Nutrition, Immunity and Illness in the Elderly

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Proceedings of the International Conference on Nutrition, Immunity and Illness in the Elderly

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Introduction

NUTRITION, IMMUNITY AND ILLNESS IN THE ELDERLY: SETTING THE THEME

The International Conference on Nutrition, Immunity and Illness in the Elderly was planned to address the critical issue of nutritional regulation of disease in old age. The progressive growth in the segment of the population above 65 years of age and the observation that the elderly consume at least one-fourth of the health care costs demand that we address the challenge posed by the health problems of this age group. In the last decade, several studies have examined the alterations in dietary intake and body composition of those individuals above the age of 60 years. Other investigations have looked at the progressive decline in immune responses with aging. This publication, based on the proceedings of the Conference held in St. John's, Newfoundland, Canada, July 9-11, 1984, presents the current state-of-the-art of the topic.

There are several theories of aging, perhaps as many as there are researchers. The programmed aging hypothesis suggests that aging and death are inevitable developmental events that cannot be altered by any external or environmental influence. If for the moment we discard this concept and consider the alternative view that senescence results from a progressive accumulation of abnormal cells and faulty molecules largely as a consequence of attrition or environmental insults superimposed on random genetic errors, we can entertain the possibility that nutritional factors are important variables of the "wear and tear". If there are dietary imbalances that make it difficult to appropriately replace these faulty cells and proteins, progressive decline in physiological functions will end in death.

Is there any evidence that nutritional deficiencies occur in old age? There are some recent data to suggest that elderly individuals often eat less, due largely to psychosocial deprivation, physical disability, dental problems and the like. Moreover, the absorptive processes do not function optimally and metabolic needs may be increased due to underlying disease. All these factors may contribute to the well established phenomenon of progressive loss of lean body mass in old age.

Are these nutritional changes of any physiological importance? Dietary factors are important determinants of the normal structure and function of most tissues and organs in the human body. Undernutrition affects each and every system, the extent of impaired function being generally proportional to the rate of cell division and protein synthesis. For this reason, perhaps, malnutrition has marked effects on the gastrointestinal tract and the immune system. We know that aging is associated with declining immunity and reduced resistance to many diseases, such as infection, cancer and others. Can we entertain the hypothesis that nutritional changes in old age contribute to the declining immunity observed in the elderly?

How frequent is the problem? At present, approximately 10 percent of the population in North America and Europe is above the age of 65 years. I believe that at

least one-fourth of these individuals have some evidence of nutritional deficiency or excess; this is based on clinical examination, anthropometric measurements, biochemistry and hematology. In the year 2020, the proportion will increase to 15 percent of the population and given the current projections about population growth and world resources, the proportion of the undernourished elderly will increase. In Canada, the 1981 census revealed that almost 50 percent of the elderly are living below the official poverty threshold.

The topics we had gathered together to discuss are of vital fundamental and public health importance. It would not be out of context to state that the interests of the scientific and health care administrators can be likened to microorganisms in culture. There is a resting phase of slower growth and then there is a logarithmic phase of rapid growth. Nutrition of the elderly and how it impacts on their health and response to disease and treatment is currently a very hot topic and the interest generated by this Conference is illustrative of that.

It was a most valuable meeting. At the beginning of the Conference, I felt that five questions needed answers. One, what is the magnitude of the public health problems related to nutrition of the elderly? Two, what are the physiological considerations and psychosocial and ecological factors that impinge upon the eating behaviour and nutrition status related to macronutrients and trace elements in old age? Three, how does the body's immune system change in the aging person and whether dietary factors modulate immunologic senescence? Four, what are the two way interactions between drugs and nutrients? Five, how do dietary factors influence the development and management of neuropsychiatric illness and of cancer?

Obviously, we have not fully answered all these questions. However, we have built a nice framework for progress in each of these areas. At the end of this Conference, we have identified areas where there are big gaps in the data. Also, having realized the frequency and clinical significance of nutritional problems in the elderly, we have to consider intervention and prevention strategies. In this context, we have to look at the effectiveness of any such programmes, of cost-benefit ratio, practicality, and also compliance. What is it which makes people take certain decisions about their dietary habits and lifestyle? A case in point is smoking, alcohol and drug abuse. People know a great deal about the health risks of substance abuse, and yet the world sales of alcohol and cigarettes continues to climb progressively.

