EFFECT OF FEEDING DIFFERENT LEVELS OF PROTEIN AND ENERGY OF BUREAU OF INDIAN STANDARD SPECIFICATION ON PRODUCTION PERFORMANCE OF CROSSBRED (HS X GH) GROWER PIG

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Abstract

Present research work was conducted to study the effect of different levels of protein and energy on growth and nutrient utilization in crossbred grower pigs. Twenty four crossbred grower pigs were divided into four groups of six each. Animals were fed four different rations containing 100% of protein and energy of Bureau of Indian Standard (BIS), 100% of protein and 75% of energy of BIS, 75% of protein and 100% of energy of BIS, and 75% of protein and 75% of energy of BIS in T₁, T₂, T₃ and T₄ groups, respectively to observe its effect on growth and nutrient utilization in crossbred grower pig. The pigs were fed on the experimental grower rations twice daily. Crude protein (CP) content (%) of the ration was ranged from 14.10±0.32 to 18.71±0.54. The average dry matter (DM) intake (g/day) was similar across all the groups which were ranged from 1357.0±5.4 to 1362.5. The majority of the nutrient digestibility coefficients were found higher (P<0.01) in T₃ group followed by T₂, T₁ and T₄ groups. The average body weight gain (g/day) was 395.7±33.1, 383.8±21.1, 379.9±12.6 and 375.3±46.0 in T₁, T₂, T₃ and T₄ groups, respectively. The cost of production per kg live weight (Rs.) was ranged from 55.30±1.7 in T₃ to 64.90±8.80 in T₄ group and the values of others were within this range. The cost of production per kg live weight was lowest (P<0.05) in T₃ in comparison to other groups. It is concluded that ration containing 75% of protein and 100% of energy specified by BIS, can meet the nutritional requirement of grower pig without affecting the growth, feed conversion ratio (FCR) and economy of feeding.

Key words: BIS, Energy, Grower pig, Production performance, Protein

INTRODUCTION

Feed costs represent 70-75% of the operating cost in swine production. Among feed cost protein alone represent about 40-50% of total feed cost. This is particularly evident in starter diet which is high in protein sources like soya bean, fish meal, groundnut cake etc. and energy sources (Maxwell and Carter, 2001). It was reported that energy intake in pigs depends on many animal and environmental

factors like body weight, genotype, sex, health, climate, housing system, pig density, feed characteristics etc. (Li and Patience, 2016; Pierozan *et al.*, 2016). In pig, feed intake is related to energy concentration of the diet and high energy level in the diet decrease feed intake where as low energy intake decreases protein deposition (Lewis and Southern, 2001; Noblet and Van Milgen, 2013). It was reported

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that the pig feed containing low protein improved faecal consistency score, enteric health and growth performance (Opapeju *et al.*, 2015; Wu *et al.*, 2015; Wen *et al.*, 2018). Therefore, present study was conducted to observe the effect of different levels of protein and energy which were either equal to or below the requirement of Bureau of Indian Standard (BIS, 1986) on growth and nutrient utilization in crossbred grower pig.

MATERIALS AND METHODS

Twenty four crossbred (Hampshire x Ghungroo, HSxGH) grower pigs (22.70 ± 0.35 to 23.00 ± 2.46 kg bwt) were divided into four groups of six in each in a randomized block design. The trial was conducted for a period of 60 days. Animals were fed on four different rations containing 100% of protein and energy of BIS, 100% of protein and 75% of energy of BIS, 75% of protein and 100% of energy of BIS, and 75% of protein and 75% of energy of BIS in T_1 , T_2 , T_3 and T_4 groups respectively. The pigs were fed on the experimental rations twice daily. Digestibility trial was conducted on the middle of experiment. The calculated energy content of the rations was 3150, 2439, 3161 and 2454 kcal ME/kg diet in T_1 , T_2 , T_3 and T_4 groups, respectively. The lysine and methionine are balanced in all the rations as per requirement. Proximate composition was done as per AOAC (1990). Data were analyzed

as per method of Snedecor and Cochran (1989).

