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ASPECTS OF DIETARY PROTEIN QUALITY
FOR THE GROWING PIG

A thesis presented in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy in Animal Science at
Massey University

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A study of several aspects of dietary protein quality for the growing pig is described. The study was conducted in three parts.

Reservations regarding the interpretation of three recent empirical estimates of the ideal amino acid balance for the growing pig prompted the first part of the study. A diet (basal diet) was formulated in which enzymatically hydrolysed casein supplemented with synthetic amino acids formed the sole protein source. The balance of essential amino acids in the diet approximated the mean of the three published estimates.

Eight entire male pigs (boars) of 28 Kg initial liveweight, confined in metabolism crates, were fed the basal diet for 20 days and thereafter a protein-free diet for a further eight days. Mean daily excretion of urinary urea nitrogen over six-day collection periods was 93 mg/Kg$^{0.75}$ for pigs fed the basal diet and the corresponding value for the protein-free diet was 19 mg/Kg$^{0.75}$. Assuming that the difference between these values was attributable to deamination of amino acids from the basal diet, this corresponds to an efficiency of utilisation of dietary protein of 0.940. It was concluded that the amino acid pattern of the basal diet approximated an ideal balance.

Part two of the study entailed the determination and evaluation of estimates of the apparent ileal digestibility of crude protein and amino acids for the growing pig and included a comparison of protein digestibility in the rat and pig.

Samples of ileal digesta were collected from boars prepared with T-piece cannulae in the terminal ileum. Values for the digestibility of crude protein and amino acids in barley-meal, pea-meal, meat-and-bone-meal, fish-meal and a mixture of enzymatically hydrolysed casein and synthetic amino acids are cited.

In an evaluation of the determined digestibility values ten boars received a barley-, pea-, meat-and-bone-, fish-meal diet and ten a control diet containing enzymatically hydrolysed casein and synthetic amino acids as its sole protein source. The gross amino acid composition
of the latter diet equalled the determined apparent ileal digestible amino acid composition of the barley-based diet. Accepting that the control protein source was completely digestible and that the two feeding regimes were iso-caloric, the similar growth characteristics of pigs on the two diets suggested that apparent ileal amino acid digestibility coefficients are accurate measures of the degree of amino acid digestion and absorption in the growing pig.

Preliminary results showed close agreement between the rat and pig for the apparent ileal digestibility of crude protein in barley-, meat-and-bone- and fish-meal.

In the third part of the study a deterministic computer model which simulates the digestion and metabolism of dietary nitrogen in the growing pig was constructed. The model was based on the concept of a partitioning of daily dietary nitrogen intake in pig growth. Initial validation exercises demonstrated that results obtained from simulation were in close agreement with observations from experimentation with the live animal.
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TABLE OF CONTENTS

ABSTRACT ii
ACKNOWLEDGEMENTS iv
LIST OF TABLES ix

INTRODUCTION 1

PART I. ESTABLISHMENT OF THE IDEAL AMINO ACID BALANCE FOR GROWTH IN THE PIG 3

Chapter 1. Review of Literature 4
1.1 Introduction 4
1.2 The determination of amino acid requirements 4
1.3 Ideal amino acid balance 7
1.4 Approaches to the estimation of the ideal amino acid balance 8
1.5 Estimates of the ideal amino acid balance 9
1.6 The influence of dietary energy intake on the utilisation of dietary amino acids 13
1.7 The influence of dietary electrolytes on the utilisation of dietary amino acids 14
1.8 Deviation from an ideal amino acid balance 17
1.9 Conclusion 18

Chapter 2. The Assessment of a Balance of Amino Acids Considered to be Ideal for the Growing Pig (20 to 80 Kg Liveweight) 20
2.1 Introduction 20
2.2 Aspects of experimental design 21
2.3 Preliminary study one: The influence of the dietary (Na⁺ + K⁺ - Cl⁻) factor on the energy and nitrogen metabolism of the growing pig 32
   (i) Introduction 32
   (ii) Experimental procedure 33
   (iii) Results 36
   (iv) Discussion 38
I.2.4 Preliminary study two: The influence of the protein-free energy level of the basal diet on urinary urea excretion in the growing pig

