EFFECT OF PROTEIN, SELECTED MINERALS AND VITAMINS ON IMMUNE SYSTEM

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A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Foods and Nutrition

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1981

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INTRODUCTION

The association of malutrition and infection has been known for centuries. The high mortality rates caused by the effects of malnutrition upon human populations always have been an intriguing problem. At one end of the scale is the availability of food and at the other end is the overwhelming infection which invariably accompanies severe malnutrition. Both malnutrition and infections are common in the developing countries and the devastation of the combined effects of both of them prompted Schrimshaw et al. (1) to employ the term "synergism of malnutrition and infection" to describe their interactions.

An intimate relationship exists between nutritional status, immune response and infection. Nutritional deficiency impairs immunocompetence and increases the severity and frequency of infection. Infectious illness is frequently associated with negative nitrogen balance which may precipitate malnutrition and depresses the immune response. Primary immunodeficiency states are characterized by failure to thrive and a variable susceptibility to infection. Undernutrition and infection often coexist and augment each other, and impair immunocompetence to a variable extent. The mutually augmenting effects of malnutrition are seen not only in individuals with gross protein-calorie malnutrition, but also in those with deficiencies of individual nutrients such as iron and folic acid (2).

A basic knowledge of the immune system is essential to understand the interrelationship between nutritional status and immunocompetence. The purpose of this report is to a) review the immune system briefly

and b) describe the role of specific nutrients in the immune system.

IMMUNE SYSTEM

The maintenance of the body's integrity is the principal function of the immune system. The immune system has evolved mechanisms to repel or destroy invaders of extrinsic origin, ranging from virus through bacteria, fungi, protozoa, and even metazoa. Immunity entails three major responses: 1) cell-mediated immune response, the thymus-dependent system often referred to as delayed hypersensitivity, 2) humoral antibody response, the apparent bone marrow dependent system, and 3) the non specific immunity response, which includes phagocytosis and macrophage-mediated cytotoxicity (3).

Cell-mediated immunity

"Cell-mediated" reactions are commonly defined as those immunological reactions transferable by cells and not serum, and include such diverse manifestations as allograft rejection, allogenic disease and delayed hypersensitivity in addition to pathogenic organisms (4).

Cell-mediated immunity works through the T-cells, the thymus dependent lymphocytes, and its end results are affected by the lymphoid killer cells which develop from the T-cells and macrophages which are required and activated by T-cells (5).

T-lymphocytes

The yolk sac and later, the fetal liver of mammalian embroys contain stem cells, whose offspring can become any of several kinds of hemopoietic cell. In adults, stem cells are produced in bone marrow. A hemopoietic stem cell or its immediate descendents, after migrating into the thymus

will divide repeatedly and give rise to small lymphocytes of the T-type. Normally T-lymphocytes become antigen responsive after they leave the primary lymphoid organ (thymus) to seed into the secondary lymphoid tissues (spleen and lymph nodes). Subpopulations of T-lymphocytes include "killer" cells, "helper" cells, "suppressor" cells, and perhaps a fourth, "amplifier" cells. As the nomenclature of these cells suggest, the killer cells can destroy other cells and the helper cells can enhance B-cell responses (vide infra) in the humoral immune system. Suppressor cells may inhibit T-helper and B-cell responses. Amplifier cells may facilitate and/or enhance the response of killer, suppressor, or helper cells (4,5,6).

T-lymphocytes recognize antigens by means of specific membrane receptors on their surfaces. Strong evidences suggest that the antigenic receptors of some T-cells are least partially if not fully structurally related to immunoglobulins (4,5).

Lymphokines

T-lymphocytes bearing specific receptors on their surface are stimulated by contact with antigen to release protein factors, collectively known as lymphokines. Lymphokines may recruit and activate macrophages to deal with intracellular parasites and microorganisms. The lymphokines produced by T-lymphocytes also include the poorly understood transfer factor, interferon, chemotactic factors, and blastogenic factors that will include proliferation of both T- and B-lymphocytes and other cells (5,7). Each of these factors is capable of amplifying the influence of the T-lymphocytes several hundred fold on a cell to cell basis.