DIETARY LYSINE REQUIREMENT IN HUMANS DETERMINED BY PHENYLALANINE FLUX AND OXIDATION

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The oxidation of phenylalanine as an indicator amino acid has been previously used to estimate amino acid requirement in animals (Ball and Bayley 1984). Since controversy exists regarding amino acid requirements in humans, the development of a new technique would be of value.

Lysine (LYS) requirement was estimated by the oxidation (OX) of L-[1-^{13}C]phenylalanine (PHE) in seven adult males consuming an energy sufficient diet with graded levels of dietary lysine, adequate phenylalanine (14 mg/kg/d), as determined in previous experiment (Zello et al. 1990), and excess tyrosine (40 mg/kg/d). Each subject was studied at 6 of the 7 lysine intakes. Primed, 4 h continuous intravenous infusions of [^{13}C]PHE (1.2 mg/kg/h) and [ring-$^{2}H_5$]PHE (0.5 mg/kg/h) resulted in isotopic steady state in plasma and breath CO_2 by 2h.

	LYS INTAKE (mg/kg/d; n=6 per intake)							
	5	10	20	30	40	50	60	(SD)
FLUX (umol/kg/h)								
[^{13}C] PHE	41.9	44.8	40.6	40.7	43.2	40.9	40.6	(5.9)
[$^{2}H_5$] PHE	42.1	44.6	40.6	40.1	42.5	41.1	41.7	(7.0)
OX (umol/kg/h)	3.1	2.7	2.5	1.8	1.6	1.5	1.6	(0.7)

Phenylalanine flux was similar for the two isotopes ($P > 0.05$) and was not affected by lysine intake, showing that measurements of flux are unnecessary when using the indicator oxidation technique. Phenylalanine conversion to tyrosine was low (2 to 4%) and unaffected by lysine intake. Phenylalanine oxidation decreased as lysine intake increased from 5 to 30 mg/kg/d, but was not further reduced as lysine intake increased to 60 mg/kg/d. Two-phase linear regression analysis of treatment means indicated that a breakpoint in oxidation, which we interpret to indicate dietary requirement, occurred near 30 mg/kg/d. Analysis of individual subject data showed variation in the oxidation breakpoint between 20 and 40 mg/kg/d.

These studies show that indicator oxidation can be used to estimate amino acid requirement in humans and indicate that the dietary lysine requirement of adult males is greater than the FAO/WHO/UNU (1985) recommendation of 12 mg/kg/d (supported by the Medical Research Council of Canada).

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