Carryover effects of dietary L–arginine on the immune system in chickens

K. Deng, C.W. Wong and J.V. Nolan

School of Rural Science and Agriculture, Animal Science, University of New England, Armidale NSW 2351
kdeng3@metz.une.edu.au

Chickens cannot biosynthesise arginine and many studies with other species have shown that immune responses can be influenced by dietary arginine. Additionally, as nutritional status in early life may permanently 'programme' immune functions in later life of humans and other species (Hales and Barker 1992), the present study investigated the carryover effect of short–term dietary arginine in early life on the immune system in chickens. Day–old ISA–Brown cockerels (n = 180) were allocated to 3 treatment groups, each with 6 replicates of 10 birds, and were given an arginine–deficient basal diet (6.7 g arginine/kg) supplemented with 0 (control), 2.7 (LA) or 5.4 (HA) g L–arginine/kg for 4 weeks; then all birds were offered a commercial pullet grower feed (8.9 g arginine/kg) for another 8 weeks. The dietary arginine contents of the control, LA and HA diets were equivalent to 70, 100 and 130% respectively of NRC, USA, recommendations. Lymphoid organ weights, serum primary antibody levels against sheep red blood cells (SRBC) and bovine serum albumin (BSA), and cutaneous reactivity of toe–webs to phytohaemagglutinin (PHA)–M as an indicator of T cell responsiveness, were measured at 4 week intervals.

The L–arginine supplementation increased (P<0.05) growth rates during the supplementary period (Table 1). At Week 4, no differences (P>0.05) in lymphoid organ weights relative to bodyweight (BW), anti–SRBC antibody levels or toe–web PHA responses were detected. These results were similar to those reported by Kidd *et al*. (2001). Although LA–fed birds had lower (P<0.05) anti–BSA IgG antibody levels than the control at Week 4, this effect did not persist (P>0.05) at Weeks 8 and 12 (Table 1). In contrast, while no difference (P>0.05) in the anti–BSA IgM antibody levels was noticed at Week 4, the LA–fed birds showed a higher (P<0.05) level at Week 12 than the control. Similarly, an increased (P<0.05) anti–SRBC antibody level and a reduced (P<0.05) relative bursa weight in HA–fed birds at Week 8 without any prior effects (P>0.05) were also evident. It is thus concluded that supplementation with L–arginine in early life was able to enhance the antibody response at a later stage of young chickens, depending on the type of antigen.

Hales, C.N. and Barker, D.J. (1992). Type 2 (non–insulin–dependent) diabetes mellitus: the thrifty phenotype hypothesis. *Diabetologia* 35, 595–601.

Kidd, M.T., Peebles, E.D., Whitmarsh, S.K., Yeatman, J.B. and Wideman, R.F., Jr. (2001). Growth and immunity of broiler chicks as affected by dietary arginine. *Poultry Science* 80, 1535–1542.

Table 1 Bodyweight (BW), lymphoid organ weights, serum primary antibody levels against SRBC and BSA, and toe–web PHA responses in chickens given a control, LA or HA diet during the first 4 weeks of age.

	Week 4			Week 8			Week 12		
	0	LA	HA	0	LA	HA	0	LA	HA
BW (g)	194[a]	208[b]	210[b]	667	678	685	1300	1296	1314
Thymus (g/kg BW)	2.91	2.84	2.92	3.83	3.69	3.65	3.73	3.76	4.46
Spleen (g/kg BW)	1.61	1.72	1.59	1.79	1.91	1.90	2.03	2.33	2.20
Bursa (g/kg BW)	4.08	3.54	3.48	4.86[a]	4.07[ab]	3.82[b]	3.33	3.34	3.45
Anti–SRBC titre (log titres)	0.63	0.55	0.60	0.50[a]	0.60 [ab]	0.95[b]	0.48	0.55	0.78
Anti–BSA IgM (unit/ml)	1.64	1.39	1.43	2.23	2.40	2.22	2.40[a]	2.92[b]	2.67[ab]
Anti–BSA IgG (unit/ml)	2.23[a]	1.66[b]	2.03[ab]	3.28	3.24	3.28	3.10	3.14	3.03
Toe–web PHA response (mm)	0.32	0.41	0.40	0.39	0.55	0.36	0.55	0.38	0.48

[a, b]Means with different superscripts in the same row within the same age differ (P<0.05)