

HEALTH PROMOTION AND AGING  
NUTRITION

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"The trick is to live to be 100. Very few people die after that."

George Burns

Aging is inevitable. Health promotion, including good nutrition, can slow the rate of degeneration and foster the independence and well-being of older individuals. For years, health promotion activities targeted only younger adults. Health professionals and adults over 65 simply accepted the high rate of chronic disease and the concomitant physical and mental impairments. Health-promoting dietary recommendations were generally viewed as useless. However, a preponderance of evidence now suggests many potential benefits of good nutrition for older persons:

- 1) Life expectancy after age 65 has increased in part because of an abundant food supply, which has eliminated most nutritional deficiencies (1).
- 2) Reducing body weight and excess intakes of sodium, sugars, fats, and cholesterol can lower the risk of developing hypertension, diabetes, and heart disease for many individuals and improve the management of these diseases for older as well as younger individuals (2).
- 3) Nutritious diets that protect physical and mental health help older people to work longer and lead independent lives (1).
- 4) Maintaining a reasonable weight, exercising regularly, and selecting a proper diet may retard the aging process and delay certain debilitating conditions common in old age (i.e., osteoporosis, hypertension, dementia, and diabetes) (3).
- 5) Preventing malnutrition can reduce the need for recurrent hospitalizations and prevent the occurrence of complicating conditions, thereby, lowering medical costs (3).
- 6) Selecting the best, most economical foods to meet nutritional needs and using appropriate nutrition programs can maximize limited financial resources and permit independent living for the older population.
- 7) Correcting poor diets for healthy older persons eliminates the need for and avoids the hazards of high doses of expensive dietary supplements (4).

To design appropriate nutrition strategies for those over 65, decision-makers need to 1) consider the heterogeneous characteristics of the elderly population, 2) differentiate age-related changes from effects of degenerative diseases, and 3) recognize the limitations of the current research base. This paper discusses these factors as well as other related areas -- problems in determining nutritional status and nutrient requirements of older persons, emerging research issues, and the effectiveness of current nutrition interventions. Several links between nutrition and other health promotion areas are identified. The issues identified in this paper, though not exhaustive, provide a starting point for developing the strategies that will address nutrition concerns in the rapidly growing, aging population in the U.S.

CHARACTERISTICS OF OLDER PERSONS

Older persons, generally defined as individuals over the age of 65, represent a very diverse group. The sex and racial composition of specific cohorts change as the subgroup ages beyond 80 years. The physical and mental capabilities of elders within and among older subgroups also vary widely; thus the potential benefits of nutrition therapies are not uniform. Attempting to foster independence and well-being in this heterogeneous population will require that policy makers and health care professionals examine the distinct characteristics of two to three age strata over 65 before developing broad interventions or formulating policies.

The variations in physiological, physical, and mental functions are greater among older persons than among any younger cohort. This heterogeneity reflects, in part, the diversity in lifestyles, economic and social conditions, food supply, culture, education, and exposure to other environmental factors experienced during their growing and maturing years. Genetics, of course, also plays a major role in the rate of functional loss in various organs and one's susceptibility to chronic diseases (such as cancer, coronary heart disease, diabetes, and osteoporosis). A later section describes more fully the differences in age-related functional changes and occurrence of chronic diseases.

### Psychosocial and economic determinants

Many psychosocial factors affect the food habits and nutritional status of the old. Depression, loss of self-esteem, loss of spouse, inability to live independently, and loss of a sense of purpose and motivation adversely affect nutritional status by decreasing appetite and interest in eating and food preparation (5). Place of residence and economic status can determine access to food sources and health care services.

In 1985, the majority of those over 65 were white, non-institutionalized women, either living in a family setting (67%) or living alone (30%). Few (5%) lived in nursing homes, and most of these were over 85. After age 80 to 85, males and blacks are more likely to survive. Although many older persons maintain households, many need help with personal care and food purchasing and preparation. Older persons tend to reside more frequently in central cities, small towns, and rural areas where access to social and health services, nutrition programs, and food stores may be limited. Because older residents in urban and rural areas are often less educated and poorer than suburban residents, their risk of nutritional problems increases (6). The dietary patterns of these rural residents include large amounts of salty snacks, heavy sweets-sugar desserts, and high fat meat (7).

Older persons are more likely than younger adults to be poor or live on fixed incomes. Federal programs (Medicare, Medicaid, Social Security) have slowed the onset of poverty for some, but more than two out of every five of those over 65 are poor or economically vulnerable (8). Those over 85, nonwhites, women, and persons living alone experience the highest rates of poverty (8, 9, 10). As inflation increases, those living on fixed or low incomes find that a larger portion of their income is spent for food. The recent low inflation rate has partly eased this burden. Participation in the food stamp program, the nutrition program for seniors, and the commodity supplemental food program has also improved older persons access to food; but these safety-net programs provide protection for only a small proportion of poor older persons (8).

