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# The effect of lysine supplementation on the performance of 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 18 weeks old, nine castrated DYL and nine 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 0.95% total lysine for finisher and L3- basal diet with 1.45% total lysine for finisher. The growth performance and back fat thickness were determined for finishing pigs. Significantly better body weight, weight gain, feed conversion ratio (FCR) and lower back fat were observed in pigs fed L2 but did not significantly differ from those fed L3. 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 feed efficiency. Between the two breeds, growth performances of DYL were superior over that of local breed. Back fat thicknesses of DYL were also thinner than that of local breed. The interactions were observed between lysine levels and different breeds regard for final body weight, cumulative gain and feed conversion ratio. It was noticeable that lysine supplementation helped to improve growth performance and reduce back fat thickness of both local breed and DYL crossed breed. The result also showed that a comparison of the two different breed revealed the improved performances in DYL crossed breed rather than that of local breed.

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## INTRODUCTION

In Myanmar, the livestock production is dominated by indigenous breeds and raised by traditional method. The Myanmar native pigs are characterized by thick fat, hardiness and poor growth, weighs about 60 kg only at one year of age. So, the indigenous breed grows more slowly than the exotic cross breeds. The general characteristics of Myanmar local breeds have small and moderately dished head, concave back and pendulous belly. [1].

Purebred native genotypes have lower growth performances than European pigs and thus are unsuitable for commercial production. Exotic breeds of pigs have higher feed conversion efficiency and faster growth rate and have higher growth potential than indigenous breeds [2]. Korean Native Pig also have slower growth rate and higher fat than commercial cross breed of Landrace× Yorkshire×Duroc (DYL) [3].

Furthermore, inadequate nutrition and feeding seem to be the major factors for low production performance [4]. Because of proteins and amino acids play a crucial role in the formulation of swine ration, feeding a diet containing less protein may result in somewhat poorer performance due to the lack of sufficient lysine. They are also essential for the normal growth of body tissues, synthesis of macromolecules involved in structural, metabolic and functional activities, reproduction and disease resistance of animals [5].

In corn-soybean meal diet for pigs, lysine is the first limiting amino acid and methionine is the second limiting amino acid. Because of the concentration of lysine in pork is relatively high (about 7%) and the feedstuffs commonly fed to pigs are quite low in lysine, it is the first limiting amino acid for pig. [6].

Supplementation of the lysine, most limiting amino acid, may affect both voluntary feed intake and efficiency of dietary energy utilization and consequently production performance [7,8].

Moreover, finishing barrows that are fed lysine supplemented diet can be achieved improved performances including ADG, FCR, carcass weight and grade [9]. The supplementation of lysine also influence on the gene expression and dietary utilization of nutrient [10].

As lysine is the first limiting amino acid in the diet of pig, the research work concerned with lysine supplementation is needed. The effect of lysine supplementation on the performance of DYL and local breed has not been investigated yet in Myanmar. 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, 18 weeks old pigs were used in this experiment. Before feeding the experimental diets, all pigs were de-wormed and vaccinated with Hog Cholera vaccine. Initial weights of the pig were recorded individually.

### Preparation of experimental diet

Compositions of the experimental diet and nutrient levels are shown in Table 1. The experimental diets were included; diet 1: basal diet only without lysine supplementation, diet 2: basal diet with total lysine of 0.95% for finisher and diet 3: basal diet with total lysine of 1.45% for finisher. 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.

## 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 pigs were randomly allocated in each individual pen. The pigs were kept in the cages for one week to acclimatize the conditions before data collections begin.

**Table 1: Composition of experimental diets**

| Ingredients | Diet 1 % | Diet 2 % | Diet 3 % |
|---|---|---|---|
| Corn | 49.00 | 49.00 | 52.60 |
| Rice Bran | 12.00 | 12.00 | 10.00 |
| Broken Rice | 20.00 | 20.00 | 18.00 |
| Soybean Meal | 15.00 | 15.00 | 15.00 |
| Fish | 3.00 | 3.00 | 3.00 |
| Lysine | - | 0.14 | 0.65 |
| Premix | 1.00 | 0.86 | 0.75 |
| Total | 100.00 | 100.00 | 100.00 |
| CP % | 16.00 | 16.00 | 16.00 |
| ME (Kcal/kg) | 3265.00 | 3265.00 | 3265.00 |
| Lysine % | 0.81 | 0.95 | 1.45 |

### 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 feed conversion ratios.

### 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 supplementation and breed on performance of pigs are shown in Table 2. The body weight (kg) and cumulative gain (kg) of pigs treated with L2 was the highest and pig treated with L1 was the lowest. The body weight (kg) and cumulative gain (kg) of pigs treated with L2 was not significantly different from that of groups treated with L3 but was significantly higher ($p<0.001$) than that of group treated with L1. The body weight (kg) and cumulative gain (kg) of DYL was significantly higher ($p<0.001$) than that of local breed.

