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EFFECT OF LYSINE INTAKE ON THE UTILIZATION OF METABOLIZABLE ENERGY AND ON PLASMA INSULIN CONCENTRATIONS IN LAMBS

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The efficiency of utilization of metabolizable energy (ME) is maximized when protein requirement is just satisfied (Hartsook and Hershberger 1971), but evidence indicating an effect of protein quality on ME utilization is equivocal. Theoretically, little change in heat production would occur with changes in concentration of individual amino acids (protein quality) provided basal metabolic rate and protein turnover remained constant. This is because synthesis of both urea and peptide bonds requires the hydrolysis of four phosphate bonds of ATP. However, gluconeogenesis may occur concurrently with urea synthesis and Krebs *et al.* (1965) suggested it may consume more energy than can be accounted for in glucose synthesis. Tasaki *et al.* (1972) showed that a gross deficiency in dietary lysine did cause an increase in heat production in pair fed chicks. Conversely, Farrell (1976) fed chicks several diets of differing amino acid content and found no difference in ME utilization. Data reported here are from a study of the effects of a wide range of lysine intakes on energy metabolism and plasma insulin concentration.

Eight male lambs weighing 12.5±0.8 kg were each given, by continuous abomasal infusion for 16 days, one of a series of isoenergetic liquid diets containing synthetic amino acids in which lysine and glycine were interchanged isonitrogenously. Each diet contained 20% dry matter and 4.98% nitrogen and supplied from 0.14 to 1.96 g/kg$^{0.75}$/day of lysine. On day 16 the animals were placed in an open circuit respirometer, and respiratory gas exchange was measured continuously for 10 hours. Heat production was calculated for periods when the lambs were resting. The Table shows that lysine intake had no significant effect on heat production or on the retention of ME.

A deficiency in lysine will result in an increase in the plasma concentration of many essential amino acids owing to their poor utilization for protein synthesis and their subsequent disposal via glucose and urea. The Table shows plasma insulin concentrations were highest at low lysine intakes, probably because of an increase in glucose entry rates from gluconeogenesis or because of an increase in the concentration of some plasma amino acids (Floyd *et al.* 1966).

Lysine Intake (g/kg$^{0.75}$/day)	ME Intake (kJ/kg$^{0.75}$/day)	Heat Production (kJ/kg$^{0.75}$/day)	Energy Retention (% of ME)	Plasma Insulin (mg/ml)
0.14	1190	596	50	1.23
0.28	1204	533	56	0.74
0.40	1183	532	55	0.24
0.58	1186	563	53	0.32
0.74	1205	568	53	0.48
0.89	1193	550	54	0.41
1.21	1207	574	52	0.48
1.96	1178	551	53	0.32

FARRELL, D.J. (1976). Publs. Eur. Ass. Anim. Prod. No. 19, p.97.
FLOYD, J.C., FAJANS, S.S., CONN, J.W., KNOPE, R.F. and RULL, J. (1966). J. Clin. Invest. 45: 1487.
HARTSOOK, E.W. and HERSHBERGER, T.V. (1971). Fed. Prod. 30: 1466.
KREBS, H.A., SPEAKE, R.N. and HEMS, R. (1965). Biochem. J. 94: 712.
TASAKI, I., KATSU, K. and OKUMURA, J. (1972). Jap.J.zootech.Sci. 43: 203.

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