The cultural and social influences on food habits are also important to consider in planning nutrition strategies (10, 11, 12, 13). Davis and Randall (14) described trends in family structures and gender roles, in social integration, in employment opportunities, in education and in economic stability that affected the food habits and food choices of three subgroups of the population who would be over 65 by the year 2000. For example, individuals born between 1910-1930 experienced food shortages: often lived close to their food supply; and were less educated. They may require different food offerings and educational tools than persons born between 1940-1950. Nutritional problems of the older cohort who ate more complex carbohydrates and less fat may differ from the younger cohort who were exposed to more processed foods with more fats and simple sugars. A lower fertility rate among those born in 1910-30 could limit family support as they age compared to those born ten to twenty years later.

### Nutritional status

The nutritional status of the older persons often reflects lifetime nutrient intakes and food behaviors, as well as age-related conditions and socioeconomic determinants. Experience with chronic degenerative diseases and conditions, drug regimens, drug and diet interactions, and functional status also influences health. To interpret the nutrition data from surveys, caution should be taken not to confuse cross-sectional data showing secular trends in dietary patterns with longitudinal data showing within person changes over time (15, 16, 17).

The most recent survey data from NHANES II showed older adults selecting most frequently the following foods from each specific group: whole and low fat milk and cheese (milk group), grapefruits and melon (fruit group), potatoes and tomatoes (vegetables), bread, biscuits, and muffins (breads and cereals group), and ground beef (meat group) (18). The 1977-78 National Food Consumption Survey data showed that one-third of older adults used whole grain breads and that older persons were the highest users of eggs, skim milk, vegetables, fruits, soups and lowest users of soft drinks (19).

National survey data (20) also show that estimated food energy intakes decline with age; the lowest mean intakes are for those 75 years and over (about 1850 kcal for males and 1400 kcal for females). Adults generally gain weight until age 50; then, relative weights decline. The variance for energy intakes of those over 65 years of age is great, due to the small numbers in this subset. Assessments of caloric intake adequacy require data on body size and physical activity.

For some older persons, having been obese and consuming inappropriate levels of sodium and perhaps, calcium, protein, and fat earlier in life may have raised their chances of developing hypertension, cardiovascular disease (CVD), diabetes, and cancer. Dietary cholesterol intakes for many over 65 (means are 461 mg for males, 316 mg for females) remain above recommended levels for lowering the risk of CVD.

Intakes of most nutrients except vitamin C and vitamin A also appear to decrease with age. Foods consumed by most older adults provided adequate levels of protein, preformed niacin, vitamin C, folate, and phosphorus. Intakes of calcium iron, vitamin A, thiamin, riboflavin, and potassium for most adults either approached or failed to meet the RDAs. In general, biochemical or clinical markers of deficiency were rarely found (<5% on average) in the older persons (21). Of concern are older women who have high rates of bone fractures and related lower intakes of calcium and vitamin D-rich milk products (22, 23).

#### Usage of dietary supplements, drugs, and alcohol

An appropriate assessment of nutritional status cannot overlook the population's use of dietary supplements, drugs, and alcohol. In turn, additional data on the nutritional status and requirements may stimulate promotion of more dietary supplement use by older persons. [The elderly as targets of health fraud are discussed later.]

Usage of supplements by older persons has increased from an estimated 1 percent in 1975 (24) to estimates of 40 percent nationwide in 1980 (25). Analysis of national survey results suggests that those who use supplements may not be the individuals most in need of them (4, 22, 26, 27). Approximately half of those who use supplemental vitamins take multivitamins, in particular vitamin C and E (22, 28, 29). Dietary supplementation does not appear to routinely improve nutritional status for older persons. It may even lead to nutrient imbalances, toxicities and/or interactions with drugs, especially if megadoses (10 times the RDAs) are taken (4, 22, 30).

Although older Americans constitute about 10 percent of the population, they use about 25 percent of all prescription drugs. This is not surprising since many chronic diseases are managed with prescription drugs. Over half of older people take at least one medication daily and many take six or more a day for multiple diseases. The drug-drug and drug-nutrient interactions may affect body composition, nutrient balance, or appetite, as discussed later (31).

Excessive alcohol intakes may also advance nutrient deficiencies (i.e., thiamin, niacin and other water soluble nutrients), may damage organs and tissues important to nutrient utilization, and may depress appetite and the desire and ability to eat. The result can be poor nutritional status. Older persons have a lower tolerance for alcohol which becomes more concentrated as body water declines with age. Approximately 30% percent of those 65 and over consume alcohol on a regular basis (at least one time/week). About 15% of this cohort are considered light drinkers, 11% moderate drinkers, and 6% heavy (32). If the older persons' drinking habits are reflective of the adult population, then the 5 percent of the population which drinks most heavily, accounts for about 50 percent of the total alcohol consumption. Since alcohol is a risk factor for diabetes, hypertension, cancer, and liver disease, moderation of intake is advisable at any age.

