Table 1. Summary of the effects of various micronutrients on different aspects of immunity. Abbreviations used: IFN, interferon; IL, interleukin; NK, natural killer; Th, T-helper; TNF, tumour necrosis factor.

Micronutrient	Role in barrier function	Role in cellular aspects of innate immunity	Role in T-cell mediated immunity	Role in B-cell mediated immunity
Vitamin A	Promotes differentiation of epithelial tissue; Promotes gut homing of B- and T-cells; Promotes intestinal immunoglobulin A+ cells; Promotes epithelial integrity	Regulates number and function of NK cells; Supports phagocytic and oxidative burst activity of macrophages	Regulates development and differentiation of Th1 and Th2 cells; Promotes conversion of naïve T-cells to regulatory T-cells; Regulates IL-2, IFN-γ and TNF production	Supports function of B-cells; Required for immunoglobulin A production
Vitamin B6	Promotes gut homing of T-cells	Supports NK cell activity	Promotes T-cell differentiation, proliferation and function, especially Th1-cells; Regulates (promotes) IL-2 production	Supports antibody production
Vitamin B9 (Folate)	Survival factor for regulatory T-cells in the small intestine	Supports NK cell activity	Promotes proliferation of T-cells and the Th1-cell response	Supports antibody production
Vitamin B12	Important co-factor for gut microbiota	Supports NK cell activity	Promotes T-cell differentiation, proliferation and function, especially cytotoxic T-cells; Controls ratio of T-helper to cytotoxic T-cells	Required for antibody production
Vitamin C	Promotes collagen synthesis; Promotes keratinocyte differentiation; Protects against oxidative damage; Promotes wound healing; Promotes complement	Supports function of neutrophils, monocytes and macrophages including phagocytosis; Supports NK cell activity	Promotes production, differentiation and proliferation of T-cells especially cytotoxic T-cells; Regulates IFN-γ production	Promotes antibody production
Vitamin D	Promotes production of antimicrobial proteins (cathelicidin, β-defensin); Promotes gut tight junctions (via E-cadherin, connexion 43); Promotes homing of T cells to the skin	Promotes differentiation of monocytes to macrophages; Promotes macrophage phagocytosis and oxidative burst	Promotes antigen processing but can inhibit antigen presentation; Can inhibit T-cell proliferation, Th1-cell function and cytotoxic T-cell function; Promotes the development of regulatory T-cells; Inhibits differentiation and maturation of dendritic cells; Regulates IFN-γ production	Can decrease antibody production
Vitamin E	Protects against oxidative damage	Supports NK cell activity	Promotes interaction between dendritic cells and T-cells; Promotes T-cell proliferation and function, especially Th1-cells; Regulates (promotes) IL-2 production	Supports antibody production

Zinc	Maintains integrity of the skin and mucosal membranes; Promotes complement activity	Supports monocyte and macrophage phagocytosis; Supports NK cell activity	Promotes Th1-cell response; Promotes proliferation of cytotoxic T-cells; Promotes development of regulatory T-cells; Regulates (promotes) IL-2 and IFN-γ production; Reduces development of Th9 and Th17 cells	Supports antibody production particularly immunoglobulin G
Copper		Promotes neutrophil, monocyte and macrophage phagocytosis; Supports NK cell activity	Regulates differentiation and proliferation of T-cells; Regulates (promotes) IL-2 production	
Iron	Essential for growth and differentiation of epithelial tissue	Promotes bacterial killing by neutrophils; Regulates balance of M1 and M2 macrophages; Supports NK cell activity	Regulates differentiation and proliferation of T-cells; Regulates IFN-γ production	
Selenium		Supports NK cell activity	Regulates differentiation and proliferation of T-cells; Regulates (promotes) IFN-γ production	Supports antibody production