Determination of the threonine requirement in adult and senior Labrador Retrievers using the indicator amino acid oxidation technique

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Introduction

Improving the health and longevity of pets involves ensuring nutrient requirements are adequately met. Protein, a nutrient consisting of amino acids, has requirements that can be met through consumption of whole foods or synthetic amino acids.

Determining the requirements of amino acids for growing pets is necessary, considering body composition, age, and breed can influence the estimated requirement. Currently, there are several methods to estimate the amino acid requirement of dogs including the nitrogen balance and indicator amino acid oxidation techniques (IAAO). The IAAO method is particularly appealing as it requires little adaptation time, therefore minimizing the harmful effects of diets deficient in amino acids on growing animals (Elango, 2009).

In this experiment, the IAAO method was used to determine the threonine requirement in adult and senior dogs. Requirements were estimated on an as-fed and lean mass basis. This study is one phase of a series of experiments aimed to define the dietary requirements of amino acids in adult and senior Labrador Retrievers using the indicator amino acid oxidation technique.

Objective

The objective of this experiment is to use the indicator amino acid oxidation technique to determine the threonine requirement in adult and senior Labrador Retrievers.

Experimental Design

A total of twelve dogs (6 adult and 6 senior) were subjected to six diets with varying levels of threonine, ranging ranging from deficient to excess. Dogs were fed a control diet for two days, followed by one day of testing. During the experimental testing period, the test diet was fed, a tracer amino acid was supplied, and breath samples were collected. To ensure a steady state was achieved before samples were obtained, a priming dose of L-[1-^{13}C]Phe (Cambridge Isotope Laboratories, Inc.) was supplied to each animal based on their body weight. Following the priming dose, a dose of [1-^{13}C]Phe was supplied every thirty minutes, spanning a four hour period. The process of obtaining samples consisted of placing a respiration mask on each subject every thirty minutes (Oxymax, Columbus Instruments). $^{13}CO_2$ was collected and isotopic enrichment of the breath sample was determined by isotope ratio mass spectrometry (IRMS). Data gained through the IRMS measurements were converted to atom percent excess and analyzed using a broken line model (JMP® Pro 15).

Results

Amino acid requirements of threonine for adult and senior Labrador Retrievers are shown in Table 1, while previous requirements established by the NRC are show in Table 2. The estimated mean and population requirements of adult and senior dogs was determined to be 1.21± 0.24 and 0.92 ± 0.17 g/1000 kcal ME (mean ± 2SD), respectively. Graphs 1 and 2 show the $^{3}CO_2$ captured across dietary treatments.

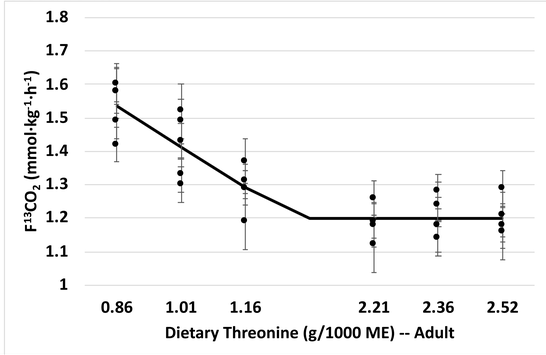
Table 1. Four Rivers amino acid requirements for threonine in adult and senior Labrador Retrievers

g/1000 kcal ME	Adult	Senior
Minimum Requirement	1.21	0.92
Recommended Allowance	1.45	1.09

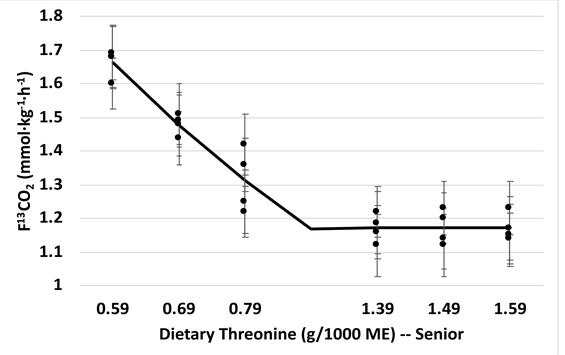
Table 2. NRC and AAFCO Amino acid recommendations of threonine for adult dogs

g/1000 kcal ME	NRC	AAFCO
Minimum Requirement	0.85	1.20
Recommended Allowance	1.08	

Graph 1. Labeled breath sample collected across dietary treatments



Graph 2. Labeled breath sample collected across dietary treatments



Conclusions

Including the proper ratios of amino acids into pet food is extremely important to ensure dogs are receiving accurate amounts. Just as amino acid deficiencies cause problems, receiving an excess of amino acids is harmful. As the pet food industry aims to provide healthy diets for to ensure healthy animals from puppies to adults, it becomes essential to understand the amino acid requirements as affected by age and body composition.

References

Elango, R., R. Ball, and P. Pencharz, 2009. Indicator amino acid oxidation: concept and application. The Journal of Nutrition. V. 138, 2. pp. 243-246.

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