(i) Introduction 40
(ii) Experimental procedure 40
(iii) Results 42
(iv) Discussion 42

I.2.5 Pilot trial: The estimation of the urinary total nitrogen excretion of growing pigs fed the basal diet

(i) Introduction 44
(ii) Experimental procedure 44
(iii) Results 44
(iv) Discussion 45

I.2.6 Main study: Determination of the irreducible minimum urinary urea nitrogen loss of the growing pig

(i) Introduction 47
(ii) Experimental procedure 48
(iii) Results 50
(iv) Discussion 52

I.2.7 Concluding discussion 56

PART II. THE DIGESTIBILITY OF AMINO ACIDS IN PROTEINS FED TO THE GROWING PIG

Chapter 1. Review of Literature

II.1.1 Introduction 62
II.1.2 The digestion and absorption of protein 62
II.1.3 The measurement of protein digestibility 65
II.1.4 Ileal analysis as a measure of amino acid digestibility 70
II.1.5 Conclusion 72
Chapter 2. The Determination and Assessment of Apparent Ileal Digestibility Coefficients for Crude Protein and Amino Acids in some Foodstuffs for the Growing Pig (20 to 80 Kg Liveweight)

11.2.1 Introduction

11.2.2 Determination of the digestibility of dietary crude protein and amino acids in protein sources for the growing pig

(i) Introduction

(ii) The digestibility of crude protein and amino acids in a casein, amino acid based (basal) diet

(a) Experimental procedure

(b) Results

(c) Discussion

(iii) The apparent ileal digestibility of amino acids in barley-, pea-, meat-and-bone- and fish-meal

(a) Experimental procedure

(b) Results

(c) Discussion

11.2.3 A comparison of the apparent digestibility of dietary crude protein in the rat and pig as determined at the terminal ileum and over the entire digestive tract

(i) Introduction

(ii) Experimental procedure

(iii) Results

(iv) Discussion
II.2.4 An assessment of the accuracy of apparent ileal amino acid digestibility as a measure of the digestion and absorption of amino acids by the growing pig

(i) Introduction 97
(ii) Experimental procedure 98
(iii) Results 105
(iv) Discussion 105

II.2.5 Summary and Conclusions 107

PART III. THE PREDICTION OF DIETARY PROTEIN QUALITY BASED ON A MODEL OF THE DIGESTION AND METABOLISM OF NITROGEN IN THE GROWING PIG 109

Chapter 1. Review of Literature 110

III.1.1 Introduction 110
III.1.2 Protein quality: An appraisal of methods of determination 110
III.1.3 Simulation modelling 112
III.1.4 Models in animal nutrition 113
III.1.5 Conclusion 115

Chapter 2. The Development of a Model Simulating the Digestion and Metabolism of Dietary Nitrogen in the Growing Pig (20 to 80 Kg Liveweight) 116

