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Non-ruminants

Dietary net energy for gilts from 25 to 100 kg body weight

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ABSTRACT - This experiment was conducted to evaluate the growth performance and carcass characteristics of gilts from 25 to 100 kg body weight (BW) fed diets with increased net energy (NE) levels. Seventy-two gilts with initial BW of 23.24±2.47 kg were allotted to one of six dietary treatments (2300, 2380, 2460, 2540, 2620, and 2700 kcal NE kg^{-1}) using a completely randomized block design, with two pigs per replicate, and six replicates per treatment. Corn-soybean meal-based diets were formulated to be fed in three phases (25 to 50, 50 to 70, and 70 to 100 kg BW). Soybean oil was added to replace the inert ingredient kaolin to meet the NE level of each diet. Increasing dietary NE decreased the average daily feed intake (ADFI) and improved the feed:gain ratio (F:G) and standardized ileal digestible (SID) lysine:gain ratio in all the phases evaluated. In the second phase, average daily gain increased with increasing dietary NE level, although SID lysine intake decreased. At the end of the first phase, increasing dietary NE increased backfat and decreased lean percentage. In the last phase, lean percentage linearly decreased as dietary NE increased. Increasing dietary NE for gilts from 25 to 100 kg BW decreases ADFI and improves F:G. However, as dietary NE increases, lean percentage decreases without affecting growth performance.

Key Words: energy:protein ratio, feed intake, nutrition, pig nutrition, swine

Introduction

To optimize pork production, nutritionists aim to meet the nutrient requirements of pigs while keeping costs as low as possible. In swine diets, energy is the most expensive nutritional component. If dietary energy is increased, attention has to be given to nutrient density, especially to amino acids (AA), since, as higher energy density may reduce daily feed intake (Smith et al., 1999; De la Llata et al., 2001; Gonçalves et al., 2015), dietary amino acid supply can be limited.

The net energy (NE) system takes into account the energy expenditure of metabolizable energy (ME) in metabolic processes and the energy lost as heat (Kil et al., 2013a). Therefore, formulating diets using NE values meets nutrient requirements of pigs more precisely (Noblet and van Milgen, 2004; Wu et al., 2007) than ME or digestible energy (DE) values.

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Previous research evaluating dietary energy density for pigs focused only on short body weight (BW) ranges, such as 20 to 50 kg (Yi et al., 2010), 35 to 80 kg (Kim et al., 2013), 60 to 95 kg (Rezende et al., 2006), 70 to 90 kg (Moura et al., 2011a,b), 70 to 100 kg (Gonçalves et al., 2015), and 100 to 125 kg (Hinson et al., 2011). Even studies that evaluated dietary energy effects during the growing and finishing phases did not use the same energy levels throughout the study; energy concentrations were adjusted from one phase to the next (Kerr et al., 2003; Wu et al., 2007).

This study was conducted to investigate the effects of feeding pigs different fixed dietary energy concentrations and the advantages of the NE system over long periods of time; the study evaluated growth performance and carcass characteristics of gilts from 25 to 100 kg BW fed diets with different fixed dietary NE levels.

Material and Methods

Research on animals was conducted according to the institutional committee on animal use (UFMS 552/2013). The study was conducted in Terenos, Mato Grosso do Sul, Brazil (20°26'49" S, 54°50'37" W). Gilts were housed in a curtain-sided barn with a solid concrete floor and ceramic roof. Each pen (1.15 × 2.86 m) was equipped with a single hole, dry self-feeder, and a nipple drinker for *ad libitum* access to feed and water. There was a gutter (1.15 × 0.30 × 0.10 m) crossing the bottom of the pens that was emptied and filled with fresh water once a day. All the animals received a single dose of vermifuge and antimicrobial mixed with the feed at the beginning of the experiment.

A total of seventy-two gilts (Large White/Landrace × Duroc/Pietrain), with average initial BW of 23.24±2.47 kg, were used in a 90-day trial. Gilts were blocked by BW and randomly assigned to one of six dietary treatments with two gilts per pen and six pens per treatment using a completely randomized block design. Pen was considered the experimental unit. Dietary treatments included six dietary NE levels (2300, 2380, 2460, 2540, 2620, and 2700 kcal kg^{-1}).

