Research Article

Effect of Digestible Lysine/Metabolisable Energy Ratio in F1 (Landrace x Yorkshire) Gilt Diets on Growth, Age at Puberty and Reproductive Performance in Closed Housing Condition

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Abstract | The aim of the study was to evaluate the effect of digestible lysine/metabolisable energy ratio (Dig.Lys/ME) in gilt diets on growth, age at puberty and reproductive performance. Total 72 gilts F1 [Landrace (L) x Yorkshire (Y)] of about 30 kg (75-80 day-old) were allocated equally into 3 treatments of 4 pens each (6 gilts/pen) according to a completely randomized design. Three experimental diets were formulated at low, medium and high Dig.Lys/ME ratio [2.34, 2.58, 2.81 in the period 1 (30-60 kg), and 2.03, 2.24, 2.44 in the period 2 (60 kg to first mating), respectively]. Results show that increasing in Dig.Lys/ME ratio in gilt diet increased average daily gain (ADG) (periods 30-60kg and 60kg to first estrus, and overall) and backfat thickness at first mating, and reduced the age at first estrus and first mating ($P < 0.05$). In overall, gilts fed diets with medium and high Dig.Lys ratio had better feed conversion raio (FCR) than gilts fed diet with low Dig.Lys/ME ratio. As a result, increasing in Dig.Lys/ME ratio in gilt diet improved reproductive performance at first parity, in terms of number of weaned piglets, birth weight, weaning weight and ADG of piglets ($P < 0.05$). In conclusion, the F1 (L x Y) gilts had higher reproductive performance when they were fed 2.81 and 2.44 g/Mcal Dig.Lys/ME ratio in the diet at 30-60 kg and 60kg to first mating periods, respectively.

Keywords | Backfat thicknes, Dig.Lys/ME ratio, Gilt, Reproductive performance, Period

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INTRODUCTION

Landrace (L), Yorkshire (Y) and F1 (LxY) crossbred are often chosen as main pig breeds for reproduction in Vietnam. In recent years, there have been many sow farms with high quality breeds (L and Y) imported from Denmark, Canada, France and the United State. However, the reproductive performance of the imported L and Y pig breeds or the LxY crossbred raised in Vietnam are still low compared to their potentials. The average number of weaned piglets/sow/year was approximately 22.22 - 22.41 piglets/sow/year in 2011 (Ngoc, 2014) and 22.63 weaned piglets/sow/year in 2016 (Ngoc et al., 2019).

Determination of reproductive performance targets is important in swine reproduction. According to Julian (2001), the first target is to achieve 2.4 liters/sow/year, one reproductive cycle includes 116 days of gestation, 18-28 days of lactation, and 6-9 days of wean-to-estrus interval. The second target is to obtain 10.5 weaned piglets/sow/litter (number of born is 11) for multiparous sow and 10 (number of born is 10.5) for primiparous sow. As a result, one sow gives 24.5 weaned piglets/year and one life cycle provides on average of 60 weaned piglets and age of culling sow is at least 3-year-old. However, these objectives seem to be difficult to achieve due to high ratio of culling sow in most of pig farms (30-50%) (Thacker, 1999; Young, 2003), in which, about 45-50% sows were culled after first farrowing and 35% sows were culled after second farrowing (Lucia et al., 2000; Julian, 2001). The most common reasons for the high culling rate were due to conception failure, failure to farrow and lack of observed heat Kraeling and Webel (2015).

Although there might be many factors that influence the reproductive performance of young females (e.g., staff, health, season, lactation length, and herd size), one important factor is gilt nutrition from time of gilt selection to first mating (Malanda, 2019). To improve sow longevity, replacement gilts should be provided adequate housing and feeding regimes to achieve optimum body composition as the gilt enters the breeding herd. Gilt diets are normally formulated at higher levels of amino acids (AA) and plus other nutrients to encourage maximal protein deposition (Rozeboom, 1999). However, Stalder (2006) proposed that the key for the success in gilt development was to slow down protein deposition and build fat reserves. Fat reserves might be manipulated by changing AA intake (Rozeboom, 2007). Inadequate availability of AA in the diet restricts the growth of lean tissue and converts dietary energy into fat deposition (Voermans et al., 1994; Kitt, 2010). Moreover, energy intake can also affect the ratio between fat and protein deposition in pigs (De Greef, 1992). Calderón Díaz et al. (2017) indicated that growth rate and age at puberty can be altered by ad libitum fed diets that differ in standard ileal digestibility (SID) lysine/metabolisable energy (Lys/ME) ratio. In a study by Calderón Díaz et al. (2015), however, growth rate and body composition of gilts did not differ when fed diets containing different SID Lys/ME ratios. This study was carried out to evaluate the effect of digestible Lys/ME (Dig.Lys/ME) ratio in F1 (L x Y) gilt diets on growth, age at puberty and reproductive performance.