The feed conversion ratio (FCR) of pigs treated with L2 was the narrowest and pig treated with L1 was the widest. The feed conversion ratio (FCR) of pigs treated with L2 not significantly different from that of groups treated with L3 but was significantly narrower ($p<0.001$) than that of group treated with L1. The feed conversion ratio (FCR) of DYL was significantly narrower ($p<0.001$) than that of local breed.

The back fat thickness (mm) (BFT) of pigs treated with L1 was the highest and pig treated with L2 was the lowest. The back fat thickness (mm) (BFT) of pigs treated with L2 was not significantly different from pig treated with L3 but was significantly thinner ($p<0.05$) than that of group treated with L1. The back fat thickness (mm) (BFT) of DYL was significantly thinner ($p<0.05$) than that of local breed.

There were no interactions ($p<0.05$) between lysine and breed in back fat thickness (mm) (BFT) of pigs in the overall experimental period. Significant interactions between lysine and breed at ($p<0.05$) were found in body weight (kg), feed conversion ratio FCR and cumulative weight gain (kg) of pigs in the overall experimental period.

**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 final body weight (kg) and cumulative weight gain (kg) of pigs treated with T3 was the highest and pigs treated with T2 was the lowest. The feed conversion ratio (FCR) of pigs treated with T3 was narrowest and pigs treated with T2 were the widest. The back fat thickness (mm) (BFT) of pigs treated with T2 was the highest and pigs treated with T5 were the lowest. To wrap up, the pigs treated with T3 and T5 had the highest performance and the pigs treated with T2 had the lowest performance.

## DISCUSSION

### Growth Performances

In this study, supplementation of crystalline lysine to basal diets, formulated to 0.95% (L2), increased body weight, cumulative gain and improvement in FCR of pigs. Increasing lysine levels to 1.45% (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 no effect on the performances of both breeds.

Results similar to current findings have been reported previously that reduction of growth performance in pigs might be expected as lysine concentration decreased in the diet [11]. Other authors also observed improved performance as dietary lysine level increases [12-14]. When the lysine to energy ratio increased average daily weight gain increased in growing finishing pigs [15, 16]. The finisher pigs that were fed with the high amino acid diet tended to grow faster and better feed conversion than those offered in low amino acid diet [17]. Increasing dietary lysine improved gain:feed ratio in finishing pigs [18]. This might be due to lysine supplementation increased the nitrogen retention and protein accretion, and improved the growth performance of the animals.

In contrast, growth performances of pigs were not affected by increasing level of lysine and ME [19]. Similarly, feed conversion ratio was not influenced by an increased level of lysine [20]. During growing and fattening stage of production, lysine levels can be reduced safely by 15% in diet compared to that of NRC (1998) without compromising on performance of pig [21].

Lysine is a key amino acid that animals need to optimize their genetic potential. In the aspects of breed, DYL were superior to that of Myanmar local breed regard for parameters measured in the current experiment. The growth performance was significantly affected by breed [22]. Farm efficiency and production performance could be improved by production of crossbred pigs [23]. The genetic improved pig breeds had better growth performance than Myanmar local breed. Genetically high crossed breed have more growth potential than Myanmar local breed that grew 60 kg only at one year of age [24]. Korean native pig showed slower growth rate and lighter carcass weight than commercial pig breed (DYL) and had more great production efficiency than pure or two-way crossbreds [25]. This means improved farm efficiency could be obtain by producing of crossed breed pigs.

In the current study, the lysine × breed interaction was significant for body weight, cumulative gain and FCR. The response of pigs to addition of lysine was not similar when the breed is different. The response of DYL to additional

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) | 92.50±3.06$^{b}$ | 98.22±2.80$^{a}$ | 97.67±2.24$^{a}$ | ** | 90.11±1.13$^{b}$ | 102.14±0.76$^{a}$ | ** | * |
| Cumulative weight gain (kg) | 35.70±2.27$^{b}$ | 39.54±2.06$^{a}$ | 39.03±1.41$^{a}$ | ** | 33.39±0.87$^{b}$ | 42.29±0.54$^{a}$ | ** | * |
| Feed conversion ratio | 4.46±0.28$^{a}$ | 4.00±0.21$^{b}$ | 4.03±0.15$^{b}$ | ** | 4.63±0.12$^{a}$ | 3.70±0.05$^{b}$ | ** | * |
| Back fat thickness (mm) | 16.83±0.60$^{a}$ | 15.17±0.31$^{b}$ | 15.67±0.71$^{b}$ | * | 16.89±0.42$^{a}$ | 14.89±0.31$^{b}$ | * | NS |

