Determination of lysine requirements of young adult and senior Labrador Retrievers using the indicator amino acid oxidation technique

Jessica L. Varney, Jason W. Fowler, Jordan T. Weil, & Craig N. Coon
Four Rivers Kennel, LLC

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Introduction
Methods
Treatments
Results
Conclusion

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INTRODUCTION

In order to improve the health and longevity of canines, the need to determine dietary amino acid requirements for aging populations is particularly important. Excess or restricted amounts of amino acids can have deleterious effects on bioprocesses in the body while an imbalance of amino acids can have detrimental effects, to the point of mortality[1,2]. In dogs, lysine deficiency has been shown to cause anorexia and weight loss and excess lysine has been shown to cause arginine deficiency, resulting in emesis, increased plasma ammonia, and amino aciduria[3]. Minimal and recommended amino acid allowances have been established via calculation by the NRC[3], but are not well backed in research. Previous research has proven that dated methods of establishing amino acid requirements, such as the use of crystalline amino acid diets, cannot always be used in practice[4]. A newer technique, the indicator amino acid oxidation technique, has been validated in many species and is now considered the gold standard for assessing amino acid requirements[5].

Little research has been completed to date on the actual dietary amino acid requirements in dogs, and especially in targeted populations such as age, breed, body composition, etc. As dogs age, the shift in body composition changes the amino acid requirements. This study is the lysine phase of a series aimed to define the actual dietary requirements of amino acids in young and senior Labrador Retrievers using the indicator amino acid oxidation technique.

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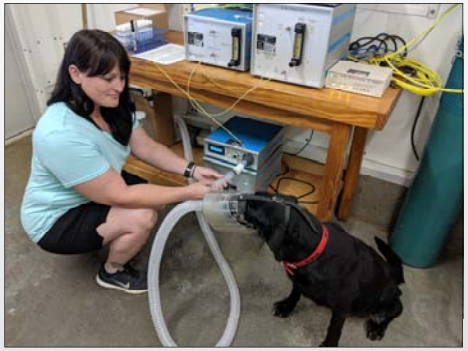
ANIMALS AND HOUSING

- Six young adults (<1.5yo) and six senior (>8yo) female Labrador retrievers were selected from colony at Four Rivers Kennel
- All dogs housed in controlled kennel environment
- All dogs aired outside in social groups for approximately six hours daily unless being tested
- Kenneled individually overnight
- Free access to automatic waterer; fed once daily in the morning

DXA PROCEDURE

- Test dogs were scanned for body composition midway through test procedures to obtain lean mass measurements
- Dual energy x-ray absorptiometry (DXA) (GE Lunar Prodigy) used for the scans
- All dogs sedated by a licensed veterinarian and positioned dorsoventrally for the scans

METHODS



- All dogs were supplied with constant dietary Phe in the control and test diets
- The control diet was fed for two days, followed by a day in which the test diet was fed, a tracer amino acid was supplied, and breath samples were collected
- On test day, a priming dose of L-[1-^{13}C]phenylalanine (Cambridge Isotope Laboratories, Inc.) based on the subject's body weight was first supplied, followed by [1-^{13}C]Phe doses every thirty minutes, spanning a four hour period
- A respiration mask was placed on each subject every thirty minutes (Oxymax, Columbus Instruments), $^{13}CO_2$ was collected, and enrichment was determined by isotope ratio mass spectrometry (IRMS)
- Results for IRMS were converted to atom percent excess (APE) and analyzed using a broken-line model of best fit (JMP Pro 14.1)

TEST DAY PROCEDURE

Indicator amino acid oxidation technique used:

- On test day, puppies were fed their assigned test diet every 30min and had a breath sample collected every 30min via respiration mask and calorimetry machine
- Received a priming dose of ^{14}C-phenylalanine after 2h of feeding, and a constant dose every 30min for 4h (based on body weight)
- Actual CO_2 production determined by indirect calorimetry performed on each dog at the end of each test day

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TREATMENTS

- Diets were isonitrogenous and isocaloric to ensure responses were due to differing amounts of digestible lysine included in the diet.

Diets

Diet	Control	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
% Lysine	0.64	0.33	0.37	0.41	0.56	0.60	0.64
Crude Protein	18	18	18	18	18	18	18
Phenylalanine	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Tyrosine	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Phe + Tyr	2.20	2.20	2.20	2.20	2.20	2.20	2.20
				%			
Corn GM 60%CP	24.08	24.08	24.08	24.08	24.08	24.08	24.08
Beet Sugar Sucrose	39.59	39.59	39.59	39.59	39.59	39.59	39.59
Arkansas Poultry Fat	9.52	9.62	9.61	9.59	9.55	9.53	9.52
Canine Mineral TD. 170782	5.34	5.34	5.34	5.34	5.34	5.34	5.34
Corn Starch	6.00	5.66	5.71	5.75	5.91	5.96	6.00
Beet Pulp	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Brewer's Broken Rice	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Flaxseed, ground	1.1	1.1	1.1	1.1	1.1	1.1	1.1
L-Lysine HCl	0.39	0.00	0.05	0.10	0.29	0.34	0.39
Kemin PAL dogs	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Canine Vitamin TD. 170783	0.504	0.504	0.504	0.504	0.504	0.504	0.504
L-Threonine 98%	0.15	0.15	0.15	0.15	0.15	0.15	0.15
L-Tyrosine	0.47	0.47	0.47	0.47	0.47	0.47	0.47
L-Tryptophan	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Kemin Verdilox GT dry antioxidant	0.03	0.03	0.03	0.03	0.03	0.03	0.03
L-Valine	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Glutamic Acid	0.27	0.80	0.72	0.64	0.33	0.25	0.17
DL-Methionine 98.5%	0.17	0.27	0.27	0.27	0.27	0.27	0.27
Potassium Chloride	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Total	100	100	100	100	100	100	100

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Interactive! Click on any of these bubbles *to jump* to each section.

