Nutrition of the Elderly: Introduction

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At the beginning of this century, only 4% of the population of the United States was over 65 years of age. By 1976 this proportion had risen to 11% and is projected to attain 14% by the year 2000 (1). This is important because senior citizens make disproportionate demands on health care. An interesting study in Massachusetts emphasizes the extent of the needs of senior citizens for health care as they age (2). The authors compute the number of years an elderly person is likely to live independently and the number of subsequent years he or she will need assistance in rising from bed, washing, dressing, and/or eating. Thus, for persons aged 65 to 69 years, it is computed that independent living will continue for an average of 9.3 years for men and 10.6 years for women. This is followed by 3.8 years of dependent living for men and 8.9 years for women. One can speculate that independent living is determined by the continued adequacy of the neuromuscular system, and that loss of this occurs at the same rate in both men and women, whereas longer survival of women in a dependent state may reflect their slower development of lethal cardiovascular diseases.

Nutrition has been recognized only recently as an important factor influencing the functional outcome of aging. In the course of the symposium, it will become evident that nutrients consumed during earlier adult life as well as in the later years can affect the terminal years of the life span. To provide some order while analyzing the evidence of dietary involvement in the aging process, we can assemble the data in several categories. First, changes in body composition and in organ function occur throughout adult life, making old age the recipient of adverse processes begun at earlier ages (e.g., loss of bone density leading to osteoporosis and fracture). Second, many degenerative diseases first assert themselves in middle life and persist into old age (e.g., cardiovascular diseases). Nutritional habits are prime factors in the etiology of some of these diseases. Third, the amounts of many individual dietary nutrients needed to maintain optimal health in old age still require quantification. This is important because the elderly tend to consume less food (3).

This conference emphasizes factors underlying nutrient needs for the elderly. The present workshop provides a wide range of topics relevant to nutrition and aging and to old age. It includes the sociology of aging, an extensive account of
physiological changes as aging progresses, specific nutrient needs of the elderly, the relevance of some age-related diseases, and finally practical aspects of the nutritional state of the elderly. In addition to this workshop, recent books (e.g., 4,5) on nutrition of the elderly provide further information.

AGE-RELATED BODILY CHANGES

Throughout adult life, there are continuous changes in body composition, in tissue function, and in metabolism. Thus, lean body mass is progressively reduced as age advances, whereas fat accumulates (6). The loss of lean body mass is most extensive from skeletal muscle, as demonstrated by the large reduction in urinary output of muscle-derived creatinine and 3-methylhistidine by the elderly (7). Along with the changes in body composition goes reduced muscle function, as illustrated by decreasing muscle strength, which can be demonstrated by measuring hand grip of men and women of various ages (8). Shock has assembled the effects of aging on the function of various organs by plotting their residual capacity at different ages (8). As measured on men aged 80 years compared with those of 30 years, loss of function was found to vary from 50% reduction of renal blood flow to only 15% for nerve conduction. Little of this has been attributed to the diet of humans. The most dramatic effect of diet on aging is, however, provided by the numerous studies on rats subjected to partial food restriction, which results in longer survival of these animals accompanied by delayed loss of tissue function (9).

CHRONIC DISEASES IN RELATION TO NUTRITION

Much literature has appeared in which components of the diet can be linked to the appearance of specific diseases in middle and later life. Several reports have emerged, the most recent being the Diet and Health Report of the National Academy of Sciences (10) and the Surgeon General’s Report (11). Both of these summarize cautiously the evidence relating long-term patterns of dietary intake to the frequency of chronic diseases in later adult life. Some major chronic diseases are probably influenced by long-term intake of fat, calcium, sodium, vitamin A, or fiber; the diseases involved are atherosclerosis, coronary heart disease, hypertension, osteoporosis, diseases of immune function, and so forth. These relationships will be evaluated in this workshop.