Experimental corn-soybean-based diets (Table 1) were offered in meal form and formulated to be given in three phases (25 to 50, 50 to 70, and 70 to 100 kg BW), according to the nutritional requirements for gilts recommended in the Brazilian Tables for Poultry and Swine (Rostagno et al., 2011)

Table 1 - Composition of basal diets (as fed)

	Phase		
	25 to 50 kg	50 to 70 kg	70 to 100 kg
Ingredient (g kg^{-1})			
Corn	668.3	694.5	711.6
Soybean meal (46%)	244.1	221.2	192.1
Soybean oil[1]	-	-	-
Kaolin	55.00	55.0	70.00
Dicalcium phosphate	12.50	10.69	9.080
Limestone	7.110	6.470	5.780
Salt	4.070	3.820	3.580
Vitamin/trace mineral premix[2,3]	4.000	4.000	4.000
L-lysine HCl	3.020	2.820	2.550
DL-methionine	1.000	0.770	0.600
L-threonine	0.890	0.710	0.690
Calculated analysis			
Crude protein (g kg^{-1})	166.9	158.2	146.0
Net energy (NE; kcal kg^{-1})	2300	2300	2300
Metabolizable energy (kcal kg^{-1})	3010	3024	2988
Digestible energy (kcal kg^{-1})	3172	3181	3139
SID lysine (g kg^{-1})	9.740	9.050	8.140
SID Met + Cys (g kg^{-1})	5.750	5.340	4.880
SID threonine (g kg^{-1})	6.330	5.880	5.450
SID tryptophan (g kg^{-1})	1.750	1.630	1.470
SID valine (g kg^{-1})	6.920	6.560	6.040
Calcium (g kg^{-1})	6.580	5.840	5.120
Available phosphorus (g kg^{-1})	3.250	2.880	2.530
Sodium (g kg^{-1})	1.800	1.700	1.600

SID - standard ileal digestible.
[1] To increase the dietary NE level by 80 kcal kg^{-1} (the difference between each sequential treatment), 10.86 kg of soybean oil were added, to replace the inert ingredient (kaolin), per ton of diet.
[2] Provided per kg of diet: pantothenic acid, 9.20 mg; niacin, 20.00 mg; folic acid, 0.50 mg; copper, 15.00 mg; iron, 0.10 mg; zinc, 0.13 mg; iodine, 1.00 mg; selenium, 0.30 mg; manganese, 0.50 mg; vitamin A, 5,000 IU; vitamin D3, 1,000 IU; vitamin E, 25.00 IU; vitamin K3, 3.00 mg; vitamin B1, 2.20 mg; vitamin B2, 5.50 mg; vitamin B6, 2.00 mg; vitamin B12, 20.00 mg; BHT, 1.00 g.
[3] Provided per kg of diet: pantothenic acid, 9.20 mg; niacin, 18.00 mg; folic acid, 0.50 mg; copper, 15.00 mg; iron, 0.10 mg; zinc, 0.13 mg; iodine, 1.00 mg; selenium, 0.30 mg; manganese, 0.50 mg; vitamin A, 5,000 IU; vitamin D3, 1,000 IU; vitamin E, 25.00 IU; vitamin K3, 3.00 mg; vitamin B1, 1.50 mg; vitamin B2, 4.00 mg; vitamin B6, 1.50 mg; vitamin B12, 18.00 mg; BHT, 1.00 g.

except for the NE levels, which, in this study, were three NE levels under and three NE levels above the recommended dietary NE of 2500 kcal kg^{-1}. For each phase, a basal diet was formulated with 2300 kcal kg^{-1} NE and then, to increase the dietary NE level by 80 kcal kg^{-1} (the difference between each sequential treatment), 10.86 kg of soybean oil were added, to replace the inert ingredient (kaolin), per ton of diet.

Diets were supplemented with dicalcium phosphate, limestone, salt, vitamin trace mineral premix, and synthetic AA. Apart from soybean oil and kaolin, the content of all other ingredients was similar in each dietary phase.

Pigs were weighed individually at the beginning and end of each phase to determine BW and average daily gain (ADG). Feed disappearance was recorded daily to determine ADFI. Feed:gain ratio (F:G) was calculated based on total feed intake divided by total gain within each phase. Net energy intake and standardized ileal digestible lysine (SID Lys) intake were determined by multiplying the total feed intake by the NE or SID Lys calculated content of the diets and divided by the number of days for each phase. Net energy:gain ratio (NE:G) and SID Lys:gain ratio (SID Lys:G) were determined by dividing the total NE intake, or total SID Lys intake, by the gain in each phase.

