Metabolism of D and L Methionine in Young Chickens

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Brief Curriculum

- 1980 Ph. D., Washington University in Cellular and Developmental Biology
- 1991 The Director of Cell Biology Research
- 2001 In research on gastrointestinal structure and function as affected by age, stress, nutrition and disease

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• Educations and Trainings:

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Current

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Summary

Ten-day-old chickens were used to determine differences in the metabolism between D and L methionine. Incorporation of the two methionine isomers into protein and free pool of major tissues and expired air was measured after intraperitoneal injection of D and L methionine. Significantly lower incorporation of D methionine into tissue protein and expired CO_2 and higher incorporation in the free pool of plasma and tissues reflected slower metabolism of D methionine compared to L methionine.

Key words: *D and L methionine, Metabolism, Protein*

Introduction

Practical diets for poultry are deficient in sulfur amino acids and supplementation with a methionine source like DL methionine or Alimet® Feed Supplement is a common practice. How the bird utilizes L methionine has been well described (Finkelstein, 1990), however D methionine utilization is less clear. For D methionine to be utilized by the cells as methionine it is required to be converted to L methionine first. The objective of this study

was to evaluate D and L methionine utilization by the major tissues in growing chickens.

Materials and methods

A pulse dose of 1-^{14}C-D methionine or 1-^{14}C-L methionine (0.06 uCi and 0.014 mg methionine per mg BW) was administered into the intraperitoneal space of 10±3 day old birds (Ross X Arbor Acre). Birds were placed in individual metabolism chambers for 10, 30 or 60 minutes and the expired air collected. Three birds per time and treatment were used in the experiment. At the end of the experiment, blood was withdrawn and samples of liver, kidney, duodenum, and breast muscle were taken for determination of [^{14}C] content in the protein and free pool of tissues. Data were analyzed as a completely randomized design.

Results and Discussion

In general, the incorporation of [^{14}C] into protein increased over time for all tissues in the presence of both isomers (Table 1). However, the rate of incorporation was higher for the L than for the D isomer. When evaluating each individual tissue, the incorporation of L methionine into protein was significantly higher than D methionine in muscle and duodenum. In the kidney, liver, and plasma the rate of protein incorporation was similar for the two

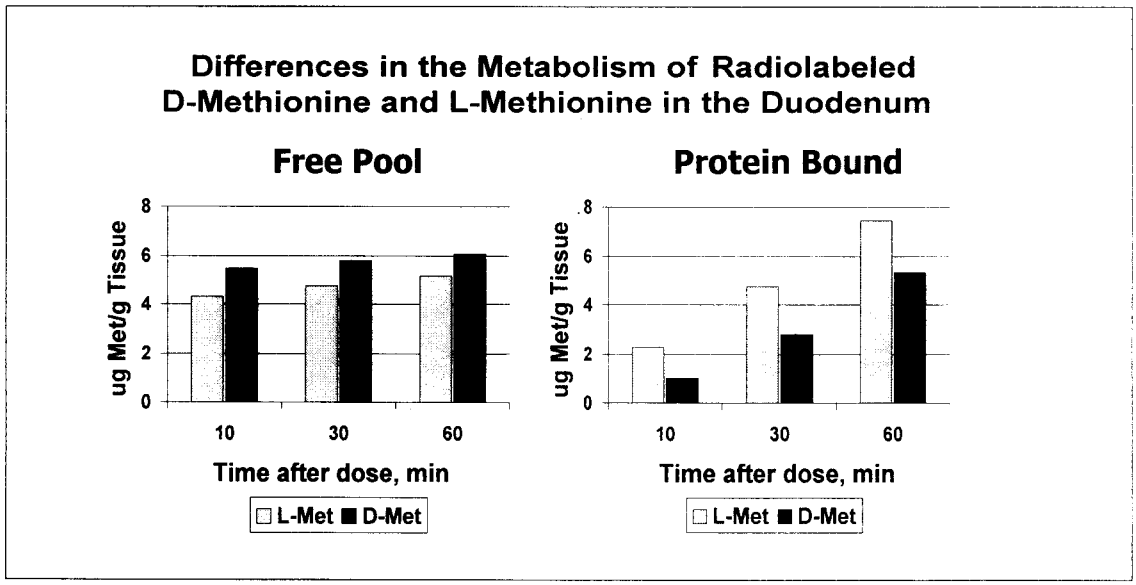
〈Table 1〉 Incorporation of D Methionine and L Methionine into protein of selected tissue

Protein Pool, ug Methionine/g Tissue									
	D-Methionine			L-Methionine				*P*-value	
Tissues	10	30	60	10	30	60	se	isomer	time
Breast	0.42	0.76	1.68	0.73	1.68	2.28	0.35	0.05	0.005
Duoden.	1.01	2.79	5.33	2.30	4.76	7.47	1.03	0.07	0.01
Liver	2.14	2.91	6.37	2.22	3.47	5.24	1.61	0.9	0.14
Kidney	1.74	3.96	6.41	1.51	2.22	5.20	1.13	0.27	0.009
Plasma	0.88	1.96	3.82	0.77	1.67	3.99	0.63	0.88	0.001

isomers reflecting the presence of the D-amino acid oxidase enzyme (Brachet and Puigserver, 1992) in these tissues. Lower rates of incorporation into protein for D methionine in breast muscle and duodenum, reflects the lag phase of D methionine to be converted to L

〈Table 2〉 Presence of D Methionine and L Methionine in the free pool of sselected tissues

Protein Pool, ug Methionine/g Tissue									
	D-Methionine			L-Methionine				*P*-value	
Tissues	10	30	60	10	30	60	se	isomer	time
Breast	1.57	3.20	4.46	1.81	2.60	2.95	0.39	0.08	0.01
Duoden.	5.47	5.78	6.06	4.32	4.74	5.17	1.41	0.07	0.01
Liver	9.11	5.37	4.65	5.24	4.28	4.08	2.74	0.42	0.56
Kidney	6.42	10.47	9.93	3.44	3.34	4.16	0.69	0.001	0.02
Plasma	8.57	11.16	8.98	5.91	4.81	5.70	0.98	0.003	0.72
CO_2	0	11.7	35.2	0	12.7	156.1	46.3	0.001	0.01



〈Figure 1〉 shows the comparison of L and D methionine in the duodenum free and protein pools. The D isomer of methionine was present in higher amounts in the free pool across all time points. Differences were signficant and indicate that the gastrointestinal system more readily uses the L-isomer of methionine than the D. Incorporation of the L isomer is higher at all time points and suggests that the isomers must be studied separately in order to interpret metabolism results.

methionine in liver and kidney prior to incorporation into protein of peripheral tissues.

Changes over time of the [^{14}C] counts in the free pool were more variable than in the protein pool. Across all tissues, there were higher [^{14}C] counts in the free pool of birds injected with D methionine reflecting lower metabolism of D methionine by the tissues. In addition, lower counts of [^{14}C] were found in expired CO_2 of birds treated with D methionine.

Summary

Higher counts in the free pool of all tissues, lower incorporation into protein of duodenum and breast muscle and into expired CO_2 found in birds dosed with D methionine indicates slower metabolism of D methionine in chickens. D methionine stays in the free form in plasma and tissues for a longer period of time than L methionine prior to its conversion to L methionine.

References

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