Whole Body Amino Acid Composition of the Growing Pig

**Objective**

To investigate whether the whole body amino acid composition of the growing pig is affected by feeding different diets (different combinations of protein and non-protein energy intake) and of systematic changes in body protein weight.

**Experimental Design**

Seventy-five samples of whole freeze dried pig bodies were analyzed for their amino acid composition from Landrace x Large White entire male and female pigs. At 12 kilograms liveweight, pigs were fed different diets (Kyriazakis and Emmans, 1992a and 1992b) for 0, 4, 6 or 8 weeks.

The range of protein weights measured for the 0 to 8 week testing, corresponded with 1.7 to 9.3 kilograms.

**Results**

On average 91% of the total protein was recovered. The analysis of the data using regression techniques suggested that none of the concentrations of the amino acids measured were affected significantly by sex or by the interaction between sex and body protein weight.

However, three amino acids were found to change as body protein increased. Lysine and histidine concentrations increased significantly ($P<0.01$) with increasing protein weight, while cystine concentration decreased significantly ($P<0.001$) (see Figure 1).

Figure 1. Amino Acid Concentration of Pig Protein Tissue at Two Different Protein Weights.
(Kyriazakis et al., 1993)
Conclusion

Whittemore (1983) and Black et al (1986) have suggested that the amino acid composition of the whole body protein of the pig proposed by ARC (1981) could be used as that of the ideal protein for growth. This study suggests the concentration of some amino acids may change in protein tissue as the animal matures. This would indicate that there may not be a single ideal protein for protein tissue growth.

The authors observed in this study, that differences in amino acid concentrations correspond to those for which the concentration in hair and body protein are very different from the rest of the body, as observed also by Harvey (1972). Histidine and lysine, whose concentrations increased with increasing protein weight, are present in relatively high proportions in the body (excluding hair) of the pigs but not in the hair (bristles).

Cystine, whose concentration decreased, is present at higher concentration in the hair than in the other tissues. Thus, it seems that the observed changes in amino acid concentrations with protein weight could reflect systematic changes in the proportion of the total body protein as hair protein.

The relative proportion of hair (hair density) per unit volume is expected to decline as the animal decreases its surface area relative to its size due to growth.

Such a consideration has already been taken for the amino acid composition of the protein in poultry. It has been reported that the amino acid composition of poultry at different weights could be better described by considering separately feathers and the remaining tissues (Emmans, 1989).

There exists a wide variation in the reported concentrations of amino acids in pig protein tissue (see Table 1). In all cases the hair protein was not measured separately from the other body tissues. Some of this variation in the literature could be accounted for by the above hypothesis, since the concentration of amino acids, which differ little between hair, and remaining tissues (e.g. threonine, phenylalanine) appear to be consistent in the literature.

<table>
<thead>
<tr>
<th>Amino Acids</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<td>Cystine</td>
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Columns description:

A  This study
B  Kemm et al (1990)
C  Batterham et al (1990)
D  Campbell et al (1988)
E  Moughan and Smith (1987)
F  ARC (1981)
In 1989, Fuller and coworkers recognized that there are differences in the amino acid compositions of the protein ideally needed for maintenance and that ideally needed for growth above maintenance. The results of this analysis suggest that there may also be systematic changes in the amino acid composition of the protein ideally needed for growth, as the pig increases in size.

Therefore, it is reasonable to assume that in the future ideal protein for swine may have to consider the weighted combination of values for tissue protein growth, hair protein growth and protein maintenance to become more accurate.

**Bibliography**


