Nutrition and Old Age: A Review

RICHARD C. THEUER
Department of Nutritional Research, Mead Johnson Research Center, Evansville, Indiana 47721

Abstract

Elderly persons in the U.S. constitute a growing population segment particularly vulnerable to nutritional problems. These problems can result from decreased intake of nutrients, altered requirements for nutrients, or impaired absorption of nutrients. The literature dealing with the adequacy of the diets of elderly persons in this country and abroad is reviewed in order to pinpoint specific problem areas. The protein requirement of the elderly may be less or more than that of younger adults, depending upon the functional competency of the kidneys as well as other factors. Less efficient absorption in the elderly can result in delayed fat and carbohydrate absorption. Vitamin deficiency has been detected in the elderly. Many elderly persons consume less than the recommended dietary allowances of several vitamins, especially ascorbic acid, thiamin, and folie acid. The deleterious effect of prolonged cooking upon these vitamins may contribute to vitamin inadequacy. The elderly, especially elderly women, have a very high incidence of osteoporosis, possibly due to long-term dietary inadequacy of calcium and vitamin D. The elderly frequently have an aversion to milk, major dietary sources of calcium and vitamin D, because of lactose intolerance.

Introduction

Nutrition in old age is a serious public health problem. An idea of the importance of this problem is given by the amount of attention devoted to the nutritional needs of the elderly at the White House Conference on Food, Nutrition and Health in December, 1969 (73) and by the increasing number of elderly in the U.S. population (46). From 1940 to 1960 the U.S. population increased about 36% (49). In the same period the population 65 years and older increased 84%, from 9 to almost 17 million, whereas the number of people 75 years and over increased 115%, from 2.6 to 5.6 million.

The purpose of this report is to sketch the nutritional dimensions of this problem, by reviewing the dietary adequacy of elderly persons in the United States.

Protein

The protein allowance recommended by the Food and Nutrition Board of the National Academy of Sciences/National Research Council (50) is 65 g per day. Average protein intakes exceeded or were approximately equivalent to 65 g per day in two groups of elderly American men, one of upper-middle socioeconomic class (40) and one of upper-lower class (22).

Actually, the protein requirement for aged men has not been satisfactorily determined (72). Both high and low protein intakes have been advised for the elderly. Renal function declines with age (19). That excess protein is catabolized to urea, which must be excreted through the kidney, argues against an increased protein intake in old age. Healthy elderly men can adjust almost as well as middle-aged or younger men to differences in protein intake (18, 71). The aged do not differ from younger persons in the rate and extent of protein digestion and absorption (15), but the rate of protein synthesis appears to be slowed somewhat in the aged (64).

The elderly may need more of certain essential amino acids than younger adults do. In one study, elderly men fed purified amino acid diets required twice as much as young men of the essential amino acids methionine and lysine to maintain nitrogen equilibrium (68). However, the question has been raised whether the reported increase in the requirement for methionine is real or whether it is due to decreased efficiency of conversion of methionine to cystine (72).

Fat

Fat is a major nutrient in the American diet, accounting for about 40% of calories in the dietary (50). There has been much recent work and speculation regarding the relation between the kind of dietary fat and the problem of atherosclerosis, but this facet of fat nutrition is not directly germane to the present nutritional status of an elderly individual. Of more
immediate significance to his overall nutrition is his ability to absorb dietary fat. Results of studies of fat absorption in the aged are at best equivocal. The absorption of fat is delayed in the elderly (8). This may result from decreased production of pancreatic lipase (8) or from some modification of the absorptive process in the intestinal mucosa (16). It has been suggested that impairment in fat absorption in an elderly person is indicative of a prior abnormality in lipid metabolism rather than an effect of old age itself (9).

**Carbohydrate**

Carbohydrate provides about 45% of the calories in the American diet. Carbohydrate nutrition and metabolism are affected by old age. Carbohydrate absorption is reduced in the elderly because of decreased efficiency of the mucosal transport systems, reduced numbers of absorbing cells, and decreased blood flow to the intestine resulting from atherosclerosis (27).

Diabetes increases with age. In the United States, the median age for male diabetics is 60 and for female diabetics it is 62 (6). The proportion of known diabetics increases sharply with age, from an estimated 1 in 900 under age 25 to at least 1 in 20 over age 65. The frequency rate for cases of undiagnosed diabetics has been estimated at about 2 undiagnosed cases for every 3 known cases (69). On this basis perhaps 10% of those over 65 are diabetic.

