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Nutrition and Immunity in Old Age

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The immune system provides a unique investigative tool to examine the altered ability of the elderly to deal with those illnesses that commonly affect them. These include infection, cancer, degenerative disorders, autoimmune disease, and others. If we extrapolate from observations on young children with primary immunodeficiency disorders who also have a high incidence of the same types of illnesses, it is to be expected that immune responses decrease in old age. Indeed this has been reported repeatedly. However when we examine the available data it is evident that these observations pointing to decline in the immunocompetence apply to the elderly as a group but not to individual old persons. Thus while almost three-fourths of those above the age of 65 years have decreased immune responsiveness as many as 25 percent show the same levels of response as those observed in young adults. These findings suggest, therefore, that immunologic senescence is not an inevitable consequence of chronological ageing.

Studies of dietary intake and assessment of nutritional status have shown the frequent prevalence of deficiencies among the elderly. Besides decreased energy intake, blood levels of several nutrients are often decreased. These include iron, zinc, vitamin C, folic acid, and more rarely, vitamin B₆, E, A, and B₁₂. There is a surprisingly high incidence of nutritional deficiencies even in the elderly living in the prosperous indus-

trialised countries; figures for developing countries are not readily available and the data are extremely limited but it is, however, reasonable to expect that the incidence of such deficiencies will be no less. Physical disability, dental problems, malabsorption, increased nutrient needs secondary to disease, sociocultural isolation, emotional stress and economic factors may contribute to nutritional deficiency seen in the elderly.

Since nutrition is an important determinant of immunocompetence in young children, we must ask the question whether dietary advice and supplementation can improve immunocompetence and decrease the risk of illness such as infection in old age.

The results of our recent studies indicate that the answer to this question is a qualified yes.

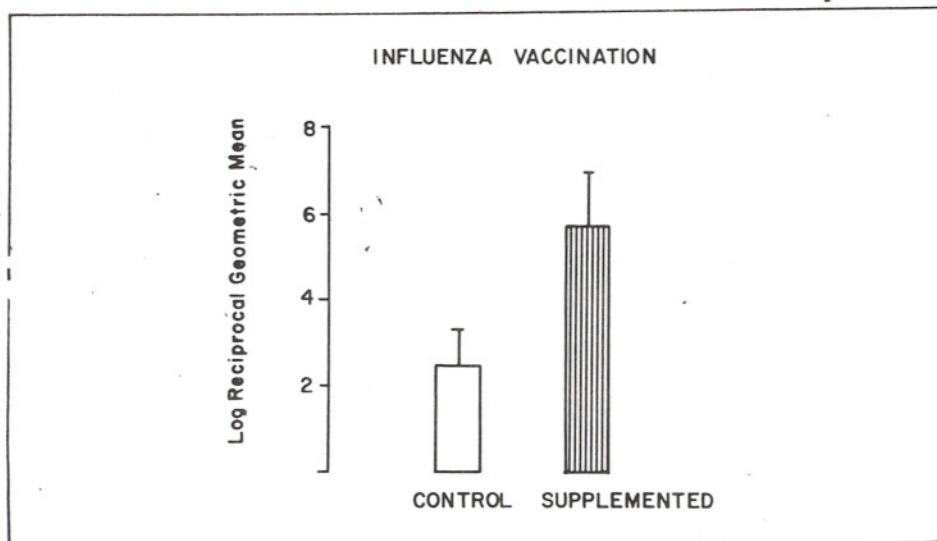
Immunocompetence in old age

Several studies have documented that ageing is associated with decreased immune responses. In man, there is an interesting correlation between chronologic age, immunocompetence and survival. Individuals above the age of 70 years who fail to react to a battery of delayed cutaneous hypersensitivity tests suffer high mortality in the immediate three-year follow-up period compared with those who show positive responses.

The number of stem cells with pluripotential ability to colonise peripheral lymphoid organs such as the spleen, lymph

node and submucosal sites in the gastrointestinal and respiratory tracts, decreases with age. There is impaired regenerative ability, and homing of precursor cells into the involuted thymus is decreased. These changes in cell number and kinetics may provide the explanation for failure to mount leukocytosis in the face of infection. Similarly, a high prevalence of anaemia in the elderly may be due to limited cell regeneration in the bone marrow.

