Intake of Essential Fatty Acids by Growing-Finishing Pigs Kept on Smallholdings in Central Vietnam

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ABSTRACT

The intake of linoleic acid (LA) and α-linolenic acid (ALA) in relation to average daily weight gain (ADG) was studied in growing-finishing pigs kept on smallholdings in Central Vietnam. Groups of three piglets each were assigned randomly to 12 farms, where they were fed on local feedstuffs according to the farmer’s choice but were given a restricted amount of dry matter according to a preset feeding regimen. On arrival at the farms, the pigs weighed $10.4 \pm 0.9$ kg (mean $\pm$ SD, $n = 36$) and at 130 days of age they weighed $45.4 \pm 9.6$ kg. Dietary LA concentration ranged from 1.34 to 2.41 g/MJ metabolizable energy (ME) and ALA from 0.06 to 0.33 g/MJ ME. On a farm level, dietary LA and ALA concentrations were significantly correlated with their concentrations in adipose tissue, both correlation coefficients being 0.63. Dietary protein concentration and protein:energy ratio were significantly correlated with ADG, the correlation coefficients being 0.68 and 0.64. For individual piglets there were significant correlations between either LA or ALA in adipose tissue and ADG, the correlation coefficients being 0.37 and 0.45. Dietary protein concentration or protein:energy ratio was correlated with the dietary contents of LA and ALA. It is uncertain whether LA and ALA intake had a causal relationship with ADG. Since dietary LA levels were above the LA requirement, LA intake may not have limited growth. It is suggested tentatively that, through enhanced disease resistance, supplementation with ALA of the diets on the farms studied might have a positive influence on ADG.

Keywords: polyunsaturated fatty acids, growing-finishing pigs, growth rate

Abbreviations: CF, crude fibre; CP, crude protein; ADG, average daily gain; ME, metabolizable energy; DM, dry matter; LA, linoleic acid; ALA, α-linolenic acid; EPA, eicosapentaenoic acid; DHA, docosahexaenoic acid; PUFA, polyunsaturated fatty acids; LW, Large White; MC, Mong Cai; GLC, gas-liquid chromatography; TFA, total fatty acids.

INTRODUCTION

Linoleic acid (LA) and α-linolenic acid (ALA) are essential polyunsaturated fatty acids (PUFA) because they cannot be synthesized in the body. LA and ALA are the parent compounds of the families of n–6 and n–3 fatty acids, respectively. They can be desaturated and elongated in the animal body to yield the n–6 fatty acid arachidonic acid (AA) and the n–3 fatty acid, eicosapentaenoic acid (EPA), which are direct precursors for the synthesis of prostaglandins and leukotrienes. The LA requirement
of growing pigs weighing up to 30 kg or weighing from 30 to 90 kg has been set at 0.08 g/MJ of metabolizable energy (ME), (National Research Council, 1998). There are no formal recommendations for the requirement of ALA.

Overt LA deficiency in swine not only causes reduced growth but also produces clinical signs such as degenerative changes in seminiferous tubules and impaired sperm development (Leskanich and Noble, 1999). Suboptimal intake of LA may lead to impaired growth in pigs (Skelley et al., 1975; Myer et al., 1985; McDonald et al., 1995; Romans et al., 1995; Smith et al., 1996; Soler-Velasquez et al., 1998). High intakes of EPA and docosahexaenoic acid (DHA) may improve disease resistance in pigs (Irie and Sakimoto, 1992; Calder, 1996; Jolly et al., 1997), which may beneficially affect growth performance. It is suggested that in those situations where swine rations are composed without consciously taking into account the supply of PUFA, growth performance could be limited by insufficient PUFA intake. We have tested our hypothesis in smallholdings in Central Vietnam. On 12 farms, using different ingredient compositions of the swine rations, we have assessed fatty acid intake, determined growth performance and analysed the fatty acid composition of swine subcutaneous adipose tissue. The objective was to look for a relationship, if any, between LA and ALA intake and growth. In a field situation, LA and ALA intake cannot be determined accurately (Beynen et al., 1986). The LA and ALA content of adipose tissue is a valid index of the long-term intake of these fatty acids (Myer et al., 1985, 1992; Fritsche et al., 1993; Romans et al., 1995; Smith et al., 1996; Leskanich et al., 1997; Soler-Velasquez et al., 1998). Thus, we determined LA and ALA in adipose tissue collected at slaughter and correlated their concentrations with growth performance. The information obtained from this study could contribute to optimization of the diet of growing-finishing pigs.

MATERIALS AND METHODS

Pigs and diets

For the field experiment, 36 castrated, male weanling piglets (Large White × Mong Cai), aged 70 days and weighing 10.4 ± 0.9 kg (mean ± SD) were purchased from a breeding pig farm. Groups of 3 piglets each were assigned randomly to 12 smallholdings. Each piglet had an ear-cut number for identification. Pigs were fed on different local feedstuffs, which were mixed on the farms according to the farmer’s choice, but they were fed a restricted amount of dry matter according to a pre-set feeding regimen (Table 1). The farmers were instructed individually by students of animal science who were present on the farms. The students recorded what pigs were fed by the farmers and watched over the feeding schedule. On each farm, the three pigs were housed together in one pen. The pigs were fed twice daily. Water was available ad libitum through nipples that were situated besides the trough in each pen. The pigs were weighed on arrival at the farm, at 130 days of age, and at slaughter.