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RESULTS

Results from IRMS revealed differences in amino acid requirements among the young and senior Labradors. The estimated amino acid requirement (EAR) and population safe requirements of young and senior dogs was determined to be 1.08 ± 0.21 and 0.83 ± 0.12 g/1000 kcal ME (mean ± 2SD), respectively. A difference of 987 g of lean mass was observed between the young and senior dogs using DEXA, with the seniors having the lesser amount.

Fig. 1. $^{13}CO_2$ oxidation for young adult dogs

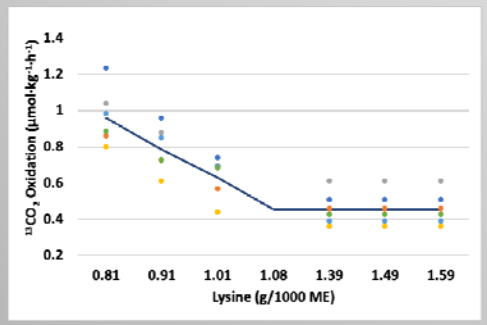

Fig. 2. $^{13}CO_2$ oxidation for senior dogs

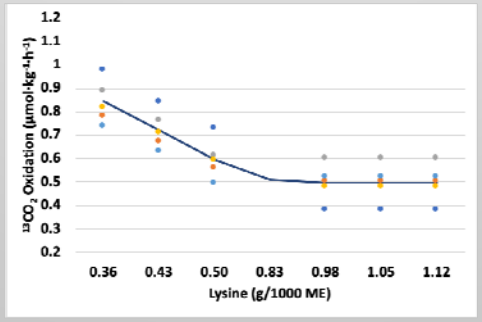

Fig. 3. Lysine requirements across age groups

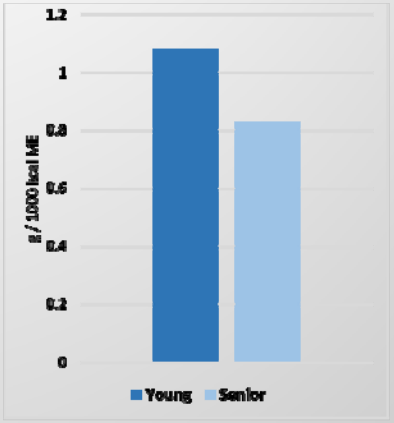

Fig. 4. Lysine requirements for young adults and senior dogs by lean mass

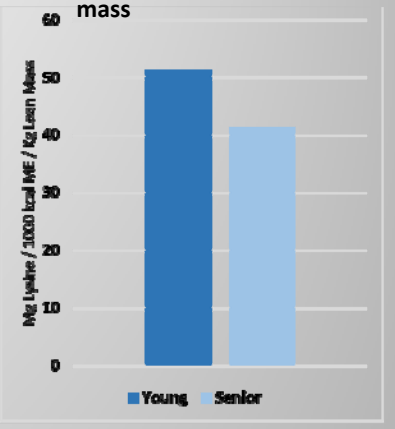

Table 1. Four Rivers amino acid requirements for lysine

	Young Adults	Seniors
g/1000 kcal ME	1.08	0.83
mg Lysine / 1000 kcal ME / Kg Lean Mass	51.28	41.34

Table 2. NRC amino acid requirements for lysine (g/1000 kcal ME)

	>14wk Puppies	Adult
Minimum Requirement	1.40	0.70
Recommended Allowance	1.75	0.88

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CONCLUSION

The amino acid requirements differed the two age groups, suggesting there is a necessity to develop ideal profiles for aging canines. Evaluating the amino acid requirements for young adult and senior dogs resulted in an estimated amino acid requirement and population safe requirement of 1.08 ± 0.21 and 0.83 ± 0.12 g/1000 kcal ME (mean ± 2SD), respectively.

The differences in requirements is explained by the change in body composition as canines age. The senior Labrador Retrievers had less lean mass by 987 g, on average. Additionally, the fat as a percentage of total body weight increased by 13.55% for the older Retrievers. The Four River senior Labs have been fed an average of 2.5 times the NRC protein requirement plus provided extensive exercise during most of their adult life yet they have lost lean mass with aging. Lean mass supports a higher maintenance requirement thus helping metabolize extra caloric intake and minimizing extra weight gain. The research indicates that senior Labrador Retrievers need less lysine/kg lean mass.

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REFERENCES

1. National Research Council (US) *Subcommittee on the Tenth Edition of the Recommended Dietary Allowances. Recommended Dietary Allowances: 10th Edition*. Washington (DC): National Academies Press (US); 1989. 6, Protein and Amino Acids.
2. Park, B. (2006). Amino Acid Imbalance-Biochemical Mechanism and Nutritional Aspects. *Asian-Aust J Anim Sci,* 19(9), 1361-1368.
3. National Research Council. (2006). *Nutrient requirements of dogs and cats*. Washington, DC: The National Academies Press. 6, Protein and Amino Acids.
4. Hirakawa, D.A., & Baker, D.H. (1986). Lysine requirement of growing puppies fed practical and purified diets. *Nutr Res,* 6, 527-538.
5. Shoveller, A.K., Atkinson, J.L., & Davenport, G.M. (2006). Protein and Amino Acids for Adult Dogs: Recommendations. *Iams Nutrition Symposium, OVC.*