Evaluation of optimal lysine level in Myanmar local breed and DYL crossed breed pig

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Abstract

A Completely Randomized Design (CRD) was comprised 2x3 factorial arrangements of two breeds (DYL and local breed) and three different lysine levels. The 12 weeks old, nine castrated DYL and nine castrated local breed were randomly allocated in each individual pen to six treatment groups with three replicates into 18 pens. Two breeds of pigs (DYL and local breed) were exposed to the three different dietary treatments, L1- basal diet without lysine supplementation, L2- basal diet with 1.15% total lysine for grower and L3- basal diet with 1.65% total lysine for grower. The growth performance and feed intake were determined for growing pigs. In this study, no significant difference (p>0.05) was found in feed intake among the three different treatments. However, significantly better body weight, weight gain and feed conversion ratio (FCR) were observed in pigs fed L2 and L3 but were not significantly (p>0.05) differ from each other. Otherwise, diets without lysine supplementation (L1) showed no better effect on the growth performances of both DYL and local breeds. It could be noted that L2 was the best level to obtain optimal growth performances and farm efficiency. Between the two breeds, body weight of DYL was superior over that of local breed. The interactions were observed between lysine levels and different breeds regard for body weight and cumulative weight gain. To wrap up, it was noticeable that crystalline lysine supplementation helped to improve growth performance in both breeds.

Key words: Lysine, local breed, DYL crossed breed, growth performance, interaction

Introduction

Nutrition plays an important role in the animal production and health. And feed cost is also take accounts for 70-80% of total animal production cost. It also exploits the genetic potentiality of the animal (Chahal *et al.*, 2008). Feeding a diet containing less protein may result in somewhat poorer performance due to the lack of sufficient lysine. So, proteins and amino acids play a crucial role in pig nutrition (Kaur *et al.*, 2006).

Therefore, corn-soybean meal diet for pigs contain low lysine concentration and so it is the first limiting amino acid while methionine is the second limiting amino acid (Lewis, 2001). The supplementation of lysine also influence on the gene expression and dietary utilization of nutrient (Wang *et al.*, 2009). The use of lysine supplementation is also economically viable and cost effective, giving higher income over feed costs.

To enhance performance, not only diet but also breed is important to be considered. Purebred native genotypes have lower growth performances than European pigs and thus are unsuitable for commercial production. Better feed conversion efficiency and faster growth rate and higher growth potential were found in exotic breeds than indigenous breeds (Mishra *et al.*, 1989). Kim *et al*. (2002) also stated that Korean Native Pig also have slower growth rate and higher fat than commercial cross breed of Landrace× Yorkshire×Duroc (DYL).

The Myanmar local breed had to rise about one year to reach the marketable weight; so, it grows more slowly than the genetic improved pig breeds (FAO, 2011). The external characteristics of Myanmar native pigs have black coat colours, short-eared and medium-sized lop ears over the eyes or horizontal ears, and dished, wrinkled face, wrinkled body and hairless pigs were also observed. In Shan state, pigs have black colour, both short ears and horizontal ears or medium-sized ears were found (Kurosawa *et al.*, 2004).

In Myanmar, the research work concerned with lysine supplementation on the performance of DYL and local breed has not been investigated yet. Therefore, the aim of this study was to evaluate the effect of lysine supplementation at different levels in the diet on the growth performance of two different breeds of pigs.

Materials and Methods

Experimental animals

Nine DYL [(Landrace×Yorkshire) × Duroc] castrated male crossed breed and nine local breed castrated male, 12 weeks old pigs were used in this experiment. Before feeding the experimental diets, all piglets were de-wormed and give Iron injection. All piglets were vaccinated with Hog Cholera vaccine. Initial weigh of piglets were recorded individually.

Preparation of experimental diet

Compositions of the experimental diet and nutrient levels are shown in Table 1. The experimental diets were; diet 1: basal diet only without lysine supplementation, diet 2: basal diet with total lysine of 1.15% for the grower and diet 3: basal diet with total lysine of 1.65% for the grower. Each diet was provided as dry form and two times per day at 9:00 am and 3:00 pm. Feed given and refusals were recorded daily to measure feed intake. Water was provided *ad libitum* throughout the experimental period.

Table 1 Composition of experimental diets.

Ingredients	Diet 1 (%)	Diet 2 (%)	Diet 3 (%)
Corn	46.00	46.00	50.60
Rice Bran	12.00	12.00	10.00
Broken Rice	20.00	20.00	17.00
Soybean Meal	14.00	14.00	14.00
Fish	7.00	7.00	7.00
Lysine	-	0.20	0.71
Premix	1.00	0.80	0.69
Total	**100.00**	**100.00**	**100.00**
CP %	18.00	18.00	18.00
ME (Kcal/kg)	3265.00	3265.00	3265.00
Lysine %	**0.95**	**1.15**	**1.65**

Methods

Experimental design

Completely randomized design (CRD) was used. There were six treatments comprising a 2×3 factorial arrangement of two different breeds (local breed and DYL) and three diets with or without lysine supplementation. Each treatment replicate three times, with one castrated male pig constituting a replicate. All piglets were randomly allocated in each individual pen. The pigs were kept in the cages for one week to acclimatize before data collections begin. The experimental period lasted for 6 weeks.