MATERIALS AND METHODS

The study was carried out in a close-house pig farm of Sungroup Company (Ba Vi district, Hanoi City, Vietnam) from October 2016 to October 2017.

Experimental design and feed

Total 72 gilts F1 (L x Y) of around 30 kg (75-80 days of age) were allocated equally into 3 treatments (three diets with low, medium and high Dig.Lys/ME ratio) according to a completely randomized design with 3 different diets. Each treatment included 4 pens, with 6 gilts/pen.

The experimental diets were based on corn, broken rice, rice bran, wheat bran, soybean meal, fish meal (Table 1) and were formulated at low, medium, high Dig.Lys/ME ratio [2.34, 2.58, 2.81 in the period 1 (30-60 kg), and 2.03, 2.24, 2.44 in the period 2 (60 kg to first mating), respectively]. The low Dig.Lys/ME ratio was a result of the survey investigated on gilt feeding regime in 2016 (Ngoc et al., 2019). Dietary methionine, methionine + cysteine, threonine and other nutrient contents were balanced according to NRC Standard (2012). Gilts accessed feed and water freely. From first mating to first weaning time (piglets at 24 day-old), gilts were fed the same diet and feeding regime.

Housing system

Gilts were raised in closed house with the ventilation fan and cooling-pad systems. During period of 30kg to first mating, gilts were kept in groups of 4 on concrete floored pens (2m x 4m). On day first mating to day 110 of gestation, gilts were kept individually in concrete floored pens (0.65m x 2.4m). On day 110 of gestation, gilts were moved to the farrowing crates which had 3 compartments with an area of ((0.8+0.6+0.4)m x 2.4m).

Measurements

Age at maturity: From 150 day-old, gilts were recorded the first estrus sign by using boar contact between one boar and each pen of gilts for twice a day with 5-10 minutes/time at 8.00 AM and 16.00 PM. Individual gilt behavior and changes in vulval condition were recorded daily and the first day of standing estrus was considered pubertal estrus. All gilts were mated by artificial insemination after skipping the first estrus or second estrus.

Body weight (BW) and average daily gain (ADG): All animals were individually weighed by using electronic scale (Rudweigh, Australia) at the beginning of the experiment, around 60kg, the first estrus age and first mating age in the morning before feeding to determine ADG. Gilts were weighed within 24 hours after farrowing and at weaning. Piglets/litter were weighed at farrowing and weaning.

Feed intake and feed conversion ratio (FCR): Feed offers and refusals were recorded daily at around 08.30 h. Feed intake and FCR were calculated.

Backfat thickness: Backfat thickness was determined at the first estrus and first mating of gilts by using the Renco LEAN-METER® (Renco Corporation, Minneapolis, MN, USA). Two measurements were made at 6.5 cm from the dorsal midline on the right and left side of the animal at the level of the 10^{th} rib (P2). Means obtained for the two sides were recorded for analyses. Ultrasonic evaluation was accomplished by using Vaseline oil and placing the probe directly on the skin of the pig.

Sample analysis

Samples of feeds and refusals samples were analyzed for dry matter, ash, crude protein, crude fibre and fat according to AOAC (1990). Metabolizable energy (ME) was estimated based on chemical composition using the formulae of Noblet và Perez (1993).

Table 1: Experimental diets of gilts.