At the end of each phase, *in vivo* ultrasonography (Aloka SSD-500 Micrus Ultrasound, Aloka Co. Ltd, Wellingtongford, CT) measurements of loin muscle area (LMA), backfat (BF), and loin depth (LD) were taken between the last thoracic and first lumbar vertebrae. Images from the ultrasonography were analyzed using the LINCE® program (M&S Consultoria Agropecuária Ltda.).

Lean percentage was determined using the equation: lean (%) = 60 – (BF × 0.58) + (muscle depth × 0.10), as described in Bridi and Silva (2007). Total lean was calculated by multiplying percentage lean by hot carcass weight (HCW).

Data were analyzed as a completely randomized block design using PROC GLM in SAS (Statistical Analysis System, University version). An analysis of variance was used first, followed by linear and quadratic regression analysis to evaluate dietary NE level effects. Significance was set at $P<0.05$.

Results

All pigs remained healthy throughout the experiment. No quadratic effects were observed ($P>0.05$) for any of the variables evaluated.

In the first phase (from 25 to 50 kg BW), there were no effects ($P>0.05$) of dietary NE on BW, ADG, daily

NE intake, or daily SID Lys intake (Table 2). However, there was a linear decrease (P<0.05) in ADFI and a linear improvement (P<0.05) in F:G as dietary NE increased. Net energy:gain worsened linearly (P<0.05) as daily NE intake rose, and SID Lys:G improved linearly (P<0.05) as daily SID Lys intake reduced. The high NE intake resulted in a linear increase (P<0.05) in BF (Table 3). There were no effects (P>0.05) of dietary NE on LD and LMA. Although lean percentage decreased linearly (P<0.05), total lean did not change (P>0.05) with increasing dietary NE in this phase.

In the second phase (from 50 to 70 kg BW), final BW was similar (P>0.05) among treatments. Increasing dietary NE increased ADG linearly (P<0.05) and decreased ADFI linearly (P<0.05). These effects improved F:G linearly in this phase (P<0.05). There were no effects (P>0.05) of dietary NE on daily NE intake, NE:G, or on the evaluated

Table 2 - Dietary net energy (NE) effects on growth performance of gilts from 25 to 100 kg body weight (BW)

	Dietary NE (kcal kg^{-1})						P-value		SEM
	2300	2380	2460	2540	2620	2700	Linear	Quadratic	
25 to 50 kg									
Initial BW (kg)	23.12	23.32	23.27	23.22	23.27	23.27	-	-	-
Final BW (kg)	50.24	50.46	49.31	50.20	50.28	50.48	0.865	0.636	1.152
ADG (kg)	0.75	0.75	0.72	0.75	0.75	0.76	0.909	0.573	0.003
ADFI (kg)[1]	1.68	1.58	1.59	1.57	1.56	1.52	0.050	0.604	0.055
F:G[1]	2.24	2.11	2.21	2.09	2.08	2.00	<0.001	0.590	0.041
NE intake (kcal)[2]	3,864	3,760	3,911	3,988	4,087	4,104	0.054	0.695	139.1
SID Lys intake (g)[2]	16.36	15.39	15.49	15.29	15.19	14.80	0.051	0.603	0.537
NE:G[1]	5,152	5,014	5,433	5,317	5,450	5,400	<0.001	0.495	76.12
SID Lys:G[1]	21.82	20.52	21.51	20.39	20.26	19.48	<0.001	0.670	0.301
50 to 70 kg									
Initial BW (kg)	50.24	50.46	49.31	50.20	50.28	50.48	0.865	0.636	1.152
Final BW (kg)	69.10	69.47	68.88	69.87	70.07	70.94	0.295	0.655	1.357
ADG (kg)[3]	0.90	0.91	0.93	0.94	0.95	0.97	0.047	0.907	0.032
ADFI (kg)[3]	2.53	2.35	2.39	2.28	2.26	2.27	0.045	0.439	0.102
F:G[3]	2.81	2.58	2.57	2.43	2.38	2.34	0.002	0.681	0.101
NE intake (kcal)	5,819	5,593	5,879	5,791	5,921	6,129	0.262	0.511	261.3
SID Lys intake (g)[3]	22.90	21.27	21.63	20.63	20.45	20.54	0.045	0.440	0.925
NE:G	6,466	6,146	6,322	6,161	6,233	6,319	0.653	0.615	270.0
SID Lys:G[3]	25.44	23.37	23.26	21.95	21.53	21.18	<0.001	0.480	0.956
70 to 100 kg									
Initial BW (kg)	69.10	69.47	68.88	69.87	70.07	70.94	0.295	0.655	1.357
Final BW (kg)	99.68	99.72	102.89	102.27	100.22	102.92	0.498	0.785	3.130
ADG (kg)	0.93	0.92	0.99	0.98	0.91	0.97	0.652	0.587	0.049
ADFI (kg)[5]	2.88	2.70	2.94	2.61	2.52	2.56	0.088	0.880	0.175
F:G[4]	3.10	2.93	2.97	2.66	2.77	2.64	0.008	0.126	0.112
NE intake (kcal)	6,624	6,426	7,232	6,629	6,602	6,912	0.712	0.828	552.7
SID Lys intake (g)[5]	23.44	21.98	23.93	21.25	20.51	20.84	0.088	0.879	1.422
NE:G	7,123	6,985	7,305	6,765	7,255	7,126	0.768	0.634	239.5
SID Lys:G[4]	25.21	23.89	24.17	21.68	22.54	21.48	<0.001	0.505	0.770
25 to 100 kg									
Initial BW (kg)	23.12	23.32	23.27	23.22	23.27	23.27	-	-	-
Final BW (kg)	99.68	99.72	102.89	102.27	100.22	102.92	0.498	0.785	3.130
ADG (kg)	0.85	0.85	0.89	0.88	0.85	0.89	0.494	0.788	0.029
ADFI (kg)[6]	2.32	2.17	2.27	2.11	2.07	2.07	0.018	0.812	0.082
F:G[6]	2.73	2.55	2.55	2.40	2.44	2.33	<0.001	0.494	0.107
NE intake (kcal)	5,336	5,165	5,584	5,359	5,423	5,589	0.254	0.897	203.6
SID Lys intake (g)[6]	20.56	19.25	20.11	18.79	18.43	18.42	0.016	0.783	0.706
NE:G	6,278	6,076	6,274	6,090	6,380	6,280	0.254	0.509	112.3
SID Lys:G[6]	24.19	22.65	22.60	21.35	21.68	20.70	<0.001	0.316	0.398