So we took away many questions that arose from the Conference deliberations. If we can generate some data on these questions in the next few years, we shall have the basis of a most stimulating second meeting in the future.

St. John's, Newfoundland
February 2, 1985

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Nutritional Considerations

THE NUTRITIONAL STATE OF THE ELDERLY: DEMOGRAPHIC AND EPIDEMIOLOGIC CONSIDERATIONS

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ABSTRACT

Epidemiology can make an important contribution to the understanding of nutritional status. When deficiency has been defined (in dietary, biochemical or clinical terms) epidemiological surveys can determine its prevalence. In general, however, there is still considerable lack of agreement as to the criteria for defining normal nutritional status. Epidemiological methods can also be helpful in determining what proportion of the elderly would benefit from a change in their eating habits. Cross-sectional surveys detect associations between nutritional status and ill-health, but they do not reveal which is the cause and which is the effect. Prospective studies will show whether the suspected cause antedates its suggested effect, and determine the prognostic significance of various indices of nutritional status. But they do not supply conclusive evidence of causation, and their interpretation in the elderly is complicated by the fact that anything that changes with age will predict mortality even when age is allowed for. Randomized controlled trials establish whether associations are causative, and show the benefits that follow dietary changes. It must be recognized, however, that there may be substantial differences between individuals' requirements, and that a high intake of certain nutrients may carry its own risks. It may therefore be inappropriate to search for an optimum intake of any given nutrient which is equally suitable for everyone.

KEY WORDS: Nutritional status, Dietary intake, Aging, Epidemiology, Demography.

INTRODUCTION

Demography

In most developed countries the elderly are increasing in numbers, both absolutely and as a proportion of the total population. Fig. 1 shows the changes that have occurred in England and Wales since 1901.

In considering the significance of their nutritional status, we must look not only at their mortality rates but also at their disease experience and quality of life. For it is clearly important that the elderly should maintain their health both for their own sake and for that of the community which has to support them when they become unable to care for themselves. The proportion of old people living in private homes or in institutions shows very great international variation (Fig. 2 and 3) and is not explained by any obvious demographic or economic factor (1).

If this variation reflects differences in the needs of old people for institutional care, it is obviously important to find out why the elderly in Spain and Canada are so much healthier than those in Finland or the Netherlands. On the other hand it may simply be due to differences in provision. In this case it would be interesting to know whether old people fare better or worse in countries with greater institutional facilities than in those where they are more likely to remain at home.

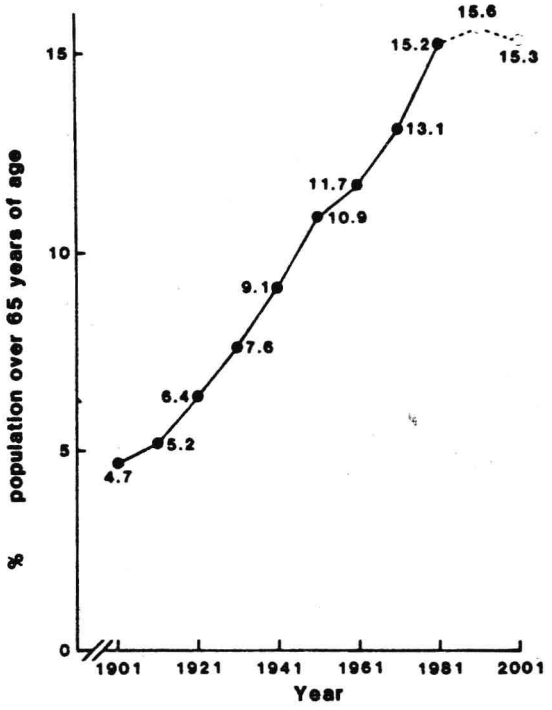

FIG. 1

Percentage population aged over 65 years in England and Wales since 1901.