Period	Period 1 (30 to 60kg)			Period 2 (60kg to first mating)		
Dig.Lys/ME ratio	Low	Medium	High	Low	Medium	High
Ingredients (%)						
Corn	50.09	49.901	49.722	50.08	49.86	49.695
Broken rice	9.02	9.02	9.02	5.61	5.61	5.61
Rice bran	10.5	10.5	10.5	23.83	23.83	23.83
Wheat bran	6.0	6.0	6.0	3.29	3.29	3.29
Soybean meal	16.72	16.72	16.72	9.78	9.78	9.78
Fish meal	2.5	2.5	2.5	2.5	2.5	2.5
Soybean oil	2.0	2.0	2.0	2.0	2.0	2.0
Limestone	1.57	1.57	1.57	1.27	1.27	1.27
L-Lysine	0.22	0.31	0.40	0.21	0.29	0.37
DL-Methionine	-	0.03	0.05	-	0.05	0.08
L-Threonine	-	0.06	0.12	-	0.08	0.13
L-Tryptophan	-	0.009	0.018	-	0.01	0.015
NaCl	0.44	0.44	0.44	0.41	0.41	0.41
DCP	0.69	0.69	0.69	0.77	0.77	0.77
Premix vitamin - mineral	0.25	0.25	0.25	0.25	0.25	0.25
Total (%)	100	100	100	100	100	100
Dietary nutrient content						
Dry matter (%)	87.22	87.22	87.24	86.85	86.87	86.88
ME (kcal/kg)	3254	3250	3246	3155	3150	3145
Crude protein (%)	16.97	16.99	17.0	14.98	14.99	15.01
Dig. Lysine (%)	0.760	0.840	0.912	0.64	0.706	0.767
Dig. Methionine + Cysteine (%)	0.448	0.496	0.544	0.384	0.424	0.464
Dig. Threonine (%)	0.496	0.552	0.60	0.432	0.472	0.52
Dig. Tryptophan (%)	0.128	0.144	0.16	0.112	0.128	0.136
Dig. Lys/ME (g/Mcal)	2.34	2.58	2.81	2.03	2.24	2.44

Dig.Lys: digestible lysine; ME: metabolisable energy; Dig: digestible. Contents per kg of premix vitamin - mineral: Vitamin A - 1,600,000 IU; Vitamin D3 - 32,000,000 IU; Vitamin E - 2400; Vitamin K3 - 400 IU; Vitamin B1 - 160 IU; Vitamin B2 - 480 IU; Vitamin B6 - 240 IU; D-calcium pantothenate - 2120 mg; Biotin - 12.8 mg; Manganese - 5.6 g; Zinc - 16g; Iron - 12,8 g; Copper - 19,2 g; Iodine - 0,2 g; Cobalt - 0.112 g; Selenium - 0.016 g.

Statistical analysis

All data were statistically analysed by GLM model using Minitab program version 16.2 software, with the kind of 3 diets as the main factor. When P values of the F test <0.05; Tukey tests were used for pairwise comparision. The statistical model as below:

$$Yij = \mu + Di + eij$$

Where; Yij = parameters observed, μ = overall mean, Di = effect of diet with different Dig.Lys/ME ratio i, eij = random error.

RESULTS AND DISCUSSION

Growth performance, feed intake, feed conversion ratio and maturity of gilts

Growth performance and puberty of experimental gilts raised in close-house condition are shown in Table 2. The earliest age at first estrus and first mating was found in gilts fed high dietary Dig.Lys/ME ratio, followed in increasing order by groups fed diets with medium and low Dig.Lys/ME ratio ($P < 0.05$) (186.14; 187.87; 190.64 days and 232.22; 234.13; 236.65, respectively). The dietary Dig.Lys/ME ratio affected backfat thickness at first mating age, with increasing in dietary Dig.Lys/ME ratio increased backfat thickness from 16.11mm to 17.22mm ($P < 0.05$). However, backfat thickness at first estrus was not affected by dietary Dig.Lys/ME ratio ($P > 0.05$).

There were significant differences in BW at period 1 (30-60 kg), the first estrus and the first mating ($P < 0.05$), with the higher value for the high dietary Dig.Lys/ME ratio, followed by the medium dietary Dig.Lys/ME ratio and the lower value for the low dietary Dig.Lys/ME ratio. In periods of 30-60 kg and 60 kg to first estrus, gilts fed high dietary Dig.Lys/ME level obtained higher ADG than diet with low Dig.Lys/ME ratio ($P < 0.05$), whereas ADG was similar between diets with high and medium Dig.Lys/ME ratio (P > 0.05). However, the ADG was not affected by Dig.Lys/ME ratio during first estrus to first mating period (P > 0.05). The overal ADG of gilts fed diets with high, medium and low Dig.Lys/ME ratio were 701, 684 and 655g/gilt/day, respectively.

