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Original Research

Effect of Energy Levels in the Diet of Large White Yorkshire Pigs on Energy Utilization

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Abstract

An experiment was conducted to study the effect of different levels of energy in the diet of Large White Yorkshire pigs on energy utilization. Twenty weaned female Large White Yorkshire piglets were randomly divided into two groups and allotted to the two dietary treatments, T1-control ration: as per NRC, 2012 and T2-high energy ration: control ration + 400 kcal/kg of ME and maintained for 70 days. Digestibility trial was conducted following total collection method and gross energy was estimated using bomb calorimeter. Gross energy of feed and faeces were 4173.92, 4410.07 and 3834.24, 4090.08 kcal/kg, respectively for T1 and T2 treatments. The gross energy converted as digestible energy was 74.37 and 87.27 per cent and the calculated digestible energy of feed was 3104.22 and 3848.81 kcal/kg, respectively for two treatments. This study reveals that higher energy content of diet over and above the requirement of pigs increased the efficiency of energy utilization in growing Large White Yorkshire pigs.

Keywords: Feeding of Pigs, Energy Utilization, Varying Energy Levels

Introduction

Energy is one of the costliest factors in commercial pork production. Indian Council of Agricultural Research (ICAR, 1985) recommended digestible energy (DE) levels of 3100 and 3000 kcal/kg feed for pigs weighing 5 to 10 and 10 to 60 kg, respectively. The National Research Council (NRC, 2012) recommended 3400 kcal of DE or 3265 kcal of ME per kg diet for pigs of all age groups. Noblet and Milgen (2004) suggested that energy value of feeds for pigs should be based on net energy (NE) content because nutrient composition of diet affects conversion of ME to NE which varies from 90 per cent for fat to 60 per cent for protein. Illescu *et al*. (1982) reported that the efficiency of utilization of ME to NE in young pigs between 10 and 50 kg body weight was 73.80 per cent and that for maintenance they required 103.4 kcal of ME/ $kgW^{0.75}$ or 76.30 kcal of NE/$kgW^{0.75}$ per day. Collin *et al.* (2001) reported that feeding of starter pigs with 13.60 MJ of ME/kg feed produced better energy efficiency (96.40 to 96.70 per cent of DE as ME). Goff and Noblet (2001) observed that availability of ME from DE was 96.50 and 94.80 per cent, respectively for growing pigs and adult sows fed with standard ration (14.43 and 14.71 MJ of ME/kg).

The availability of findings is scanty and also with high variation prompted to undertake this study to find out effect of different energy levels in the diet of large White Yorkshire pigs on energy utilization.

Materials and Methods

Twenty weaned female Large White Yorkshire piglets were randomly divided into two groups with five replicates in each group. Each replicates was 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 (2012). The two groups of piglets were randomly allotted to the two dietary treatments, T1- control ration: as per NRC, 2012 and T2- high energy ration: control ration + 400 kcal of ME/kg. Ingredient and chemical composition of pig grower and finisher rations were given in the Table 1 and 2.

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

Ingredients	Grower Rations[1]		Finisher Rations[1]	
	T1	T2	T1	T2
Yellow maize	35	70	37	74
Wheat bran	31	1.5	34.7.	3.6
Soyabean meal	25.5	26.25	19.7	20.5
Animal fat	6.5	5	7	5
Salt	0.5	0.5	0.5	0.5
Dicalcium phosphate	0.4	0.9	0.1	0.65
Calcite	1.1	0.85	1	0.75
Total	100	105	100	105
Nicomix AB_2D_3K [1], g	25	25	25	25
Nicomix BE [2], g	25	25	25	25
Zinc Oxide[3], g	13	45	0	30
Oxylock antioxidant [4], g	10	10	10	10
Cost per kg feed[5], Rs.	17.3	19.37	16.38	18.3

[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 g; [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 g; [3]Zinc oxide (Nice Chemicals Pvt. Ltd., kochi) containing 81.38% of Zinc; [4]Oxylock antioxidant (Vetline Ltd., Indore) contains Ethoxyquin, Butylated HydroxyToluene (BHT), Chelators and Surfactant

