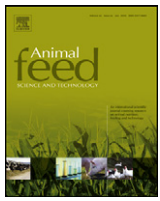
Animal Feed Science and Technology 154 (2009) 248–253

Contents lists available at ScienceDirect

Animal Feed Science and Technology

journal homepage: www.elsevier.com/locate/anifeedsci



Short communication

Isoleucine and valine supplementation of crude protein-reduced diets for pigs aged 5–8 weeks

J.V. Nørgaard*, J.A. Fernández

Department of Animal Health and Bioscience, Aarhus University, P.O. Box 50, DK-8830 Tjele, Denmark

ARTICLE INFO

Article history:
Received 12 November 2008
Received in revised form 12 August 2009
Accepted 19 August 2009

Keywords:
Amino acids
Protein
Recommendations
Piglet

ABSTRACT

The present experiment had two purposes: (i) to study crystalline amino acid supplementation to crude protein-reduced diets, and (ii) to study the effect of different isoleucine (Ile) to lysine (Lys) and valine (Val) to Lys ratios in diets for young pigs. A total of 145 pigs were weaned at 28 days and fed one of 5 diets for a total of 4 weeks. Two basal diets were formulated to provide crude protein in levels either as recommended (positive reference diet, PRD), or below recommendations (negative reference diet, NRD). The basal diets contained 95% of recommended Lys, and all other essential amino acids were provided proportionally to Lys. The NRD diet contained 0.53 Ile and 0.61 Val relative to Lys. This diet was supplemented with either Ile (0.61 of Lys) or Val (0.72 of Lys), or both Ile and Val, in order to make up the 5 diets. Supplementation with Ile to the NRD diet did not improve (P>0.05) average daily gain (ADG) and feed conversion ratio (FCR), whereas supplementation with Val or both Ile and Val improved ADG (P=0.02) and FCR (P=0.03). By adding either Val or both Ile and Val to the crude protein-reduced diets, both ADG and FCR could be maintained at the same level as for the pigs fed the PRD diet. These results indicate that Val is limiting before Ile, when reduced relative to Lys. By supplying crystalline amino acids, dietary crude protein can be reduced without negative effects on animal performance.

© 2009 Elsevier B.V. All rights reserved.

Abbreviations: Ile, isoleucine; Val, valine; Lys, lysine; PRD, positive reference diet; NRD, negative reference diet; ADG, average daily gain; FCR, feed conversion ratio; SID, standardised ileal digestible.

* Corresponding author. Tel.: +45 89991562; fax: +45 89991525.
E-mail address: jan.noergaard@agrsci.dk (J.V. Nørgaard).

0377-8401/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.anifeedsci.2009.08.010

1. Introduction

Research to estimate the requirements of isoleucine (Ile) and valine (Val) for young pigs is sparse (Kerr et al., 2004), particularly in low protein diets. Nevertheless there are several estimates of requirements for Ile and Val in the literature (ARC, 1981; NRC, 1998; Jørgensen and Tybirk, 2008). In general, and in diets based on barley, wheat and maize, and soya as the main protein source, Val will often be the third to fifth limiting amino acid. Isoleucine, histidine, leucine and phenylalanine will often follow closely in the order of limitation.

Given the overall lack of information in this area, the objectives of the current experiment were to study: (i) the effect of crystalline amino acid supplementation to crude protein-reduced diets on weaner pig performance, and (ii) the effect of Ile:Lysine (Lys) and Val:Lys ratios below or above the recommendations for young pigs. Ideal protein can be defined as the amount of essential amino acids relative to the recommended amount of Lys (Boisen et al., 2000), and in this experiment we were interested in studying the ratio of Ile and Val to Lys because Lys is the first limiting essential amino acid in most pig diets.

2. Materials and methods

2.1. Animals and diets

Crossbred (Landrace × Yorkshire × Duroc) female and castrated male pigs weaned at 28 ± 2 (mean ± SE) days of age were used. Full sibling pigs were penned individually and allocated to five treatments on the basis of live weight. The experiment contained 29 litters (i.e. replications) with a total of 145 pigs, such that either 5 female or male pigs were used from each litter. Pigs were housed individually in pens that comprised one-third concrete flooring and two-thirds plastic flooring, which permitted drainage. The pens were equipped with an open feed crib and a water nipple. The present experiment complied with the Danish Ministry of Justice Law no. 382 (June 10, 1987), Act no. 726 (September 9, 1993), concerning experiments with animals and care of experimental animals.

Five experimental diets based mainly on maize, barley, wheat and soya protein were used. The ingredient composition of the PRD and the NRD is shown in Table 1, and the calculated concentration of crude protein and amino acids is shown in Table 2. To assure maximal response, the PRD diet was formulated to contain a normal amount of crude protein but 5% less than the actual recommended amount of Lys, while other crystalline amino acids (DL-methionine, L-threonine, L-tryptophan) in the PRD diet were provided proportionally in accordance with amino acid recommendations (Jørgensen and Tybirk, 2006). The NRD diet was formulated to contain a reduced amount of crude protein and amounts of amino acids equivalent to those in the PRD diet, except for Ile and Val which were present in amounts below the recommendations.

The chemical composition of the main ingredients was determined before the start of the experiment to formulate diets based on the actual content of nutrients. Subsequently, the amino acid content was adjusted by addition of crystalline amino acids on basis of the analysed nutrient content of the PRD and NRD diet. Finally, the NRD diet was divided into 4 equivalent portions and supplemented with Ile (NRD + Ile) or Val (NRD + Val), or both Ile and Val (NRD + Ile + Val), to achieve the amounts indicated in Table 2.

The experimental diets were fed *ad libitum* for 4 weeks corresponding to a pig age of 5–8 weeks. All pigs were weighed at the beginning and at the end of the experiment. Health status including incidence of diarrhoea was recorded daily.

2.2. Analysis

The dry matter content was determined by oven-drying at 103 °C for 20 h. Gross energy, *in vitro* ileal digestibility of protein and fecal digestibility of organic matter were estimated as described by Boisen and Fernández (1995, 1997). Crude fat was extracted with diethyl ether after hydrochloric acid hydrolysis (Stoldt, 1952). Crude protein content (total nitrogen × 6.25) was analysed by a modified Kjeldahl method (AOAC, No. 984.13). Samples for amino acid analysis were hydrolysed for 23 h at

Download English Version:

https://daneshyari.com/en/article/2420193

Download Persian Version:

https://daneshyari.com/article/2420193

Daneshyari.com