Foxcroft and Aherne (2001) reported that if replacement gilts are fed to achieve their maximal lean growth potential this will increase mature BW and lifetime maintenance costs in the breeding herd. High growth rates may also have negative effects on the physical fitness of replacement gilts and culling rates of higher parity sows. According to Beltranena et al. (2001), there was negatively correlation between growth rate and fist estrus age, low growth rate during period from birth to first estrus (<550 g/day) increased first estrus age of gilts. However, higher growth rate simply produced heavier BW at first estrus and at first mating, and therefore leading to extra cost of heavier developing gilts. Foxcroft and Aherne (2001) summerized from some studies and suggested that the appropriate growth rate of gilts during the rearing period was ranged from 550 to 800 g/head/day. Young (2003) also recommended that the expected growth rate of gilt was about 650 g/head/day. In the present study, the ADG of gitls fed high, medium and low Dig.Lys/ME ratio in the diet was 701, 684 and 655g g/head/day, respectively, and was in range of recommendations by Foxcroft and Aherne (2001) and Young (2003). Ngoc (2014) concluded that Dig.Lys/ME ratio in the diets of 2.17 g/Mcal at the period of 50-80 kg and 1.68 g/Mcal at the period of 80 kg to first mating, the ADG ranged from 556 to 698g/head/day in the rearing period 50 kg to the first mating. The differences in results between two studies could be due to: i) the higher dietary Dig.Lys/ME ratio in the current study (2.34-2.81 g/Mcal at the period of 30-60 kg and 2.03-2.44 at the period of 60 kg to first mating); ii) the different pig breeds between this study (the improved L x Y crossbred) and the study (L and Y breeds) by Ngoc (2014). In general, gilt group fed diet with high level of Dig.Lys/ME (2.81 g/Mcal at 30-60 kg and 2.44 at 60 kg to first mating) obtained most reasonable ADG.

Nathalie and Lee (2001) reported that the puberty age (first estrus) of gilts usually appears between 200 and 220 days with large variation (102 to 350 days old), depending on many factors, of which the most important fators are weather and feeding regimes. In this study, the first estrus age and first mating age of the crossbred gilts (L and Y) raised in closed house conditions were, respectively from 186.14 to 190.61 days (from 105.17 to 109.78 kg BW) and from 232.22 to 236.65 days (from 135.09 to 139.96 kg BW), and backfat thickness was ranging 16.11 - 17.22 mm. Close et al. (2004) suggested that young gilts should be of sufficient age, size, maturity and achieve a certain target body condition at first mating: 220 to 230 days of age, 130-140 kg BW with 16-20 mm P2 backfat thickness and mating at the second or third estrus. To achieve these, young gilts should be selected at around 60 kg BW and put on a special gilt rearer diet and feeding regime. Calderón Díaz et al. (2017) reported that gilts obtained the expected BW at the first estrus of 116-140kg. Bortolozzo et al. (2009) recommended that approproate BW of gilts at first mating ranged from 135 to 160kg. Thus, the results of this study show that gilt groups fed diets with high, medium and low levels of Dig.Lys/ME had similar recommendations of BW and backfat thickness by previous studies (Close et al., 2004; Bortolozzo et al., 2009; Calderón Díaz et al., 2017). The first mating age of gilts in this experiment was higher than that reported by Close et al. (2004) and lower than that reported by Ngoc (2014) (ranged from 236 to 245 days of age in L and Y breeds), this could be due to differences in climatic conditions, feeding regimes and pig genetic potential among studies.

In the present study, the first estrus age of gilts fed diets with high and medium Dig.Lys/ME ratio was earlier (2-4 days) than gitls fed diet with low Dig.Lys/ME ratio. Similarly, Calderón Díaz et al. (2017) concluded that the first estrus average age of L and Y gilts was 202 days (ranging from 166 to 222 days) and authors also indicated that gilts fed medium and high SID Lys/ME ratio (2.57 and 2.79 g/Mcal at 100 to 142 days of age and 1.94 and 2.08 g/Mcal at 143 to 220 days of age) reached maturity age 10 and 6 days earlier than gilts fed a low SID Lys/ME diet (2.29 g/Mcal at 100 to 142 days of age and 1.69 g/Mcal at 143 to 220 days of age). The current study and study by Calderón Díaz et al. (2017) were confirmed by results from previous reports (Hutchens et al., 1981; Rydhmer et al., 1992; Kummer et al., 2009; Ngoc, 2014), when gilts fed higher Lys/ME ration had a higher growth rate, leading to the earlier age at first estrus.

The feed intake of gilts did not differ among diets (P > 0.05), while Dig.Lys intake was significantly different among diets (P < 0.05) (Table 3). The feed and Dig. Lys intakes of gilts in this study was higher compare to the recommendations of NRC (1998, 2012). It could be explained by the differences in dietary Dig.Lys/ME ratio and genetic pig breeds, resulting in differences in feed and lysine intakes.

