and comparable with control group, hence its preferred in time of unavailability of maize, but not 100 per cent replacement of maize.

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