The number and function of thymus-dependent T cells is decreased in the elderly. These cells play an important role in a variety of host protective mechanisms, including killing of virus-infected cells, tumour cells, delayed hypersensitivity and rejection of grafts. Monoclonal antibodies can identify various subsets of T cells and these are altered in old age. Furthermore, the production and release of interferons, interleukins and other cell substances is decreased. Natural killer cell activity is reduced. The activity of thymic hormones is barely detectable in persons beyond the age of 50 years; interestingly, this inductive factor binds with zinc, copper and other trace elements and its biological activity is dependent upon the nutrients. In vitro thymic epithelium from old animals fails to promote maturation of stem cells into fully differentiated T lymphocytes, in contrast to the ability of thymic epithelium of young animals. There are antigenic and ultrastructural changes in lymphocytes in old age. Many cells develop the "senescent cell antigen" that binds IgG and may promote the identification and elimination of "old" cells. There is swelling of mitochondria and the cristae are less prominent. Myelin-like structures may appear. Cyclic AMP and GMP activity is altered and these metabolic changes may contribute to reduced lymphocyte response to mitogens.



Changes are described in the migratory ability of phagocytes as well as their capacity to kill ingested microorganisms. The production of interleukin-1 is decreased. Serum IgG levels are lower and IgA higher in the elderly compared with findings in younger persons. Antibody response to T cell dependent antigens is decreased. There is a reduction in antibody affinity and monoclonal gammopathy is uncommon.

Nutrition and immunity in the elderly

Given the consistent effects of nutrition on immunocompetence in younger individuals, the frequent occurrence of nutritional deficiencies in old age, and declining immune responses, it is logical to postulate that there may be a causal relationship between nutritional status and immunocompetence in the elderly. Surprisingly, there are few published data so far. The topic has been reviewed recently (Chandra R.K., Puri S. *Brit. Med. Jour.* 1985. 291. 705)

In an earlier study, we demonstrated that the provision of a general nutritional supplement that contained about 500 KCal with the daily requirements of vitamins, minerals and trace elements, resulted in improved lymphocyte responses and delayed cutaneous hypersensitivity reactions within eight weeks. Almost 50 percent of the energetic individuals showed a positive skin reaction at the end of eight weeks of supplementation. In individuals, the nature of nutritional counselling and supplement to be given would depend upon that person's nutritional status and biochemical profile. For example, zinc given to a group of the elderly resulted in improved immune response in about one-third of them; this may reflect the prevalence of

functional zinc deficiency in that population. Similar observations have been made for iron.

Practical applications

There are several practical applications of nutrition-immunity interactions in old age. Firstly, improved immunocompetence achieved by correction of nutritional deficiencies may be expected to reduce the burden of illness in old age. This is of immense practical and economic importance. Secondly, there is a reduction in postoperative complications, such as sepsis, if elective surgery is carried out after correction of obvious nutritional deficiencies. Thirdly, response to immunisation, for example influenza virus vaccine, is enhanced if nutritional support is provided before or together with vaccination (Fig.). The impact of nutritional correction of immunologic abnormalities on the course of other illnesses and responses in old age remains to be determined. With increasing life expectancy, nutritional problems of old age will demand serious attention in India in the years ahead. It is reasonable to expect that in view of prevailing economic factors, nutritional deficiencies may be more widely prevalent among the aged in India than among those of the prosperous countries of the industrialised West. It is precisely for this reason that the subject would seem to merit special attention.

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Based on part of the XI Gopalan Oration delivered before the Nutrition Society of India on November 6, 1987 at Baroda

NUTRITION NEWS

The XX Annual Meeting of the Nutrition Society of India was held at the M.S. University, Baroda, on November 6 and 7, 1987. Two hundred-and-seventy delegates participated in the meeting. The Scientific Session included:

- Symposium on "Nutrition and Physical Efficiency".

- Special Lectures —

- i) "Neonatal Thyroid Failure in Iodine Deficient Regions in India" by Dr. N. Kochupillai.

- ii) "Simple Traditional Methods for Reducing Dietary Bulk of Cereal Based Diets in Rural Homes" by Dr. Tara GopalDas.

- iii) "Social Marketing Strategy for Combating Nutritional Blindness" by Dr. P.G. Ramachandran.

- 72 free communications and poster presentations.

The following young scientists received awards for their presentations:

Community Nutrition

- 1) Dr. S. K. Upadhyaya, Dept. of Paediatrics, Institute of Medical Sciences, Varanasi.
- 2) Dr. Shubhada Kanani, Baroda Citizen's Council, Baroda.

Experimental Nutrition

- 3) Dr. D. V. Muralidhara, Dept. of Physiology, Kasturba Medical College, Mangalore.
- 4) Ms. Arti Pande, NRTC, Dept. of Paediatrics, Institute of Medical Sciences, Varanasi.

The Eleventh Gopalan Oration was delivered by Dr. R. K. Chandra on the subject of "Nutrition, Immunity and Outcome: Past, Present and Future".

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