Results in Table 3 also show that, in the periods 30-60 kg and 60 kg-first estrus, gilts fed diet with high Dig.Lys ratio had lower FCR than gilts fed diet with low Dig.Lys ratio (3,53 vs 3,76 kg feed/kg gain) (P<0,05) and similar to gilts fed diet with medium Dig.Lys ratio (P>0.05). Similarly, Calderón Díaz et al. (2017) reported that diets of high levels of SID Lys/ME (2.79 g/Mcal at 100 to 142 day-old and 2.08 g/Mcal at 143 to 220 day-old) improved FCR by 12.5% and 28.2% compared with diet of low SID Lys/ME (2.29 g/Mcal at period of 100 to 142 days old and 1.69 g/Mcal at a stage of 143 to 220 days old). According to Chiba (2004), gilts should only be moderately restricted since they reach 100 kg or more.

Reproductive performance of gilts at first parity

Reproductive performance of gilts was shown in Table 4. The number of born was not significantly different between diets (P > 0.05). However, number of weaned piglets, birth weight, weaning weight and preweaning ADG of piglets were found higher for gilt groups fed diets with high and medium Dig.Lys/ME ratio than for diet with low Dig. Lys ratio (P < 0,05). PIC (2014) indicated that nutrient requirements of gilts during growing and development period had a singhificant impact on reproductive performance and lifetime of sows. This could be a reason for the higher growth rate, earlier maturity age and resulting in better reproductive performance of gilts fed diets with high and medium Dig.Lys/ME ratio compared to gilts fed diet with low Dig.Lys/ME ratio (P < 0,05). The reproductive performance (number of borns, number of weaned piglets, weaning weight, survival rate of piglets to weaning) in the curent study was significantly higher than that reported by Ngoc (2014), this may be due to the fact that the breeds of pigs in this study have higher reproductive potential and higher Dig.Lys/ME ratio in the diet.

Table 2: Effect of dietary Dig.Lys/ME ratio on growth performance, backfat thickness and maturity age of gilts.

Criteria	Dig.Lys/ME ratio			SEM[d]	P value
	Low	Medium	High		
Body weight (kg)					
At the beginning	29.31	29.85	29.77	0.79	0.872
At the end of period 30-60kg	61.60[a]	64.04[ab]	65.06[b]	0.74	0.005
At the fisrt estrus	105.17[a]	108.23[ab]	109.78[b]	0.91	0.002
At the first mating	135.09[a]	138.45[ab]	139.96[b]	1.10	0.008
Average daily gain (g/head/day)					
From 30 to 60kg	651[a]	691[b]	708[b]	11.54	0.003
From 60 kg to first estrus	667[a]	707[ab]	732[b]	16.03	0.020
From first estrus to first mating	651	655	659	15.81	0.950
From 30 to first mating	655[a]	684[b]	701[b]	8.56	0.001
Maturity (days)					
First estrus age	190.61[a]	187.87[ab]	186.14[b]	1.21	0.038
First mating age	236.65[a]	234.13[ab]	232.22[b]	0.97	0.007
Backfat thickness (mm)					
At first estrus age	12.18	12.77	12.95	0.23	0.055
At first mating age	16.11[a]	16.87[ab]	17.22[b]	0.27	0.014

Dig.Lys: digestible lysine; ME: metabolisable energy; [d] Standard error of mean with df error= 9.

Table 3: Effect of dietary Dig.Lys/ME ratio on feed intake and feed conversion ratio of gilts.

Criteria	Dig.Lys/ME ratio			SEM[d]	P value
	Low	Medium	High		
Feed intake (kg/head/day)					
From 30 to 60kg	1.85	1.87	1.86	0.008	0.210
From 60 kg to first estrus	2.54	2.56	2.58	0.005	0.124
From first estrus to first mating	3.02	3.03	3.01	0.006	0.291
From 30 to first mating	2.46	2.48	2.47	0.004	0.109
Digestible lysine intake (g/head/day)					
From 30 to 60kg	14.02[a]	15.69[b]	16.93[c]	0.022	0.001
From 60 kg to first estrus	16.26[a]	18.07[b]	19.80[c]	0.011	0.001
From first estrus to first mating	19.32[a]	21.35[b]	23.11[c]	0.044	0.001
From 30 to first mating	16.40[a]	18.23[b]	19.81[c]	0.019	0.001
Feed conversion ratio (kg feed/kg gain)					
From 30 to 60kg	2.86[a]	2.71[ab]	2.64[b]	0.048	0.005
From 60 kg to first estrus	3.88[a]	3.66[ab]	3.55[b]	0.087	0.027
From first estrus to first mating	4.67	4.70	4.64	0.115	0.948
From 30 to first mating	3.76[a]	3.62[b]	3.53[b]	0.031	0.001

Dig.Lys: digestible lysine; ME: metabolisable energy; [d] Standard error of mean with df error = 9.