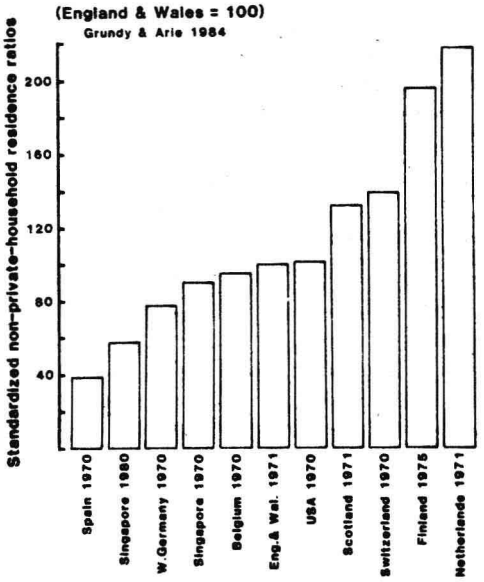

FIG. 2

Standardized non-private household ratios for persons over 65 years (1).

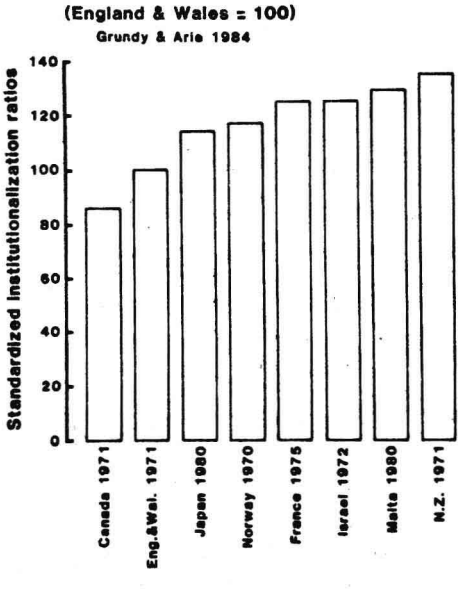

FIG. 3

Standardized institutionalization ratios for persons over 65 years (1).

EPIDEMIOLOGICAL METHODS

Epidemiology can illuminate nutritional deficiencies in two ways. Firstly, if we have agreed criteria for defining deficiency in terms of dietary intake, blood concentrations or clinical signs, its prevalence can be measured and compared in different groups of persons. Secondly, epidemiology can be employed to investigate the significance of various indices of nutritional status where no clear criteria of deficiency have yet been established.

Epidemiological methods can be classified broadly as follows:

1. ***Mortality and morbidity data.*** Published mortality statistics are not very useful in this context, since deaths are seldom attributed to nutritional inadequacies which may nevertheless have contributed to the illness. Routinely-collected morbidity data are notoriously imprecise and are of little value in relation to nutritional insufficiency.

2. ***Dietary surveys.*** Surveys of dietary intakes, using questionnaires or weighed inventories, provide data which can be compared with the recommended daily intakes of various nutrients. It is, however, by no means obvious how the results of these surveys should be interpreted. The intakes recommended by different authorities show considerable divergences, the American standards being in general much higher than the British figures. They are based on various criteria, but an element of guesswork seems to be involved in most of them. A further difficulty is that people may have a low intake of food as a consequence of disease rather than as a cause of it.

3. ***Biochemical surveys.*** Nutritional status is often assessed by means of the concentration of nutrients in the blood or some other biochemical Zrocedure. The values obtained in a survey are then compared with those which are regarded as normal. The interpretation of such surveys is hampered by the same difficulties that beset the interpretation of dietary surveys: there is frequently some disagreement about what are normal limits, and low values may occur as the result of disease rather than as a cause of it.

4. ***Clinical surveys.*** Subjects can be clinically examined in order to determine the prevalence of nutritional deficiency, or to see whether a poor nutritional status is associated with evidence of ill-health. But again the clinical signs of nutritional deficiency, like the biochemical and dietary criteria, are not universally agreed upon except in the case of overt diseases like beriberi and xerophthalmia, which are rare in developed countries. Obesity and generalized undernutrition are the most obvious types of nutritional disorder in the elderly, and can be defined in terms of weight, height, and skinfold thickness.