There is still debate about the ideal body weight for adults of various ages. In a recent commentary, Willett et al. (12) challenged the proposal of the Dietary Guidelines for Americans, which suggests that adults over 35 years of age can substantially raise the body weight recommended for longest survival. Instead, Willett et al. produced arguments that ideal body weight does not change during adult life.
NUTRIENT NEEDS AND INTAKES OF ELDERLY PEOPLE

Our knowledge of the nutrient requirements of elderly people remains inadequately documented. The National Academy of Sciences' Recommended Dietary Allowances (13) provide for only three age-related categories for adults, namely, 19 to 24 years, 25 to 50 years, and 51+ years. The latter represents the age range from 51 years up to and beyond 100 years. Better knowledge of the effects of aging on nutritional status over this wide range is restricted by the lack of available data such as the limitation of the HANES surveys of representative US populations to persons not exceeding 74 years of age. In contrast, we need to be able to establish the dietary allowances for a 90-year-old man in a nursing home consuming 1250 kcal per day, compared with a middle-aged man eating 2500 kcal per day and presumably consuming twice the protein, vitamin, and mineral intakes of the 90-year-old man. Does this large reduction in nutrient intake result in impaired function and survival? If the elderly are considered to require the same minimum amounts as do younger adults, then the voluntary low intakes of old people may risk deficiency. Detailed analysis of the literature on the nutrient needs of the elderly is provided by this workshop and is also documented elsewhere (4).

Regarding the frequency of inadequate intakes by the elderly and the occurrence of clinically diagnosable evidence of deficiency, the literature has to be approached with caution. For example, the blood levels of selected vitamins can be compared in free-living and in nursing home elderly in two locations, namely, Northern Ireland (14) and New Jersey (15). In Northern Ireland (Table 1), subnormal thiamin levels were just as infrequent in nursing home elderly as in free-living elderly, whereas in New Jersey there were many more subnormal thiamin values in the blood of the free-living population. In the case of vitamin B₆, subnormal levels were much more frequent among the nursing-home elderly in both locations, whereas subnormal blood values for vitamin C were more frequent in the nursing home elderly of Northern Ireland but were much fewer in the nursing home population than in the free-living elderly in New Jersey. These distributions probably reflect differences in the pattern of vitamin intakes at the two locations. More important is the need for evidence of

<table>
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<th>Population</th>
<th>Thiamin</th>
<th>Vitamin B₆</th>
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<tr>
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<td>Nursing home</td>
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TABLE 1. Percentage of subnormal values for three vitamins in the blood of elderly subjects in Northern Ireland (14) and in New Jersey (15) who were either free-living or in nursing homes.
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clinical deficiency in elderly people associated with such subnormal values and, finally, whether these levels impair bodily function and survival.

In this context, it is worth comparing two studies of the nutritional status of elderly adults. One was made on a group of British elderly people who were representative of the British population and included elderly people with chronic wasting diseases (16). The other was a Boston population of elderly people who had been purged of subjects suffering from debilitating diseases (17). The British survey evaluated 365 men and women 70 years and older and included measures of nutrient intake, biochemical tests of deficiency, and clinical evaluation. The survey identified malnutrition in 26 subjects. For subjects not yet 80 years old, the frequencies were less (6% men, 5% women) than for those 80 years and older (12% men, 8% women). Protein-energy malnutrition was the most common deficiency. All but 1 of the 26 malnourished subjects had long-term debilitating conditions such as chronic bronchitis, emphysema, mental depression, and so forth. These subjects showed a smaller intake of nutrients than the other elderly persons who had no evidence of malnutrition. The Boston study (17) excluded those elderly people having diseases associated with wasting and was rewarded by the absence of overt malnutrition in the remaining subjects.

FACTORS AFFECTING NUTRITIONAL STATUS OF THE ELDERLY

In view of the above demonstration of severe malnutrition secondary to certain diseases, there are other factors listed by Exton-Smith (18) that tend to put the elderly at risk of malnutrition. First, the environment may provide adverse nutritional conditions. These include poverty, which may restrict food choices. This also occurs in cases of house-bound elderly people. Loss of interest in food can occur and this is sometimes reversed by communal eating. Ignorance of the basic principles of adequate nutrition can lead to unbalanced nutrient intake, especially in the case of widowed men who have never cooked a meal.

Second, malnutrition can be secondary to pathological factors. In addition to the conditions identified in the British survey described above, malnutrition can also be associated with gastrointestinal features of aging such as achlorhydria, malabsorption following gastrectomy, as well as inefficient mastication from ill-fitting dentures and the use of certain drugs interacting with utilization of specific nutrients.

In conclusion, it must be recognized that the nutritional status of the elderly is subject to more adverse environmental factors than occur in the case of the young. More study is needed of the interaction of nutrients with the preservation of function in the elderly, and procedures for screening the elderly for malnutrition (19) should be extended (5).

REFERENCES

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