Table 4: Effect of dietary Dig.Lys/ME ratio on reproductive performance of gilts at first parity.

Criteria	Dig.Lys/ME ratio			SEM[d]	P
	Low	Medium	High		
Number of born/litter	10.74	11.04	11.22	0.223	0.313
Number of weaned/litter	9.83[a]	10.26[ab]	10.39[b]	0.157	0.034
Alive rate until weaning time (%)	91.61	92.93	92.60		
Total litter weight (kg)					
At birth	14.60[a]	15.31[ab]	15.91[b]	0.301	0.012
At weaning	62.30[a]	66.69[b]	68.34[b]	0.937	0.001
Average weight of piglet (kg)					
At birth	1.36[a]	1.39[ab]	1.42[b]	0.017	0.034
At weaning	6.35[a]	6.51[ab]	6.58[b]	0.053	0.009
Lactation length (day)	24	24	24		
ADG of piglet (g/head/day)	207[a]	213[ab]	215[b]	2.08	0.045

Dig.Lys: digestible lysine; ME: metabolisable energy; ADG: average daily gain; [d] Standard error of mean with df error = 66.

Table 5: Effect of dietary Dig.Lys/ME ratio on body weight change and weaning-to-estrus interval of gilts at first parity.

Criteria	Dig.Lys/ME ratio			SEM[d]	P
	Low	Medium	High		
Body weight at farrowing (kg)	198.11[a]	202.51[ab]	203.76[b]	1.307	0.008
Body weight at weaning (kg)	181.42[a]	187.00[b]	188.71[b]	1.354	0.001
Weight loss (kg)	16.70	15.51	15.05	0.823	0.350
Weight loss rate (%)	8.43	7.66	7.39	0.389	0.166
Weaning-to-estrus interval (day)	6.83[a]	6.35[ab]	6.01[b]	0.203	0.039

Dig.Lys: digestible lysine; ME: metabolisable energy; [d] Standard error of mean with df error = 66

The Dig.Lys/ME ratio had a significant impact on sow's weight at farrowing and weaning time ($P < 0.05$) (Table 5). Weight loss and weight loss rate during the nursery period were not affected by dietary Dig.Lys/ME ratio ($P > 0.05$) although there was a decreasing tendency of these parameters with the increasing level of dietary Dig. Lys/ME ratio. This leaded to the lower weaning to estrus interval in gilt groups fed high and medium dietary Dig. Lys/ME ratio compared to gilt group fed low dietary Dig. Lys/ME ratio. Similarly, the weaning-to-estrus interval was shortened as the SID-Lys/ME ratio increased in a study by Xue at al. (2012). Other studies showed that increasing lysine intake did not affect weaning-to-estrus interval of sows (Dos Santos et al., 2006; Mejia-Guadarrama et al., 2002; Yang et al., 2000), these results could be due to the weaning-to-estrus interval was impacted by the large weight loss for sows during lactation rather than by the low lysine intake. Vesseur et al. (1994) found that weight loss of sows with greater than 7.5% during lactation exhibited a prolonged weaning to estrus interval, leading lower number of weaned piglets/sow/years.

CONCLUSIONS AND RECOMMENDATIONS

Growth performance, feed conversion ratio and maturity age improved as increasing Dig.Lys/ME ratio in L x Y gilt diet. The increase in Dig.Lys/ME ratio in gilt diet also enhanced reproductive performance at first parity. The L x Y gilts had higher reproductive performance when they were fed 2.81 and 2.44 g/Mcal Dig.Lys/ME ratio in the diet at 30-60 kg and 60kg to first mating periods, respectively.

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NOVELTY STATEMENT

Further research is required to determine the appropriate Dig.Lys/ME ratio in the gestation and lactation sows (L xY).

AUTHOR'S CONTRIBUTION

Authors contributed to the work, discussed the results and contributed to the final manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

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