Protein Metabolism in the Adult Domestic Cat (*Felis catus*)

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Wouter H. Hendriks

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ABSTRACT

The main objective of this study was to provide information for the determination of the protein and amino acid requirements of the adult domestic cat by the factorial method. Data are presented on four factors for a factorial model: (1) the endogenous amino acids excreted in the faeces, (2) the amino acids which are required for the replacement of hair, (3) the body amino acids which are catabolised and ultimately voided in the urine and (4) the excretion of the urinary amino acid felinine.

Endogenous ileal nitrogen and amino acid excretions were determined under the conditions of protein-free and peptide (enzymatically hydrolysed casein, molecular weight < 10,000 Da) alimentation while the relative contribution of the hindgut to total endogenous gut excretion was investigated in a separate study by feeding cats a protein-free diet with or without added antibiotics. Endogenous ileal nitrogen and amino acid nitrogen excretions (mean ± SEM) of 2.4 ± 0.27 and 1.9 ± 0.13 mg/g food dry matter intake, respectively, were found for the cats fed the protein-free diet, whereas higher excretions of 3.6 ± 0.73 ($P = 0.12$) and 3.6 ± 0.76 ($P = 0.03$) mg/g food dry matter intake were obtained under the condition of peptide alimentation. Significantly ($P < 0.05$) higher endogenous ileal amino acid excretions, for the enzymatically hydrolysed casein-fed cats compared with those fed the protein-free diet, were found for methionine, aspartic acid, serine, glutamic acid, proline, valine and isoleucine, with the differences in excretions of glycine, alanine, leucine and histidine being significant at the 6 % level. Most of the endogenous faecal amino acid excretions were unaffected by the inclusion of the antibiotics in the protein-free diet, although bacterial numbers were significantly ($P < 0.01$) reduced (69 %). Antibiotics addition led to significantly higher faecal endogenous excretions of nitrogen, taurine, threonine, serine and histidine but significantly lower excretions for methionine and lysine.

Nitrogen and amino acids required for the growth of hair were estimated by the measurement of hair growth and loss rates for adult male and female domestic short-haired cats, and the nitrogen and amino acid composition of cat hair. Hair growth rate was determined using the mid-side patch technique in combination with the ratio of hair on the mid-side area to total hair on the body to allow conversion of mid-side hair growth rates to hair growth rates over the entire body. Hair loss rate was determined in a separate experiment by quantitative collection of ingested and non-

ingested hair loss. The mid-side hair growth and the hair loss rates showed a sinusoidal pattern throughout the year. The peak hair growth rate for the female cats was reached earlier than that for the male cats. Hair loss rate was 75 d out of phase with hair growth rate. The estimate for the total amount of hair growth throughout the year (32.7 $g \cdot kg^{-1}$body weight) was similar to the estimate for the total amount of hair loss throughout the year (28.1 $g \cdot kg^{-1}$body weight). The amino acid composition of cat hair was determined by conventional 24 h acid hydrolysis and by a compartmental model which took into account the simultaneously occurring processes of hydrolysis and degradation of amino acids over time. Four colours of cat hair, were also analysed (24 h hydrolysis) to determine if there was an effect of hair colour on amino acid composition. There was no significant ($P > 0.05$) effect of hair colour on the amino acid composition of cat hair. Amino acid nitrogen accounted for 94 and 99 % of the total nitrogen when determined by conventional 24 h hydrolysis and the compartmental model, respectively. The accurate amino acid composition of cat hair is presented.

Endogenous urinary excretions of total, urea, ammonia and creatinine nitrogen in the adult cat were determined by feeding cats a protein-free diet or by regression to zero protein intake of urinary nitrogen metabolite excretions for adult cats fed four levels of dietary protein. The mean (± SEM) endogenous total, urea and ammonia nitrogen excretions for the cats fed the protein-free diet were 360 (± 11.3), 243 (± 8.8) and 27.6 (± 1.06) $mg \cdot kg^{-0.75}$body $weight \cdot d^{-1}$, respectively. Lower mean (± SEM) estimates of 316 (± 53.9) and 232 (± 43.4) $mg \cdot kg^{-0.75}$body $weight \cdot d^{-1}$ were obtained for the endogenous excretions of total and urea nitrogen, respectively using the regression technique while a higher endogenous urinary ammonia nitrogen excretion of 33.7 (± 5.68) $mg \cdot kg^{-0.75}$body $weight \cdot d^{-1}$ was found. The differences between the two techniques were not statistically significant. Daily excretions of creatinine nitrogen were not significantly ($P = 0.64$) different (mean ± SEM, 16.2 ± 0.46 and 17.5 ± 1.19 $mg \cdot kg^{-0.67}$body weight, respectively) for the two methods. The chemical body composition of male and female adult cats was determined to obtain an estimate of the pattern of endogenous amino acid catabolism. Dehaired empty cat bodies were subjected to analysis for dry matter, lipid, ash, crude protein, amino acids, and several minerals (Ca, P, K, Mg, Fe, Mn and Zn). The chemical body composition was found to be similar between male and female cats except for the amount of crude protein which was significantly ($P < 0.05$) higher on a wet tissue (21.7 ± 0.35 % vs. 20.0 ± 0.60 %),

lipid-free matter (24.1 ± 0.22 % vs. 23.0 ± 0.22 %) and lipid-free dry matter (80.7 ± 0.23 % vs. 78.3 ± 0.32 %) basis in the male cats compared to the female cats. There was no significant ($P > 0.05$) effect of gender on the whole body amino acid composition (lipid-free dry matter or mol % basis) except for cysteine which was significantly ($P < 0.05$) lower in the male cats in comparison to the female cats.

A review on the urinary amino acid, felinine, which can be found in cat urine is presented. The biological significance of felinine to the animal is still a matter for speculation, but its function as a precursor to a pheromone seems likely. To obtain a standard for quantification experiments, several published synthesis procedures reported leading to (±)-felinine were evaluated for their yield. Most of the procedures were found to produce an amino acid isomeric with felinine. The yield for the only evaluated synthesis procedure shown to produce felinine was found to be low. A new higher yielding method for the synthesis of (±)-felinine is presented. In a separate study, normal urinary excretions of felinine by entire male, castrated male, entire female and spayed female cats were determined and were found to be (mean ± SEM) 122 ± 23.6, 41 ± 8.4, 36 ± 7.3 and 20 ± 3.8 $\mu mol \cdot kg^{-1}$ body weight$\cdot d^{-1}$, respectively.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

CHAPTER 2

CHAPTER 3 PART 1

CHAPTER 3 PART 2

CHAPTER 3 PART 3

CHAPTER 4 PART 1

Table

CHAPTER 4 PART 2

Table

CHAPTER 5 PART 1

Table

CHAPTER 5 PART 3

Table

LIST OF FIGURES

CHAPTER 1

CHAPTER 3 PART 1

CHAPTER 3 PART 2

CHAPTER 4 PART 1

CHAPTER 5 PART 1

Figure

CHAPTER 5 PART 2

Figure

CHAPTER 5 PART 3

Figure

CHAPTER 6

Figure