III.2.1 Introduction 116
III.2.2 Design of the model 117

(i) Introduction 117
(ii) Description of the model 121

III.2.3 Evaluation of the model 131
III.2.4 Discussion 142

APPENDICES 150

BIBLIOGRAPHY 160
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1.1</td>
<td>Requirements of the growing pig for some amino acids (Agricultural Research Council, 1981)</td>
<td>5</td>
</tr>
<tr>
<td>1.1.2</td>
<td>Amino acid composition of ideal protein for the growing pig (lysine = 100)</td>
<td>11</td>
</tr>
<tr>
<td>1.2.1</td>
<td>The determined amino acid composition of enzymatically hydrolysed casein and amounts of synthetic amino acids added to provide the sole protein source of the basal diet</td>
<td>25</td>
</tr>
<tr>
<td>1.2.2</td>
<td>Ingredient composition of the basal diet</td>
<td>26</td>
</tr>
<tr>
<td>1.2.3</td>
<td>Nutrient composition of the basal diet</td>
<td>27</td>
</tr>
<tr>
<td>1.2.4</td>
<td>The amino acid composition of the basal diet</td>
<td>28</td>
</tr>
<tr>
<td>1.2.5</td>
<td>Feeding level of the basal diet</td>
<td>29</td>
</tr>
<tr>
<td>1.2.6</td>
<td>The ingredient and nutrient compositions of the control diet</td>
<td>34</td>
</tr>
<tr>
<td>1.2.7</td>
<td>Mean apparent faecal digestibility values determined at three dietary levels of the (Na(^+) + K(^+) - Cl(^-)) factor</td>
<td>37</td>
</tr>
<tr>
<td>1.2.8</td>
<td>Mean metabolisability values determined at three dietary levels of the (Na(^+) + K(^+) - Cl(^-)) factor</td>
<td>37</td>
</tr>
<tr>
<td>1.2.9</td>
<td>Mean values of daily urinary total nitrogen excretion (g/Kg(^{0.75})) at three dietary levels of the (Na(^+) + K(^+) - Cl(^-)) factor</td>
<td>38</td>
</tr>
<tr>
<td>1.2.10</td>
<td>Mean values of daily urinary urea excretion (g/Kg(^{0.75})) at three dietary levels of the (Na(^+) + K(^+) - Cl(^-)) factor</td>
<td>38</td>
</tr>
<tr>
<td>1.2.11</td>
<td>Ingredient compositions of the basal and experimental diets</td>
<td>41</td>
</tr>
<tr>
<td>1.2.12</td>
<td>Mean daily urinary urea excretion (mg/Kg(^{0.75})) of pigs fed at two dietary gross energy levels</td>
<td>42</td>
</tr>
</tbody>
</table>
Table

1.2.13 The mean urinary total nitrogen excretion (mg/Kg\(^{0.75}\)/d) of pigs fed the basal diet 45

1.2.14 Estimates of the endogenous urinary nitrogen loss of growing pigs 45

1.2.15 Ingredient composition of the protein-free diet 48

1.2.16 Liveweights of the boars during the urinary collection periods 51

1.2.17 Mean daily urinary excretions (mg/Kg\(^{0.75}\)) of urea, urea nitrogen and total nitrogen for pigs fed the basal and protein-free diets 51

1.2.18 Comparison of the estimate of ideal amino acid balance found in the present study with that recommended by the Agricultural Research Council (1981) 58

1.2.19 Comparison of the estimate of ideal amino acid balance found in the present study with the amino acid patterns of pig muscle, liver and intestinal tissues 59

II.2.1 Ingredient composition of a casein, amino acid based (basal) diet 77

II.2.2 Ingredient composition of a protein-free diet 78

II.2.3 The digestibility of crude protein in the casein, amino acid based (basal) diet 79

II.2.4 The ileal digestibility of amino acids in the casein, amino acid based (basal) diet 80

II.2.5 The ingredient compositions (g/Kg air-dry weight) of the diets 84

II.2.6 Mean coefficients of apparent ileal amino acid digestibility in four dietary protein sources for the growing pig 87

II.2.7 Predicted and determined apparent ileal amino acid digestibilities in a mixed diet containing four protein sources 89
Table

II.2.8 The ingredient composition (g/Kg air-dry weight) of four diets for the growing rat 92
II.2.9 The mean apparent digestibility of crude protein (± S.E.) in three dietary ingredients as measured on ileal digesta or faeces in the rat and the pig 95
II.2.10 The ingredient and nutrient compositions of the barley-based diet 99
II.2.11 The amino acid balance of the barley-based diet compared with an estimate of ideal amino acid balance 100
II.2.12 The ingredient and nutrient compositions of the enzymatically hydrolysed casein, synthetic amino acid control diet 102
II.2.13 The feeding scale for pigs fed the barley-based and control diets 104
II.2.14 Mean (± S.E.) daily liveweight gains and lean and total fat contents of the ham joint 105

III.2.1 A suggested procedure for the construction of a model (Baldwin, 1976) 117
III.2.2 Urinary nitrogen (N) excretion; actual (balance experiment) vs. predicted (simulation model) 134
III.2.3 Body protein deposition (Pd); actual (balance experiment) vs. predicted (simulation model) 136
III.2.4 Ingredient composition of the diet fed in the study of Henderson et al. (1980) 138
III.2.5 The ingredient compositions (g/Kg air-dry weight) of some commercial pig grower diets 146
III.2.6 Model prediction of the utilisation of dietary crude protein at three levels of food intake 147