Following a glucose challenge, 20% of those aged 65 to 74 and 23% of those aged 75 to 79 showed sugar in the urine (28). There is some concern whether this high incidence of abnormal glucose tolerance in apparently normal people over 70 years of age makes this diagnostic criterion for diabetes an invalid procedure (28).

Lactose intolerance due to lactase deficiency is being recognized as a very prevalent disorder. Based on their survey of the literature, Bayless and Christopher (7) indicate lactose intolerance was present in 10 to 20% of American white adults, 70 to 80% of American Negro adults, and 95% of American Oriental adults. Excessive milk ingestion by lactose intolerant subjects can cause abdominal bloating, cramps, or diarrhea.

**Ascorbic Acid**

The recommended daily allowance for ascorbic acid for adult man 18 or older is 60 mg (50). However, the elderly may need more ascorbic acid than this. To restore blood levels of ascorbic acid to normal in the elderly, mas-
insomnia. For instance, a greater frequency of cardiovascular complaints was noted in relatively older persons who consume relatively small quantities of thiamin (14). Thiamin also can be destroyed by prolonged cooking (45).

Most dietary surveys of the elderly indicate that the riboflavin intake of the elderly usually is below the recommended daily dietary allowance of 1.7 mg. The riboflavin intake of elderly men in public housing in Syracuse, New York, was about 1.3 mg per day (22). Ten elderly men in a community home for the aged in the same city were consuming an average of 1.6 mg daily. None of these men had abnormally low urinary riboflavin excretion (12).

**Folic Acid**

Folic acid is a vitamin in which much interest has been shown of late. Herbert (32) believes that folic acid deficiency may be the commonest vitamin deficiency in man. In this country and in Britain, the two groups in the population most vulnerable to folic acid deficiency are pregnant women and the elderly.

Read and associates (56) found low folic acid levels in 80% of the old people awaiting admission to a British welfare home; there were no cases of anemia due to this deficiency, however. Similar results have been reported in this country (38). Another group of workers (33) found low serum folate levels in more than one-third of elderly patients admitted to a London hospital. Sixty-seven per cent of those unable to care for themselves because of mental disorder were folate-deficient. In another study, a statistically significant correlation between organic brain disease and low serum folate levels was revealed (5). Since folate deficiency is so common in psychiatric patients, it has been suggested that deficiency of folic acid may be the cause of mental disturbance rather than the result of it (57). Two cases of severe dementia due to folate deficiency have been described (66). Both patients had low serum folate levels and, in each case, treatment with folic acid led to a complete resolution of the dementing process.

The usual major symptom of folic acid deficiency is megaloblastic anemia. However, nutritional megaloblastic anemia is relatively uncommon in the elderly, although the body reserves of folic acid are probably low in a large number of elderly people (25). This is especially true of those whose intake of food is impaired due to apathy, depression, and other physical and mental disabilities. Cooking can destroy folate (31). In addition, a low intake of ascorbic acid is known to hasten folic acid deficiency in infants (44). As indicated, many of the elderly have low ascorbic acid intakes.

**Vitamin B12**

The healthy elderly appear to have adequate vitamin B12 stores (67). However, serum vitamin B12 levels may be abnormally low among the elderly ill. In a study of 100 patients 70 years or older admitted to an acute medical ward in Scotland, a low serum vitamin B12 level was found in 26 (21). A high incidence of psychiatric abnormality was found in this group. Vitamin B12 and folic acid are alike, then, in that low serum levels of both of these vitamins have been associated with mental confusion and psychiatric abnormalities (35).

**Calcium**

Calcium, along with fluoride and vitamin D relates to the very prevalent disease of the elderly, osteoporosis. Osteoporosis is estimated to be present in 50% of the postmenopausal white women in this country (65).

Osteoporosis leads to a thinning and rarefaction of the skeleton and reduced bone density. Thinning of the skeleton makes the skeleton more prone to fracture. Diagnosis of osteoporosis is difficult since most radiological methods of determining bone density will not detect thinning of bone until 30 to 50% of the bone mineral is gone (62).

There is controversy whether osteoporosis is a disease in itself or a natural consequence of aging (51). It is agreed that osteoporosis can have many causes. Long-term inadequate intake of calcium has been hypothesized as a major cause (52). Hurxthal and Vose (34) estimated the lifetime daily calcium intake through interview in osteoporotics and age-matched controls. The mean estimated total calcium intake in osteoporotics was 21% lower. However, Garn et al. (26) have shown that a high calcium intake did not necessarily prevent bone loss in adult and elderly females. Moreover, calcium intakes well below recommended daily allowances were not associated with reduced bone density in their population of male and female adults 25 to 85 years of age.