BW - body weight; ADG - daily average gain; ADFI - average daily feed intake; F:G - feed to gain ratio; NE:G - net energy to gain ratio; SID Lys:G - standardized ileal digestible lysine to gain ratio; SEM - standard error of the mean.

[1] Linear effect (P<0.05): ADFI: Y = 2.37 – 0.0003X, R^2 = 0.78; F:G: Y = 3.38 – 0.001X, R^2 = 0.72; NE:G: Y = 3112 + 0.83X, R^2 = 0.55; SID Lys:G: Y = 32.81 – 0.005X, R^2 = 0.71.

[2] Linear effect (P<0.1): NE intake: Y = 1936 + 0.81X, R^2 = 0.82; SID Lys intake: Y = 23.1 – 0.003X, R^2 = 0.79.

[3] Linear effect (P<0.05): ADG: Y = 0.5 + 0.0002X, R^2 = 0.99; ADFI: Y = 3.85 – 0.0006X, R^2 = 0.76; F:G: Y = 5.28 – 0.001X, R^2 = 0.91; SID Lys intake: Y = 34.86 – 0.005X, R^2 = 0.76; SID Lys:G: Y = 47.9 – 0.01X, R^2 = 0.91.

[4] Linear effect (P<0.05): F:G: Y = 5.60 – 0.001X, R^2 = 0.80; SID Lys:G: Y = 45.65 – 0.009X, R^2 = 0.81.

[5] Linear effect (P<0.1): ADFI: Y = 4.91 − 0.001X, R^2 = 0.58; SID Lys intake: Y = 39.93 – 0.007X, R^2 = 0.58.

[6] Linear effect (P<0.05): ADFI: Y = 3.70 – 0.0006X, R^2 = 0.74; F:G: Y = 4.71 – 0.001X, R^2 = 0.88; SID Lys intake: Y = 32.19 – 0.005X, R^2 = 0.74; SID Lys:G: Y = 41.49 – 0.008X, R^2 = 0.88.

