

DAILY GAIN RESPONSE TO DIETARY LYSINE OF GROWING PIGS
AS INFLUENCED BY SEX, LIVE WEIGHT AND CEREAL

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SUMMARY

Response surface functions were developed relating average daily live-weight gain (DLG) to dietary lysine level and live weight. DLG was measured over 10 kg liveweight ranges from 20 to 50 kg in an experiment including 128 pigs of both sexes fed ad libitum a diet with a cereal base of either wheat or barley. The maximum dietary lysine response (g/kg) was similar for both wheat and barley based diets. Because of the differences in dietary energy contents of the wheat and barley the dietary lysine:energy ratios which produced maximum DLG were as follows: Maximum DLG occurred at lysine levels of 7 g/kg or less (0.48 or 0.53 g lysine/MJDE or less for wheat and barley respectively) for females; and 11.8 g/kg (0.81 or 0.89 g lysine/MJDE for wheat and barley respectively) for males up to 35 kg live weight and 7 g/kg thereafter. The available lysine:energy ratios would be approximately 90% of the above total lysine:energy values.

INTRODUCTION

Although lysine is an essential and costly ingredient in the diet of pigs, published recommendations vary considerably and in general do not distinguish between the sexes. For example, the **lysine:energy** recommendations (g lysine/MJDE) of the National Research Council (NRC) (1979) are 0.5-0.44 and 0.44-0.41 while the Agricultural Research Council (ARC) (1981) recommendations are 0.84 and 0.60 for the 20-50 and 50-90 kg liveweight ranges respectively.

The results of Giles, Dettmann and Batterham (1982) indicated that the lysine requirements of males were higher than females. Their results showed that within the 20 to 50 kg liveweight range the maximum average daily liveweight gain (DLG) was obtained from at least 0.72 g lysine/MJ digestible energy (DE) for ad libitum-fed males and from less than 0.62 g **lysine/MJDE** for ad libitum-fed females. Potential sex differences could have been greater as 0.72 g **lysine/MJDE** was the maximum dietary lysine concentration examined in that experiment. The objective of this experiment was to examine the **lysine:energy** response over a wider range of dietary lysine than used by Giles et al. (1982). It was also decided to compare the effect of dietary energy density and fibre content on feed intake and **lysine:energy** response by comparing barley and wheat as the dietary cereal base.

MATERIALS AND METHODS

The effects of dietary lysine level (7, 8, 9, 10, 11, 12, 13 and 14 g/kg total, air-dry basis), cereal base (wheat or barley) and sex on DLG response during the 20 to 50 kg liveweight range were compared in four randomised blocks of an 8 x 2 x 2 factorial experiment involving 128 individually-penned pigs fed ad libitum.

The basal wheat and barley diets were supplemented with **soyabean** meal plus minerals, vitamins and antibiotic and formulated to contain 7 g/kg total lysine. The wheat and barley-based diets contained 177 g/kg and 153 g/kg crude protein

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(N x 6.25) and an estimated 14.5 and 13.2 MJDE/kg respectively. Free lysine was added to formulate the dietary treatments and essential free amino acids were added where necessary to maintain the balance of essential amino acids relative to lysine as recommended by the ARC (1981). The availability of lysine in these diets was estimated to be 90% of total lysine.

The diets were offered ad libitum to the pigs at 20 kg live weight and they were slaughtered after reaching 50 kg live weight. Accumulated feed was collected twice weekly with the aim of ensuring fresh feed was available to the pigs at all times.

Liveweight gain and feed intake of all pigs was recorded weekly. DLG and feed intake were calculated for the liveweight ranges 20 to 30, 30 to 40 and 40 to 50 kg for each pig. Regression equations were developed for DLG of individual pigs as a function of dietary lysine (g/kg), lysine squared, live weight (kg), square root of live weight and all useful two way interactions for each combination of sex and cereal.

The lysine level which produced maximum DLG was calculated from the regression equations for varying live weights between 20 and 50 kg.

RESULTS

Feed intake

Significant differences in mean feed intakes occurred for sex, liveweight and cereal. The mean feed intakes of pigs offered the wheat-based diet were 1730, 2089, 2273 g/day for males and 1747, 2135, 2312 g/day for females at 25, 35 and 45 kg live weight respectively. The mean feed intakes of pigs offered the barley-based diet were 1676, 2035, 2219 g/day for males and 1783, 2171, 2348 g/day for females at 25, 35 and 45 kg live weight respectively.

Daily gains

Significant differences in mean DLG occurred for liveweight and cereal. The mean DLG's of pigs offered the wheat-based diet were 977, 927, 896 g/day for males and 967, 904, 864 g/day for females at 25, 35 and 45 kg live weight respectively. The mean DLG's of pigs offered the barley-based diet were 945, 895, 863 g/day for males and 945, 882, 841 for females at 25, 35 and 45 kg live weight respectively.

Daily gain response curves

The functions relating DLG to lysine level and live weight for each cereal and sex combination are presented in Table 1. The DLG response to lysine for males was curvilinear and varied with live weight. The shape of the curve changed from concave upwards to concave downwards at about 40 kg live weight. At this point the response surface becomes flat and the lysine level which gives maximum DLG cannot be determined mathematically. There was no significant lysine effect at this live weight. DLG of females was not affected significantly by lysine level at any live weight between 20 and 50 kg.

Maximum DLG occurred at lysine levels of 7 g/kg or less (0.48 or 0.53 g lysine/MJDE or less for wheat and barley respectively) for females; and 11.8 g/kg (0.81 or 0.89 g lysine/MJDE for wheat and barley respectively) for males up to 35 kg live weight and 7 g/kg thereafter. The available lysine:energy ratios would be approximately 90% of the above total lysine:energy values.

TABLE 1 Regression coefficients of average daily liveweight gain (g/day) as a function of dietary lysine concentration (g/kg) (L) and live weight (kg) (W) for all combinations of sexes and cereal bases of diet

Variable	Regression coefficients			
	Males		Females	
	Barley	Wheat	Barley	Wheat
Intercept	-295.4	-263.1	1603.6	1626.3
W	52.5	52.5	10.6	10.6
L	324.0	324.0	0.0	0.0
L ²	-14.0	-14.0	0.0	0.0
W ^{1/2}	-155.2	-155.2	-185.0	-185.0
W x L	-7.9	-7.9	0.0	0.0
W x L ²	0.3	0.3	0.0	0.0
R ² #	16.6	16.6	17.3	17.3
R.S.D. (per pig)	103.8	103.8	97.1	97.1

Coefficient of determination

DISCUSSION

There are three main conclusions which can be drawn from the results of this experiment. Firstly females were found to require less dietary lysine than males when fed ad libitum. This result confirms the earlier findings of Giles et al. (1982). Secondly the lower lysine requirement found for ad libitum-fed females is a possible explanation for the lower NRC (1979) lysine recommendations which are based on ad libitum-fed females and castrate males, which have been found by other workers (reported by Cole 1980) to have lower lysine requirements than males. Thirdly the lysine requirements found for males agrees with the ARC (1981) recommendation which are more broadly based than those of the NRC and include males.

The similar maximum lysine response (g/kg) found for wheat and barley-fed pigs means a higher lysine:energy requirement for barley compared to wheat. This was unexpected but may reflect a lower lysine digestibility of the barley as a result of its higher crude fibre content.

This study points to the considerable savings in dietary lysine which may be achieved in the separate penning of ad libitum-fed females. In a practical situation this may mean the feeding of a finisher diet to ad libitum-fed females during the 20 to 50 kg live weight range.

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