Measurement and analysis

Growth performance and feed conversion ratio

Animals were weighed at the beginning and weekly throughout the experimental period and recorded. The feed intake per pen was recorded daily throughout the experimental period and each pig was weighed at the beginning and the end of the experiment to determine weight gain and average daily feed intake (ADFI). Feed conversion ratios were calculated on weekly basis.

Statistical analysis

All data collected in this study were analysed by using analysis of variance (ANOVA, SAS® Institute, 2002). The differences among treatment groups were examined by Duncan's Multiple Range Test (DMRT)

Result

Main effects of lysine supplementations and breeds on performance of pigs

The main effects of lysine supplementations and breeds on performance of pigs are shown in Table 2. There were no significant differences in cumulative feed intake (kg) among different lysine supplementation and different breeds.

The body weight (kg) of pigs treated with L2 was the highest and pig treated with L1 was the lowest. The body weight (kg) of pigs treated with L2 was not significantly different from that of groups treated with L3 but was significantly ($p<0.05$) higher than that of group treated with L1. The body weight (kg) and cumulative gain (kg) of DYL was significantly higher ($p<0.05$) than that of local breed.

The cumulative weight gain (kg) of pigs treated with L3 was the highest and pig treated with L1 was the lowest. The cumulative weight gain (kg) of pigs treated with L3 was not significantly ($p>0.05$) different from that of groups treated with L2 but was significantly higher ($p<0.05$) than that of group treated with L1. The cumulative weight gain (kg) of DYL was not significantly different ($p>0.05$) from that of local breed.

The feed conversion ratio (FCR) of pigs treated with L3 was the narrowest and pig treated with L1 was the widest. The feed conversion ratio (FCR) of pigs treated with L3 not significantly different from that of groups treated with L2 but was significantly narrower ($p<0.05$) than that of group treated with L1. The feed conversion ratio (FCR) of DYL was not significantly different ($p>0.05$) from that of local breed.

There were no interactions ($p<0.05$) between lysine and breed in cumulative feed intake (kg) and FCR of pigs. Significant interactions between lysine and breed at ($p<0.05$) were found in body weight (kg) and cumulative weight gain (kg) of pigs.

Table 2 Main effects of lysine supplementation and breed on performance of pigs

Parameters	Lysine supplementations			Sig. level	Breeds		Sig. level	Lys×Breed
	L1	L2	L3		Local	DYL		
Body weight (kg)	46.75±0.32^{b}	49.53±0.70^{a}	49.05±0.97^{a}	*	47.30±0.29^{b}	49.59±0.77^{a}	*	*
Cumulative Feed Intake (kg)	79.60±0.99^{a}	80.03±1.33^{a}	78.13±2.18^{a}	NS	80.77±0.84^{a}	77.74±1.42^{a}	NS	NS
Cumulative weight gain (kg)	24.98±0.19^{b}	26.32±0.36^{a}	26.75±0.63^{a}	*	25.82±0.27^{a}	26.21±0.54^{a}	NS	*
Feed conversion ratio	3.19±0.03^{a}	3.04±0.03^{ab}	2.93±0.12^{b}	*	3.13±0.04^{a}	2.98±0.08^{a}	NS	NS

^{a,b} The means with different superscripts within the same row are significantly different at ($p<0.05$)*.

NS= non-significant

L1= without lysine supplementation

L2= total lysine of 1.15% for the grower

L3= total lysine of 1.65% for the grower

The effects of different lysine levels and breeds on the performance of pigs

The effects of different lysine levels and breeds on the performance of pigs are shown in Table 3. The body weight (kg) of pig treated with T5 was the highest and pig treated with T2 was the lowest. The cumulative weight gain (kg) of pig treated with T5 was the highest and pig treated with T1 was the lowest. The feed conversion ratio (FCR) of pig treated with T5 was narrowest and pig treated with T2 was the widest. To wrap up, the pigs treated with T3 and T5 had the highest performance and the pigs treated with T1 and T2 had the lowest performance.