Table 3 - Dietary net energy (NE) effects on carcass characteristics of gilts from 25 to 100 kg body weight

	Dietary NE (kcal kg^{-1})						P-value		SEM
	2300	2380	2460	2540	2620	2700	Linear	Quadratic	
Body weight - 50 kg									
BF (mm)[1]	3.10	2.57	3.03	3.44	3.87	3.80	0.026	0.613	0.457
LD (mm)	35.84	33.25	33.48	33.77	33.59	33.04	0.221	0.472	1.344
LMA (cm^2)	19.99	18.95	18.01	19.04	18.20	18.91	0.426	0.292	1.035
Lean (%)[1]	61.78	61.83	61.59	61.38	61.12	61.10	0.001	0.870	0.232
Total lean (kg)	23.51	23.39	23.57	23.55	23.14	23.18	0.700	0.836	0.862
Body weight - 70 kg									
BF (mm)	7.44	6.85	7.90	8.11	7.38	8.61	0.189	0.698	0.768
LD (mm)	43.17	42.24	41.33	44.78	41.38	42.30	0.687	0.940	1.296
LMA (cm^2)	31.07	29.89	30.15	31.74	28.86	30.04	0.459	0.985	1.224
Lean (%)	60.00	60.25	59.55	59.77	59.86	59.24	0.110	0.646	0.399
Total lean (kg)	31.15	31.45	31.76	31.91	30.90	31.51	0.981	0.707	1.017
Final body weight - 100 kg									
BF (mm)[3]	9.89	8.66	9.01	10.34	9.64	11.28	0.088	0.188	0.839
LD (mm)	47.23	45.00	44.68	46.23	43.47	46.09	0.354	0.149	1.126
LMA (cm^2)	38.62	36.61	36.67	37.82	36.38	37.25	0.499	0.453	1.244
Lean (%)[2]	58.98	59.48	59.24	58.63	58.75	58.06	0.041	0.283	0.464
Total lean (kg)	44.57	44.68	45.13	45.79	45.17	46.59	0.110	0.754	1.029
HCW (kg)	75.72	75.54	73.71	77.40	76.92	80.65	0.130	0.830	5.770

BF - backfat; LD - loin depth; LMA - loin muscle area; HCW - hot carcass weight; SEM - standard error of the mean.
[1] Linear effect ($P<0.05$): BF: $Y = -3.67 + 0.003X$, $R^2 = 0.70$; Lean: $Y = 66.59 - 0.002X$, $R^2 = 0.93$.
[2] Linear effect ($P<0.05$): Lean: $Y = 65.46 - 0.0003X$, $R^2 = 0.63$.
[3] Linear effect ($P<0.1$): BF: $Y = -0.215 + 0.0001X$, $R^2 = 0.41$.

carcass characteristics. However, SID Lys intake decreased linearly (P<0.05), and SID Lys:G improved linearly (P<0.05) when the NE level of the diets was increased.

In the last phase (70 to 100 kg BW), there were no effects (P<0.05) of diet on final BW, ADG, ADFI, or daily SID Lys intake. Increasing dietary NE improved F:G linearly (P<0.05). As observed in the second phase, daily NE intake and NE:G were similar (P>0.05) among dietary treatments, and SID Lys:G was linearly improved (P<0.05) as dietary NE increased.

Overall, from 25 to 100 kg BW, there was no effect (P>0.05) of diet on ADG. However, ADFI decreased linearly (P<0.05), and F:G improved linearly (P<0.05), as dietary NE increased. Daily NE intake was similar (P>0.05), and daily SID Lys intake decreased linearly (P<0.05) with increasing dietary NE; this resulted in no difference (P>0.05) in NE:G, but in a linear improvement (P<0.05) in SID Lys:G.

At the end of the study, as dietary NE increased, a linear reduction (P<0.05) in lean percentage was observed. There were no effects (P>0.05) of diet on BF, LD, LMA, total lean, or HCW.

Discussion

Average daily gain in this study was 0.105, 0.035, and 0.073 kg lower than ADG predicted in Rostagno et al. (2011) for phases 1, 2, and 3, respectively. The major difference was observed in phase 1 and it is likely because of the lighter initial BW in this experiment (23.2 vs 30.0 kg). Although there were no effects of diets on ADG, ADFI reduced linearly. Comparing ADFI of gilts of this experiment to ADFI of animals in Rostagno et al. (2011), gilts fed the three lowest NE diets had greater ADFI, which confirms that dietary energy density drives feed intake.

Growing-finishing pigs fed *ad libitum* are known for their capacity to adjust daily feed intake to maintain a constant daily energy intake over a wide range of dietary energy concentrations (Cole et al. 1967; Ellis and Augspurger, 2001; Quiniou and Noblet, 2012). A decrease in dietary energy concentration has been shown to increase ADFI (Quiniou and Noblet, 2012; Nitikanchana et al., 2015). However, lighter pigs have a limited digestive tract capacity that might restrict young pigs from achieving their energy requirements. Therefore, a low gut-fill capacity was likely the reason why gilts fed the lowest NE levels had a poorer NE intake, despite the increase in ADFI in the first phase. Our results agree with those of Wu et al. (2007), who reported an increase in NE intake from 23 to 60 kg BW, but no difference in NE intake from 60 to 98 kg BW. Finishing pigs usually have similar energy intakes when fed diets with different energy levels (Smith et al., 1999; Wu et al., 2007; Gonçalves et al., 2015).