Osteoporosis can be brought on by other means, including immobilization (43) and castration (61). Castration and sex hormones are implicated because of the findings that postmenopausal women frequently get osteoporosis and estrogen therapy seems to delay its onset (20). Osteoporosis can also follow gastrectomy (48).

The results of epidemiologic studies indicate that long-term intake of the essential nutrient
fluoride reduces the prevalence of osteoporosis (10, 39). Fluoride becomes part of the bone mineral, making a bigger, harder crystal from which calcium is less easily resorbed (54). Therapeutic amounts of fluoride have been administered to osteoporotic subjects with some benefit (55, 58, 59). Periodontal disease may also be a manifestation of osteoporosis (30). High intakes of calcium may reverse the alveolar bone loss and provide a firmer foundation for the teeth (53).

Milk as a Food for the Elderly

In light of the nutritional inadequacies of the elderly dietary as outlined, vitamin D milk may be characterized as a liquid food containing, along with a host of other nutrients, nutritionally significant amounts of protein, calcium, riboflavin, vitamin D, and lactose, relatively small amounts of thiamin and ascorbic acid, and an insignificant amount of iron. The liquid nature of milk should be stressed, since 50% of Americans 65 years and older have lost all of their teeth and only 75% of these edentulous persons have satisfactory dentures (37).

The significant amounts of calcium, vitamin D, and lactose in milk lead to considerations of the role of milk consumption in the development of osteoporosis. Osteoporosis in certain patients is ascribed to chronically inadequate dietary calcium intake (52). Since milk is the chief source of food calcium in the U.S. dietary, it can be postulated that osteoporosis is associated with low consumption of milk. This association was investigated by Birge et al. (11), who found that half of a group of 19 patients with osteoporosis had lactose intolerance. Enzyme assay confirmed that 11 of the subjects had lactase deficiency. These subjects gave a history of long-standing milk intolerance and showed malabsorption of lactose. Understandably, they drank very little milk and so had very low calcium intakes. The osteoporosis may have developed in part through long-term dietary calcium restriction, which was voluntarily instituted to avoid the symptoms of lactose intolerance brought on by drinking milk. Moreover, the consumption of milk by lactose-intolerant individuals can actually aggravate negative calcium balance (17). Fermented milk products, including yogurt, contain less lactose than milk and may be useful to lactose-intolerant subjects (3).

Fortified milk is a major dietary source of vitamin D. Vitamin D also may play a role in osteoporosis. Smith and Rizek (65) studied women over 45 years of age residing in Michigan and in Puerto Rico and found a lower incidence of osteoporosis in the Puerto Rican women. They postulated that increased exposure to sunlight in Puerto Rico, with the consequent production of vitamin D in the skin, may have been at least partially responsible for this difference.

Nutrition education programs aimed at increasing milk consumption by the elderly can be effective. In a study in Storrs, Connecticut, a visit by a nutritionist resulted in a 45% increase in milk consumption (41). Mailing literature, though less effective than personal visits, was considerably better than providing information through a television program.

General Considerations on Foods for the Elderly

Decisions on the packaging and labeling of foods for the elderly should be influenced by consideration of some of the chronic disabilities which affect this population group. The elderly have a high incidence of osteoarthritis (60) and of rheumatoid arthritis (24), which increases in prevalence and severity with age in both men and women. Women, who make up the bulk of the elderly (49), have the greater incidence of both of these conditions. More than one-third of men and one-half of women over 75 years have moderate and severe osteoarthritis involving the hands, whereas 14% of men and 23% of women over 75 years have rheumatoid arthritis. Even if healthy, the aged generally have less mobile joints than younger adults (4).

Foods intended for use by the elderly should be labeled clearly, since visual acuity declines with age, especially beyond the age of sixty. In a survey of residents of a home for the aged and indigent, it was found that only 53% in the 80 and over age group had 20/50 or better vision (70). A full 20% had less than 20/400 corrected visual acuity.

The great number of Americans 65 years of age and older and their vulnerability to significant nutritional problems make nutrition and old age an important public health consideration. The recent emphasis and public concern with hunger and malnutrition in America provide hope that concrete steps will soon be taken to help alleviate some of these problems.

References


