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Rapid restoration of immunity to parasites in lactating rats by changing nutrient demand

P. Sakkas[1], L. A. Jones[1], J. G. M. Houdijk[1], D. P. Knox[2] and I. Kyriazakis[1,3]
[1]*Animal Health, SAC, Edinburgh EH9 3JG, UK,* [2]*Parasitology Division, Moredun Research Institute, Penicuik EH26 0PZ, UK and* [3]*Veterinary Faculty, University of Thessaly, 43100 Karditsa, Greece*

The periparturient relaxation of immunity to parasites in mammals may have a nutritional basis(1). Indeed, at times of protein scarcity, resistance and immunity to the intestinal parasite *Nippostrongylus brasiliensis* in lactating rats improves with increased protein supply(2) and reduced litter size and thus reduced nutrient demand(3). Here, we use the latter observation to assess the rate at which improved host nutritional status can improve periparturient resistance and immunity.

Second parity rats were infected with 1600 *N. brasiliensis* larvae prior to mating (primary infection). Upon parturition (d_0), dams were fed *ad libitum* a low-protein food (100 g CP/kg DM) and were either nursing 12 pups (LS12) or 3 pups (LS3) throughout, or nursed 12 pups until day 5 when their litter was adjusted to 3 pups (LS12-3). Rats were re-infected with 1600 larvae on d_2 (secondary infection). Food intake, and dam and litter weight were assessed daily until either d_5 (for LS12 only), or d_8 and d_{11} (all treatments) when the number of worms, worm eggs in the colon contents (EIC) and small intestinal mucosal inflammatory cells per villus-crypt unit (vcu) were assessed. These data were log-transformed prior to statistical analysis through ANOVA.

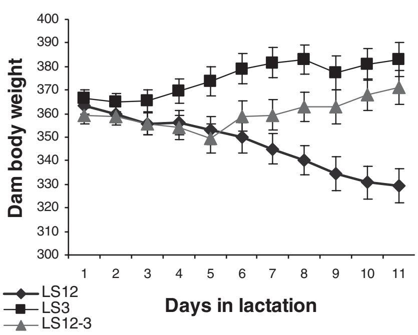

Fig. 1. Dam weight.

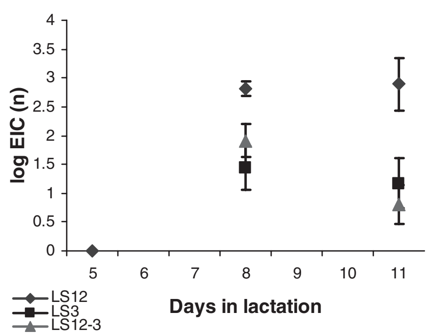

Fig. 2. Eggs in colon.

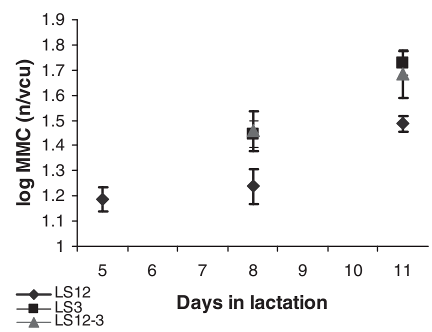

Fig. 3. Mucosal mast cells.

Litter size manipulation did not affect feed intake (data not shown). Figure 1 shows that the body weight of LS12 dams gradually reduced, while that of LS12-3 dams gradually increased to that of LS3 dams. Sampling time post challenge did not interact with litter size manipulation for any of the parasitological and immunological parameters ($P > 0.10$). However, averaged over sampling points, LS12-3 and LS3 dams had fewer EIC (Fig. 2; $P < 0.001$), more mucosal mast cells (Fig. 3; $P < 0.01$) and worm burdens ($P < 0.05$; data not shown) than LS12 dams. Litter size manipulation did not affect the number of eosinophils or goblet cells ($P > 0.10$; data not shown).

These results confirm that the resistance to *N. brasiliensis* is sensitive to nutrient demand(3). The cessation of body weight loss following pup removal suggests that nutrient supply changed from scarce to more than adequate. Since worm burdens and mucosal mast cell numbers taken 3 d following pup removal were similar to those in dams rearing small litters throughout, our results support the view that nutrient supplementation can rapidly improve periparturient resistance and immunity to parasites.

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