



Bioavailability of lysine in L-Lysine HCl

Objective

Experiments estimating amino acid requirements and measures of bioavailability normally assume that crystalline amino acids are 100% absorbed. This study was conducted to determine whether or not the assumption is valid.

Experimental Procedures

Animals

Six assays were conducted in this study. Assay 1 was a precision fed rooster assay to determine the true digestibility of lysine in casein and in L-Lysine HCl. Mixtures of sucrose and casein, sucrose and L-Lysine HCl and only sucrose were precision fed to groups of 5 cecectomized adult cockerels. The true lysine digestibility (TLD) was estimated using the equation:

$$TLD = \frac{\text{Lys input} - (\text{Lys output} - \text{Lys output of negative control}) \times 100}{\text{Lys input}}$$

Assays 2 and 3 estimated the lysine bioavailability in L-Lysine HCl, casein, and a casein simulated amino acid mixture using a chick growth method. Lysine levels were selected to lie on the linear portion of the growth curve.

Assay 4 was also a chick growth method where L-Lysine HCl was administered either by crop intubation or intraperitoneally. Birds in this assay were fed a lysine deficient diet to assure a growth response.

Assay 5 and 6 were similar to assay 4 except that 3 levels of lysine were administered to produce growth responses on the linear portion of the growth curve. Assay 5 was ad libitum fed while assay 6 was meal fed.

Results

Table 1. True digestibility of lysine in L-Lysine HCl and casein. (Assay 1)

Treatment	Lys intake (mg)	Lys excreted (mg)	True Lys dig (%)
Sucrose	0	26.9	
Sucrose + casein	450	41.4	97.0
Sucrose + L-Lys	450	35.0	98.4
Pooled SEM		10.6	2.4

Table 2. Relative lysine availabilities using chick growth assays. (Assays 2 and 3, pooled)

Treatment	Regression coefficient (g gain/mg lys intake)	Slopes relative to casein (%)
Casein	.1565(+/- .010)	100.0
Casein simul. AA	.1564(+/- .011)	99.9
L-Lysine HCl	.1587(+/- .010)	101.4

Table 3. Effect of intraperitoneal (IP) vs. crop intubated (CI) L-Lysine HCl administration. (Assay 4)

Treatment	Route of admin.	Weight gain (g)	Gain/Feed g/kg
Basal		36.0	424
+ 28 mg L-Lys/d	SHAM*	57.0	536
+ 28 mg L-Lys/d	IP	55.0	544
Pooled SEM	CI	.9	5

Table 4. Relative lysine availabilities of IP vs CI administration using regression analysis

Assay	Feeding	Rte of Admin.	Regression Coef.** (g gain/mg Lys delivered)
5	ad-lib	IP	.06466(±.006)
5	ad-lib	CI	.06658(±.006)
6	meal	IP	.13950(±.012)
6	meal	CI	.17460(±.012)

Discussion

This study has demonstrated that both the digestibility and the availability of lysine in L-Lysine HCl is not significantly different from 100% based on three independent methods of evaluation. The precision fed rooster assay (Table 1) yielded a true digestibility figure of 98.4%, not significantly different from 100% or 97.0% in casein which is recognized to be fully digestible. This observation agrees closely with the 98% figure reported by Nelson et al (1986), the 100% value reported by Leibholz et al (1986), and the 98.5-109.3% values reported by Qin et al (1988).

Lysine availability, as measured by chick growth assays is considerably more time consuming and yielded a value of 101.4% relative to casein (Table 2). This assay also demonstrated that amino acid interactions do not appear to affect the availability of lysine in L-Lysine HCl when the relative value of 99.9% is considered for the amino acid mixture.

Utilization of L-Lysine HCl does not appear to be influenced by route of administration (Tables 3 and 4). The possibility of lysine from L-Lysine HCl being poorly absorbed across the gut lumen can be ruled out since crop intubated lysine is utilized as well as lysine placed directly in the peritoneal cavity. This evidence fully confirms that lysine given as L-Lysine HCl is 100% absorbed from the gut lumen into the portal blood.

Conclusion

Lysine from crystalline L-Lysine HCl is fully digestible and available for productive purposes. This should be taken into consideration when formulating diets since the digestibility of lysine is commonly used protein sources is clearly less than 100% (Table 5).

Table 5. The true digestibility of lysine in selected feedstuff.

Ingredient	Number of samples	Average true lysine digestibility (%)
Corn	12	84.8
Feather meal	14	62.5
Meat meal	20	81.8
Poultry meal	7	80.0
Soybean meal	30	89.8
Wheat	30	81.4

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