The use of NE values to formulate diets for pigs has the advantage of counting the energy lost as heat, without overestimating feed energy values, mainly fiber-rich ingredients (Noblet et al., 1994; Noblet and van Milgen, 2004). Thus, the evaluation of dietary NE effects on feed intake is critical, because the amount of digestible nutrients consumed in the feed will drive growth performance.

Smith et al. (1999) evaluated dietary ME levels from 3310 to 3570 kcal kg^{-1} for gilts from 30 to 70 kg BW and observed an increase in ADG, a decrease in ADFI, and an improvement in F:G; however, Lys:calorie was maintained at constant levels in the diets used in their study. Kerr et al. (2003) fed growing-finishing gilts increased dietary NE levels and observed an improvement only in F:G and ADG. These authors justified that the lack of dietary NE effects on ADFI was due to the small difference between NE levels.

Increasing dietary NE from 2410 to 2570 kcal kg^{-1} in diets for pigs from 30 to 90 kg BW had no effect on ADFI, ADG, or F:G in the growing phase (30 to 60 kg), but decreased ADFI and improved F:G ratio in the finishing period (60 to 90 kg) (Paiano et al., 2008).

In the last phase, the results of the present study agree with those of Gonçalves et al. (2015), who reported no effects of dietary NE from 2300 to 2800 kcal kg^{-1} on ADG or daily NE intake of finishing pigs (70 to 100 kg BW). In the present study, as ADFI decreased, SID Lys intake decreased as well due to the use of isoproteic diets. The absence of a dietary NE effect on NE intake in the second and third phases (50 to 100 kg BW) is consistent with other studies (Wu et al., 2007; Quiniou and Noblet, 2012; Kil et al., 2013b) and confirms that pigs control their ADFI to meet their energy requirements.

Despite the reduction in SID Lys intake, there was no negative effect on ADG in the present study. According to Adeola and Orban (1995), using soybean oil can reduce the speed of digestion and increase the duration of digestion and absorption of nutrients. Adding lipid sources to diets also improves the energy digestibility (Kil et al., 2011), because the digestibility of lipid sources is greater than that of intact lipids inside ingredients (Kil et al., 2010). Moreover, adding soybean oil to diets for growing-finishing pigs increases NE of the diets (Kil et al. 2013b), because NE of soybean oil is greater than that of corn and soybean meal (Rostagno et al., 2011).

The presence of lipids in diets also increases the digestibility of AA (Cervantes-Pahm and Stein, 2008). The improvement in SID Lys:G observed in this study is an indicator that an increase in dietary energy concentration, without increasing dietary AA, does not impair growth performance and improves F:G. However, some researchers reported an increase in weight gain by maintaining a constant Lys:calorie ratio when they evaluated different energy densities, mainly in the growing phase (Smith et al., 1999; Kerr et al., 2003).

In the first phase, the worst NE:G was an effect of a tendency for increased NE intake as dietary NE increased without changes in ADG. Since there was no effect of diet on LMA in this phase, the excess energy consumed was stored in the adipose tissue, increasing BF. Cerisuelo et al. (2012) increased the energy density of diets offered to pigs from 60 to 100 kg BW with a constant Lys:calorie and reported improved energy:G and increased LD.

Although the observed increase in NE intake was not statistically significant, it was numerically higher in the first phase and may explain the thicker BF of the pigs fed high dietary NE levels. The lack of dietary NE effects on most carcass characteristics in the second and third phases may be explained by the similar NE intake among treatments in these phases. Moura et al. (2011a) reported an increase in BF of finishing gilts when dietary NE was raised from 2300 to 2668 kcal kg^{-1}, and Kil et al. (2011) reported an increase in lipid gain, without changes in protein gain, in growing pigs with increasing lipid in their diets, but there was no effect in the finishing phase. The decreased lean percentage in the last phase was likely due to the reduction in SID Lys intake, once lysine function is related to carcass protein deposition.

Conclusions

Increasing dietary net energy in the diets of 25 to 100 kg gilts, from 2300 to 2700 kcal kg^{-1}, reduces average daily feed intake and improves feed to gain ratio. However, as dietary net energy increases, lean percentage decreases without affecting growth performance.

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