Table 3 The effects of different lysine levels and breeds on the performance of pigs

Parameters	Treatments						Sig. level
	1	2	3	4	5	6	
Body weight (kg)	46.83±0.63^{b}	46.67±0.33^{b}	50.83±0.83^{a}	48.23±0.23^{b}	51.10±0.56^{a}	47.00±0.40^{b}	**
Cumulative Feed Intake (kg)	77.90±0.95^{a}	81.30±1.04^{a}	78.60±2.49^{a}	81.47±0.74^{a}	76.73±4.03^{a}	79.53±2.37^{a}	NS
Cumulative weight gain (kg)	24.67±0.26^{d}	25.30±0.10^{cd}	25.90±0.67^{bc}	26.73±0.15^{b}	28.07±0.12^{a}	25.43±0.50^{cd}	**
Feed conversion ratio	3.16±0.07^{a}	3.21±0.03^{a}	3.03±0.05^{a}	3.05±0.04^{a}	2.74±0.16^{b}	3.13±0.12^{a}	*

^{a,b,c,d} The means with different superscripts within the same row are significantly different at ($p<0.001$)** and ($p<0.05$)*.

NS= non-significant

T1= without lysine supplementation + DYL

T2= without lysine supplementation + local breed

T3= total lysine of 1.15% for the grower + DYL

T4= total lysine of 1.15% for the grower + local breed

T5= total lysine of 1.65% for the grower + DYL

T6 =total lysine of 1.65% for the grower + local breed

Discussion

Feed intake

In this study, diet composition with different levels of lysine had no significant influence on feed intake. But contrary to this, Martinez and Knabe (1990) found a significant increased with increasing lysine

level. Cho *et al.* (2012) also observed that as Lys:DE ratio was increased, ADFI was improved in finishing barrows. However, the present result was consistent with Eggert *et al.* (1997) and Davis *et al.*, (1996) who observed that average daily feed intake was not significantly different among different lysine levels in the diets. Thaler *et al.* (1986) also stated that feed intake was not significantly affected by the addition dietary lysine.

Growth Performances

In this study, supplementation of crystalline lysine to basal diets, formulated to 1.15% (L2), increased in body weight. Increasing lysine levels to 1.65% (L3) also resulted in increased body weight, cumulative gain and improvement in FCR of pigs. Although numerical means favoured the highest lysine levels (L3), the effects were not significantly different from the mean values for (L2). Possibly, the lysine concentration of L2 was sufficient for optimal growth performance. Therefore, it could be defined that L2 was the appropriate level to gain the optimal performances. The basal diet without lysine supplementation, lowest level of lysine (L1), in this experiment seems to have lower performances in both breeds.

Results similar to current findings have been reported previously by Batterham *et al.* (1990) who found that increasing the dietary lysine concentration resulted in significant increased in growth rates. Lysine deficiency had negative impact on animal health and growth performance (Liao *et al.*, 2015; Rodríguez-Sánchez *et al.*, 2011) and it appeared that dietary lysine level had no harmful effect on growth performance even at a high level of supplementation. By contrast, Li *et al.* (1989) demonstrated that growth performance of pigs weighing 45 to 75 lb was optimized by a diet containing at least 0.85% lysine. That level was slightly lower than that of the current experiment. Otten *et al.* (2013) also found that an increased level of lysine and ME had no effect on daily weight gain or feed conversion ratio.

According to result of current study, the growth response observed with additional lysine suggests that the lysine requirements of pigs for maximum growth might be higher than what the NRC (1998) recommended. It was consistent with Figueroa *et al*. (2012) who stated that supplementation with lysine increased growth performance and the lysine requirement might be higher than the level suggested by NRC (1998) for fattening pigs or for the pigs that had a greater potential for lean tissue deposition. However, Zhang and Kim (2014) reported that the dietary lysine concentration was sufficient for the growth of weaned pigs according to NRC (1998).

In the aspects of breed, the body weights of DYL were superior to that of Myanmar local. FAO, (2011) also reported that the Myanmar local breed grows more slowly than the genetic improved pig breeds. Myanmar local breed grew 60 kg only at one year of age (National Consultative Committee Myanmar, 2001). This means that the growth performance was significantly affected by breed (Renaudeau *et al.*, 2006) and also due to protein accretion rates and total empty body protein were highest in high-lean breed (Friesen *et al.*, 1994b).

In the current study, the lysine × breed interaction was significant for body weight, average daily gain and cumulative gain. The response of DYL to additional lysine was greater than local breed. Therefore, it might be noted that the requirement of lysine could not be the same between different breed. It might be because of their different genetic potential and protein accretion rate. Chiba *et al.* (2002) also stated that some grower diet × genotype interactions were found and pigs selected for lean growth efficiency may have to be offered a grower diet containing adequate amino acid concentrations to optimize overall growth performance.

Conversely, a studied by Friesen *et al.* (1994b) indicated that the largest improvements in growth performance, carcass characteristics and protein accretion were detected regardless of genotype when dietary lysine was increased. Fabian *et al.* (2002) also stated that no diet×genotype interactions were observed.

Conclusion

To sum up, supplementation of lysine in pig diets have beneficial effect on growth performance compared with diets based solely on intact proteins without lysine supplementation. Furthermore, DYL crossed breed showed better growth performance compared to that of Myanmar local breed. Therefore, it could be concluded that lysine is first limiting amino acid and supplementation of lysine in pig diets should practice in order to gain better performances in both different breeds.

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