5. ***Prospective studies.*** A prospective cohort study will reveal the prognostic significance of various indices of nutritional status by showing whether they are associated with an increased risk of death.

   This longitudinal type of study has great advantages over the cross-sectional approach. It enables the investigator to be reasonably sure that the suspected cause really was present before its suggested effect. It ensures that the independent variables (dietary intake or blood concentrations) are recorded without the bias which may attend knowledge of the dependent variable (illness). And it avoids the survivor effect which confounds any cross-sectional study of the elderly - i.e. the fact that the eighty-year-olds cannot be regarded as the seventy-year-olds ten years later, since many people die in their seventies and do not attain eighty years. Prospective studies are by their very nature long-term and this is a disincentive to their being conducted. But they are of considerable value and it is desirable that more should be done. Nevertheless they share the weakness of all observational methods, in that association does not necessarily imply causation, as examples discussed below will illustrate.

6. ***Randomized controlled trials***. Controlled trials provide the most precise information about causes and effects. They are, however, rather difficult to conduct. Nutrients such as vitamin C can be administered as tablets, and matched by placebo of indistinguishable appearance and taste. But other foodstuffs, (e.g. dietary fibre) are very much more difficult to give in this way. Nevertheless, it is highly desirable that controlled trials should be performed to test etiological hypotheses and to ascertain whether any benefit accompanies the raising of intakes.

Trials can be considered as being of two broad kinds. Firstly, there are those where the object is to determine the effect of a nutrient on a supposed risk factor, such as a biochemical variate. Secondly, there are those where the end-point is overt disease, death, or some change in function directly relevant to daily life. Obviously the first kind is the easier to conduct, and in some circumstances is the only type of trial which is feasible. But the second kind of trial alone provides conclusive evidence of benefit, and it is to be regretted that relatively few of sufficient size have been conducted.

BODY WEIGHT

Studies of weight (adjusted for height) are very easy to perform and provide simple evidence of general nutritional status. If we take a cross-section of people of all ages, we find that their body mass index (weight divided by height squared, or some such index) rises with age until about the age of 60, and then falls steeply. There are three alternative explanations of the decline of weight in the latter part of life, and they illustrate the inadequacy of cross-sectional studies, in the absence of other evidence.

Firstly, it may be that individuals, having progressively gained weight in young and middle life, then progressively lose it again in old age. Secondly, the apparent decline in old age may be due to a survival effect as the fattest people die off first leaving their healthier and thinner contemporaries to reach the greatest ages. Thirdly, there could be a cohort effect - i.e. the oldest people belong to a former generation which may always have been leaner than persons born in successive decades of this century.

In fact a longitudinal study reveals that the first explanation is the correct one (2). The tendency to become stouter and then thinner was noticed long ago (3): Shakespeare's fifth age of man is "the justice, in fair round belly", while "the sixth age shifts into the lean and slipper'd pantaloon, ... his youthful hose well sav'd, a world too wide for his shrunk shank".

Furthermore, the second explanation offered (that of a survival effect) turns out to be the reverse of the truth. In old age a high body mass index is a favourable prognostic index, in contrast to its significance in younger people. But this does not necessarily mean that thin old people would live longer if they became obese. It is probably a reflection of the fact that not everyone enters Shakespeare's sixth age at the same chronological point. It follows that those old people who are biologically younger than their contemporaries will be both heavier on average and less likely to die. This effect will appear with any biological variate that changes with age, and complicates the interpretation of prospective studies.

VITAMIN C

It is rare for death to be attributed to vitamin C deficiency in developed countries - in 1980 only one death in England and Wales was registered as due to scurvy. Obviously, there may be many cases that remit following a spontaneous change in diet or upon diagnosis and treatment, but the numbers are quite unknown. In one survey carried out by the British Department of Health and Social Security (DHSS), two cases were diagnosed among 879 subjects (0.2%) (4).