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Effects of a marginal zinc diet on intestinal health and immune function

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ABSTRACT

Zinc (Zn) is an essential nutrient for overall health and proper immune function, especially within the digestive system, although the specific mechanisms by which it exerts these effects are not well understood. In this study we examined the effects of short term exposure to a marginal Zn diet on the intestinal health and immune function of lipopolysaccharide (LPS) challenged mice through plasma cytokine profiling and histologic evaluation of intestinal tissue sections. Adult male mice were fed a Zn-adequate (30 ppm) or Zn-marginal (3 ppm) diet for 4 wk and then a bacterial challenge was simulated with an intraperitoneal injection of LPS (10 ug/g BW) or saline (control). Plasma and tissues were collected at 0, 6, or 24 h post-challenge for analysis. Ileal, jejunal and cecal samples were thinly sectioned, mounted on slides and stained with hematoxylin-eosin for histological evaluation of villi length, villi width, lamina propria width, crypt depth, intraepithelial leukocyte number, lamina propria leukocyte number and presence or absence of Peyer's patches. Plasma was analyzed for IL-1 beta, IL-4, IL-6, IL-10, IL-12p40, IL-12p70, IFN gamma, and TNF alpha. The marginal Zn diet led to shorter and wider villi in the ileum and jejunum ($P<0.05$), greater lymphocyte infiltration in the lamina propria after LPS challenge ($P<0.05$), and higher plasma IL-6 levels at 24 h post-LPS ($P<0.01$). Results indicate that Zn status substantially impacts the intestinal response to LPS through modulation of the cytokine response and leukocyte recruitment, and this impact is evident even with short-term (4 wk) Zn depletion.