Table 2: Chemical composition*of pig grower and finisher rations

Parameters	Treatments (Grower Ration)[1]		Treatments (Finisher Ration)[1]	
	T1	T2	T1	T2
Dry matter, %	90.56±0.11	89.10±0.13	90.41±0.17	89.10±0.06
Crude protein, %	18.18±0.17	17.88±0.17	16.28±0.06	15.76±0.12
Ether extract, %	8.53±0.09	7.75±0.06	9.04±0.11	8.05±0.04
Crude fibre, %	6.58±0.13	3.41±0.07	6.54±0.10	3.52±0.13
Total ash, %	9.50±0.20	5.45±0.24	9.54±0.12	5.23±0.10
Nitrogen free extract, %	57.21±0.21	65.51±0.31	58.60±0.30	67.44±0.12
Acid insoluble ash, %	4.51±0.09	1.05±0.05	4.29±0.13	0.93±0.06
GE, kcal/kg	4134.95 ±14.98	4436.27± 10.62	4203.07±17.05	4390.61±31.34
Calcium, %	0.62±0.006	0.58±0.006	0.65±0.01	0.60±0.007
Phosphorus, %	0.71±0.01	0.64±0.06	0.72±0.02	0.54±0.02
Magnesium, %	0.24±0.009	0.14±0.004	0.25±0.01	0.13±0.01
Manganese, ppm	39.14±1.76	15.92±0.25	38.76±0.96	15.91±0.01
Copper, ppm	9.34±0.06	6.30±0.10	9.17±0.08	6.10±0.20
Zinc, ppm	67.19±2.23	65.56±0.91	64.95±1.47	67.45±2.18

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

The pigs were weighed at the beginning of the experiment and subsequently at fortnight intervals. Digestibility trial was conducted at the end of the experiment following total collection method. Gross energy of feed and faeces were estimated using bomb calorimeter (plain jacket calorimeter, model: 1341, Parr instruments co., USA) to determine the energy utilization of pigs fed two experimental rations. Data collected 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. 17.0.1v) software. (Snedecor and Cochran, 1994).

Results and Discussion

Data on energy utilization of pigs under the two experimental rations T1 and T2 are presented in Table 3. Gross energy of feed and faeces were 4173.92, 4410.07 and 3834.24, 4090.08 kcal/kg, respectively for T1 and T2 treatments. The gross energy converted as digestible energy was 74.37 and 87.27 per cent and the calculated digestible energy of feed was 3104.22 and 3848.81 kcal/kg, respectively for two treatments.

Table 3: Energy utilization of LWY pigs maintained on the two experimental rations

Parameter	Two Experimental Rations[1]	
	T1	T2
Average dry matter intake, kg	2.4330±0.08^{b}	2.2016±0.03^{a}
Gross energy of feed, kcal/kg	4173.92^{a}	4410.07^{b}
Gross energy intake, kcal	10155.02±647^{b}	9708.81±118^{a}
Dry matter voided, kg	0.6718±.02^{b}	0.3008±0.01^{a}
Gross energy of faeces, kcal/kg	3834.24±94^{a}	4090.08±141^{b}
Gross energy voided, kcal	2580.87±122^{b}	1233.27±83^{a}
Gross energy-digested, kcal	7574.15±431^{a}	8475.55±168^{b}
Per cent gross energy as digestible energy	74.37±1.83^{a}	87.27±0.92^{b}
Digestible energy of feed, kcal/kg	3104.22±76.15^{a}	3848.81±40.69^{b}

[1]Mean of 5 observations; a, b - Means of different superscripts within the same row differ significantly; Significant (P<0.05)

From the Table it can be seen that the high energy diet group (T2) had higher (P<0.01) DE compared to control ration. Addition of excess five per cent animal fat contributed higher energy level in the T2 ration compared to control (T1) ration. Significant improvement in digestibility of energy as a result of fat supplementation in the diet of pigs was also reported by Li *et al.* (1990) (white choice grease supplemented at 10 per cent), Overland *et al.*

(1994) (six per cent of rendered fat) and Reis *et al.* (2000) (eight per cent tallow). However, no significant difference in the energy digestibility in pigs by supplementation of tallow at five per cent in the diet was observed by Garry *et al.* (2007) and Huang *et al.* (2010).

Illescu *et al*. (1982) reported that the efficiency of utilization of ME to NE in young pigs between 10 and 50 kg body weight was 73.80 per cent and that for maintenance they required 103.40 kcal of ME/ $kgW^{0.75}$ or 76.30 kcal of NE/$kgW^{0.75}$ per day. Collin *et al.* (2001) reported that feeding of starter pigs with 13.60 MJ of ME/kg feed produced better energy efficiency (96.40 to 96.70 per cent of DE as ME). Goff and Noblet (2001) observed that availability of ME from DE was 96.50 and 94.80 per cent, respectively for growing pigs and adult sows fed with standard ration (14.43 and 14.71 MJ of ME/kg). Lawrence and Maxwell (1983) found that efficiency of use of digestible energy tended to decrease with added fat. Galloway and Ewan (1989) stated that when additional metabolizable energy was supplied by tallow, tallow was not efficiently utilized for growth.

Conclusion

This study reveals that higher energy content of diet over and above the requirement of pigs increased the efficiency of energy utilization in growing Large White Yorkshire pigs.

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Conflict of Interests

There is no conflict of interest.

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