[a,b] The means with different superscripts within the same row are significantly different at ($p<0.001$)** and ($p<0.05$)*. NS= non-significant, L1 = without lysine supplementation, L2= total lysine of 0.95% for the finisher, L3= total lysine of 1.45% for the finisher

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) | 99.33±0.17$^{c}$ | 85.67±0.33$^{e}$ | 104.43±0.30$^{a}$ | 92.00±0.58$^{d}$ | 102.67±0.17$^{b}$ | 92.67±0.18$^{d}$ | ** |
| Cumulative weight gain (kg) | 40.73±0.52$^{b}$ | 30.67±0.33$^{d}$ | 44.08±0.65$^{a}$ | 35.00±0.38$^{c}$ | 42.05±0.13$^{b}$ | 36.00±0.91$^{c}$ | ** |
| Feed conversion ratio | 3.83±0.05$^{c}$ | 5.09±0.06$^{a}$ | 3.54±0.05$^{d}$ | 4.46±0.05$^{b}$ | 3.71±0.01$^{d}$ | 4.34±0.11$^{b}$ | ** |
| Back fat thickness (mm) | 15.67±0.33$^{bc}$ | 18.00±0.58$^{a}$ | 14.67±0.33$^{c}$ | 15.67±0.33$^{bc}$ | 14.33±0.67$^{c}$ | 17.00±0.58$^{ab}$ | * |

[a,b,c,d,e] 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 0.95% for the finisher + DYL, T4= total lysine of 0.95% for the finisher + local breed. T5= total lysine of 1.45% for the finisher + DYL, T6 =total lysine of 1.45% for the finisher + local breed 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. Some grower diet × genotype interactions were found and a diet containing adequate lysine and amino acid should be fed in order to optimize overall growth performance pigs selected for lean growth efficiency [26]. Although the dietary lysine was increased, the largest improvements in growth performance, carcass characteristics and protein accretion were detected regardless of genotype [27]. The interactions between diet and genotype were not observed [28].

### Back fat thickness

The current results showed that pigs fed lowest lysine level (L1) in the diet had higher back fat thickness than those fed L2 and L3. This might be because of feeding diets containing less than adequate lysine concentration affected the ability of the pigs to use energy for protein deposition.

The animals consumed feeds with higher lysine level had a trend towards increasing in gain, muscle of *longgissimus dorsi* and decreasing in back fat thickness [29]. The meat quality was also improves with increasing level of lysine content in diet [30, 31]. When the lysine to energy ratio was increased from 1.35 to 2.59 g Lys/Mcal DE, growth performance and carcass trait were improved but there is a concomitant reduction in marbling and back fat thickness [32]. However, dietary lysine level had no effect on average back fat at 55 kg body weight [33]. Conversely, average fat depth was increased with dietary energy-lysine level [34].

The data from the current study indicated that local breed had greater back fat thickness than DYL crossed breed. As a consequence of poor genetic capacity, higher lipid deposition can potentially account for the decreased ADG with the result that increased back fat in local breed than that of DYL crossed breed.

The variability of back fat may be due to the level of lysine, the genetic capacity for lean tissue retention [35]. Indigenous pigs of South East Asia are fattier compared to that of South Asian pigs [36]. Fat percent of Myanmar local breed is 11.8% and is greater than hybrid breed that have only 2% [37]. The lean meat content class, otherwise body fat percent, had relation with back fat thickness [38].

Improved farm efficiency could be obtained by producing of crossed breed pigs. Using Duroc boar in crossing with other breed also result in the production of best quality carcasses with correct ratios between lean and adipose cuts and have an impact on meat quality [39]. Duroc×(Landrace×Yorkshire) (DLY) had good carcass and meat quality traits than Chinese native crossbreeds [40]. However, differences between pure breeds and Cross-breeds in back fat were not significant [41].

## CONCLUSION

According to the present findings, supplementation of lysine leads to have a beneficial effect on the growth performances and reduce back fat thickness of pigs. Beside the supplementation of lysine, DYL crossed breed showed better growth performance and lower back fat compared to that of Myanmar local breed. Therefore, it could be concluded that lysine supplementation in the pig diet is essential and could provide better performances in both different breeds.

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