RESULTS

The protein content of the ration ranged from 13.65 ± 0.52 (75% of BIS) in T_3 to 18.71 ± 0.54 (100% of BIS) in T_1 . Nitrogen free extract content (% DM) of the rations ranged from 67.30 ± 0.54 in T_1 to 73.98 ± 0.34 in T_4 (Table 1). The digestibility of dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fiber (CF) and nitrogen free extract (NFE) were ranged from 82.94 ± 0.21 to 86.36 ± 0.17 ; 84.63 ± 0.18 to 87.72 ± 0.16 ; 83.57 ± 0.19 to 89.03 ± 0.33 ; 58.30 ± 1.12 to 74.57 ± 3.97 ; 61.98 ± 0.43 to 63.31 ± 0.47 and 85.66 ± 0.17 to 90.08 ± 0.22 respectively. In most of the treatments, digestibility of nutrients showed increasing trend ($P < 0.05$) from T_1 to T_3 and thereby reduced in T_4 (Table 2).

The feed intake (g/day) was ranged from 1357.4 ± 6.5 to 1362.5 ± 7.5 in T_1 and T_2 respectively and others namely T_3 and T_4 were within this range of variation (Table 3). The DM intake was found similar ($P > 0.05$) across all treatment groups. Average growth rate (g/day) was ranged from 375.3 ± 46.0 in T_4 group (75% of energy and protein of BIS) to 395.7 ± 33.1 in T_1 group respectively (Table 3). The feed conversion ratio (FCR) and feed cost (Rs./kg gain) ranged from 3.50 ± 0.29 to 3.58 ± 0.19 and 55.3 ± 1.7 to 65.1 ± 3.5 , respectively (Table 3).

Table 1. Proximate composition of grower ration containing different level of protein and energy

Grower feed	OM%	CP%	CF%	EE%	Ash%	NFE%
T_1	95.79 ± 1.01	18.71 ± 0.54	5.73 ± 0.37	4.05 ± 0.64	4.22 ± 1.01	67.30 ± 0.54
T_2	94.92 ± 0.37	17.64 ± 0.08	5.31 ± 0.18	2.76 ± 0.34	5.09 ± 0.37	69.21 ± 0.96
T_3	94.70 ± 0.11	13.65 ± 0.52	5.62 ± 0.16	2.05 ± 0.59	5.28 ± 0.13	73.41 ± 0.83
T_4	94.89 ± 0.10	14.10 ± 0.32	4.71 ± 0.15	2.10 ± 0.22	5.12 ± 0.10	73.98 ± 0.34

T_1 : 100% of protein and energy of BIS (Bureau of Indian Standard), T_2 : 100% of protein and 75% of energy of BIS, T_3 : 75% of protein and 100% of energy of BIS, and T_4 : 75% of protein and 75% of energy of BIS

Table 2. Effect of different levels of protein and energy on digestibility of nutrients in crossbred grower pigs

Group	DM	OM	CP	EE	CF	NFE
T ₁	82.94 ^a ±0.21	84.63 ^a ±0.18	87.01 ^b ±0.16	72.39 ^c ±0.91	62.12±0.91	85.66 ^a ±0.17
T ₂	85.31 ^b ±0.44	86.76 ^b ±0.52	89.03 ^c ±0.33	74.57 ^c ±3.97	62.44±0.05	88.82 ^b ±0.34
T ₃	86.36 ^c ±0.17	87.72 ^c ±0.16	86.93 ^b ±0.17	64.36 ^b ±0.38	63.31±0.47	90.08 ^c ±0.22
T ₄	84.71 ^{bd} ±0.17	86.76 ^{bd} ±0.22	83.57 ^a ±0.19	58.30 ^a ±1.12	61.98±0.43	89.36 ^b ±0.20
P Value	0.01**	0.04*	0.01**	0.05*	0.626	0.01**

^{a,b,c,d} different superscript in a column differ significantly, (**, P<0.01, *, P<0.05); T₁: 100% of protein and energy of BIS, T₂: 100% of protein and 75% of energy of BIS, T₃: 75% of protein and 100% of energy of BIS, and T₄: 75% of protein and 75% of energy of BIS

Table 3. Effect of different level of protein and energy on feed intake, growth, FCR and cost of feeding of crossbred (HSxGH) grower pig

