Carry–over effects of dietary methionine on the immune system in chickens

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Methionine is often the first limiting amino acid in typical chicken diets and a supplement is essential for growth. Additions to the diet may enhance or depress immune responses depending on factors that include the amount of the supplement and its interactions with other amino acids and nutrients (Bhargava *et al*. 1970; Tsiagbe *et al*. 1987; Konashi *et al*. 2000). Day–old ISA–Brown cockerels (n=180) were allocated to 3 treatment groups, each with 6 replicates of 10 birds, to examine possible carry–over of effects on the immune system of a short–term methionine supplement. For 4 weeks they were given (i) a peanut meal–based diet containing 0.20% methionine (LM); (ii) LM + 0.20% methionine (MM); or (iii) LM + 0.40% methionine (HM), and then for 8 weeks a commercial pullet grower diet. Two birds per replicate were randomly selected and immunised with 12.5% sheep red blood cells (SRBC) one week before bleeding and slaughter at Weeks 4, 8 and 12. Body–weight (BW), lymphoid organ weights, serum levels of primary antibody to SRBC, and 24 h cutaneous response of foot webs to a T–cell mitogen phytohaemagglutimin (PHA)–M, were measured.

Methionine promoted growth (P<0.05) in birds in a dose–dependent manner, indicating an inadequacy in the LM and MM diets, and LM vs HM showed a clear effect on the immune system. LM resulted in a lower (P<0.05) weight of the T–cell producing thymus during the supplementation, but this was not carried over into later life and T cell function was not altered. The higher relative thymic weight (P<0.05) in LM birds at Week 12 suggests that their diet might have retarded the normal atrophy with age of the thymus. The bursa of Fabricius is an important site for antibody–forming B cells in newborn birds, and relative weight was significantly lower with LM (P<0.05) during the supplementation period than with the other treatments. This effect continued for up to 4 weeks; the difference (P<0.05) between LM and HM at Week 8 had disappeared by Week 12, probably because of a gradual involution of the bursa within the first 2 weeks of life. The function of B cells might be altered by diet, as shown by the difference (P<0.05) in serum antibody against SRBC between LM and HM birds during the supplementation; the effect was carried over to Week 12. This effect might not be associated with any effect of the diets on the involuting bursa but rather on other lymphoid tissues. Our findings indicatethat the immuno–modulatory effects of dietary methionine in early life of chickens can persist into a later stage of life.

Bhargava, K.K., Hanson, R.P. and Sunde, M.L. (1970). Effects of methionine and valine on antibody production in chicks infected with Newcastle disease virus. *Journal of Nutrition* 100, 241–248.

Konashi, S., Takahashi, K. and Akiba, Y. (2000). Effects of dietary essential amino acid deficiencies on immunological variables in broiler chickens. *British Journal of Nutrition* 83, 449–456.

Tsiagbe, V.K., Cook, M.E., Harper, A.E. and Sunde, M.L. (1987). Enhanced immune responses in broiler chicks fed methionine–supplemented diets. *Poultry Science* 66, 1147–1154.

Table 1 Body–weight (BW), relative lymphoid organ weights (% BW), primary antibody to SRBC and foot web responses to PHA–M in chickens at 4, 8 and 12 weeks of age given a LM, MM or HM diet.

	Week 4			Week 8			Week 12		
	LM	MM	HM	LM	MM	HM	LM	MM	HM
BW (g)	218^{a}	350^{b}	353^{b}	661^{a}	916^{b}	934^{b}	1376^{a}	1657^{b}	1693^{b}
Relative thymus wt. (%)	0.25^{a}	0.32^{ab}	0.34^{b}	0.37	0.33	0.35	0.45^{a}	0.34^{b}	0.32^{b}
Relative spleen wt. (%)	0.13	0.15	0.14	0.18	0.18	0.17	0.17	0.17	0.16
Relative bursa wt. (%)	0.32^{a}	0.49^{b}	0.40^{c}	0.34^{a}	0.39^{ab}	0.42^{b}	0.30	0.28	0.24
Anti–SRBC titre (log titres)	3.25^{a}	2.80^{ab}	1.67^{b}	5.33^{a}	4.75^{ab}	4.17^{b}	5.42^{a}	5.08^{ab}	3.42^{b}
Foot web PHA–M response (mm)	0.22	0.20	0.30	0.30	0.20	0.32	0.48	0.51	0.57

$^{a, b, c}$ Means bearing different superscripts in the same row within the same age differ (P<0.05)