Parameters	T ₁	T ₂	T ₃	T ₄	P value
Feed intake, g/day	1357.4±6.5	1362.5±7.5	1357.0±5.4	1361.0±4.5	0.894
Initial body weight, kg	22.90±2.83	23.00±2.46	22.90±2.21	22.70±0.35	0.999
Final body weight, kg	48.45±2.89	47.28±2.57	48.63±2.06	46.63±2.90	0.968
Growth, g/day	395.7±33.1	383.8±21.1	387.0±13.0	375.3±46.0	0.888
FCR (Feed conversion ratio)	3.50±0.29	3.58±0.19	3.52±0.11	3.81±0.52	0.907
Feed cost/kg gain	62.0±5.1	65.1±3.5	55.3±1.7	64.9±8.8	0.566

T₁: 100% of protein and energy of BIS (Bureau of Indian Standard), T₂: 100% of protein and 75% of energy of BIS, T₃: 75% of protein and 100% of energy of BIS, and T₄: 75% of protein and 75% of energy of BIS;

DISCUSSION

From the proximate composition of the present study it was found that CP% of experimental diet was reduced by 3.99% to 4.61% in T₃ and T₄ groups when diet was formulated to meet the 75% protein requirement of BIS (Table 1).

The digestibility coefficient of dry matter, organic matter, crude protein and nitrogen free extract was found higher (P<0.05) in T₃ group in comparison to other three groups, while digestibility of ether extract was similar in T₁ and T₂ groups and reduced significantly (P<0.05) in T₃ and T₄ groups (Table 2). The crude fiber digestibility was found similar across

the treatment groups. In a similar study, Ball *et al.* (2013) reported that energy digestibility decreased with decreasing level of CP in diets containing 6.9 g/kg available lysine in finisher crossbred pigs (Landrace x Large White Yorkshire). Similar to present findings, Kashyap (2010) also found higher digestibility of dry matter in high protein high energy diet in indigenous Ghungroo pig. The increase digestibility of crude protein in group T₁ and T₂ might be due to high level of protein in those diets. Similar high digestibility of protein was also reported by Kashyap (2010). Crude fiber digestibility was found similar across the

groups. Similar result also reported by other workers (Myer *et al.*, 1975; Kashyap, 2010). In a similar study, Fang *et al.* (2019) also reported that feeding of low protein and high energy diet in crossbred (Duroc x Large White Yorkshire x Landrace) weaner pigs improved the nutrient digestibility. In another study, Zhao *et al.* (2019) reported that 3.5% decreased in dietary protein than requirement did not affect the nutrient digestibility while significantly ($P<0.05$) reduces faecal nitrogen excretion and *Escherichia coli* count.

In the present study, although growth was found slightly higher at 100% energy and protein of BIS, but, there was no significant difference on growth among the treatment groups. Similar to present finding, several workers (Sharda *et al.*, 1976; Kennelly and Aherne, 1980; Phuath and Hutagalung, 1982) reported that growth rate was decreased with decreased level of energy in the diet of pig. In a similar study, Fang *et al.* (2019) reported that feeding of low protein and high energy diet in crossbred (Duroc x Large White Yorkshire x Landrace) weaner pigs improved the growth

performance. In another study, Zhao *et al.* (2019) reported that 3.5% decreased in dietary protein than requirement did not affect the growth performance of growing-finishing pigs. In contrast to this, other researchers (Ribeiro *et al.*, 2016; Lee *et al.*, 2017) found that energy level did not affect growth performances in weaning piglets.

The feed conversion ratio was found slightly higher in T₂, T₃ and T₄ groups, but there were no significant difference between the groups. Similar, result also reported by Barman *et al.* (2013) when experimental starter crossbred pigs were fed with different level of protein and energy of BIS. Feed cost per kg gain (Rs.) was found similar across the treatment groups. Similar finding was also reported by Barman *et al.* (2013) in starter crossbred pigs by feeding different level of protein and energy of BIS.

From this study, it can be concluded that 75% protein and 100% energy of Bureau of Indian Standard can meet the nutritional requirement of grower pig without affecting the production performances.

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