#### EFFECTS OF AGING AND CHRONIC DEGENERATIVE DISEASES

Normal aging changes body composition, physical performance, organ system function and condition in all individuals if they live long enough; however, changes occur at different rates in different people. Even within the same individual, degeneration of various tissues and organs occurs at different rates (33). There are some 60- or 70-year-olds with organ function tests equivalent to someone 30 or 40 years younger. Conversely, there are some younger individuals with physiological capacities in the range of an average elder (34).

#### Age-related changes

Physiological changes in many organ systems naturally accompany the aging process. Examples of various age-related conditions that can affect the nutritional status of older persons include sensory impairments, altered endocrine, gastrointestinal, and cardiovascular functions, and changes in the renal and musculo-skeletal systems (35).

During the aging process, changes in dentation and in the oral cavity (recession of gums and decreased salivary flow) can occur. These conditions are exacerbated by some medications. Dental caries, periodontal disease, and trauma have led to the loss of natural teeth in approximately 29% of those over 65 and 50% of individuals over 80. Being toothless or having ill-fitting dentures can reduce chewing ability and raise the risk of choking. Well-fitting dentures are essential for chewing high fiber, nutritionally-rich foods, such as raw fruits and vegetables, whole grain products, and nuts. The use of fluoridated water, fluoride treatments, regular dental care, and improved diet may decrease dental problems for the next generation of older persons. Less is known about prevention of periodontal disease, especially the potential role of nutrients (e.g., sucrose, fluoride, and calcium). [These issues will be considered in background papers prepared for other working groups.]

Decreased organ or tissue function can be accelerated by anorexia or nutrient imbalances or deficiencies related to chronic illness, use of therapeutic regimens, or lack of proper medical care. Many age-related conditions affect the older person's ability to ingest, absorb and utilize

essential nutrients, as well as obtain and prepare food. Additional age-related changes are discussed under emerging research issues.

#### Chronic disease-related changes

The prevalence of hypertension, diabetes, CVD, cancer, osteoporosis, and arthritis increases with age. Four out of five older persons have at least one chronic condition and many have multiple problems. Obesity, affecting approximately 28% of older persons, is also related to many chronic diseases. Many of these conditions require special diets, drugs, or other therapeutic regimens that could further compromise nutritional status.

Mortality and morbidity rates for diseases differ by gender and race. This may reflect genetic differences, lifestyle habits, or differences in access to health care. Therefore, when planning nutrition strategies, special diet-related problems should be considered by race and sex. Briefly, 1982-84 data (36, 37) show that reported rates of CVD, stroke, and cancer are higher for males than females, with the highest incidence among black males. Hypertension and arthritis rates are highest among females, especially blacks. The prevalence of diabetes is comparable for white males and females, but about 50% higher for black females than for white females (36, 38). This may be due to the high prevalence of obesity among older black females (37).

Osteoporosis, generally affects more women than men, measured by the higher proportion (four to one) of bone fractures in women than men, and more whites than blacks (36) and Mexican Americans (39). Higher bone density initially explains part of these differences; but the potential for obesity may explain the racial difference and should also be explored. Associated immobility handicaps an older person's ability to purchase and prepare food and thus limits food selections and independent living. Similarly, resorption of the residual alveolar ridge (bony ridge in which teeth are positioned) reduces the retention of dentures (40, 41) and may limit food selections.

#### MAJOR POLICY ISSUES

The previous descriptions of the socioeconomic factors, nutritional status, usage of drugs, alcohol and dietary supplements, and specific health problems, serve as background to the major policy issues. This section highlights the following areas to explore in developing nutrition policies for the aging:

- 1) Nutrition surveillance and monitoring
- 2) Emerging research issues
- 3) Nutrition services for older persons
- 4) Technology advances
- 5) Food assistance and nutrition programs
- 6) Nutrition education and information

This listing does not order the importance of these issues, but rather the logical progression from information gathering to dissemination. For the public, the value of research is best realized when people learn the consensus on the findings through the mass media or nutrition education programs.

#### Nutrition surveillance

Several national and state surveys have been conducted on, or include, the older population. These surveys are designed to determine the amounts and types of foods consumed, the nutrient content of intakes, the existence of clinical signs of nutritional problems, and the hematological or biochemical evidence of sub-clinical nutritional deficiencies. A limited number of cross-sectional population studies supplement these national data; however, there is almost as much variability between individuals within an age group as between group averages of age decade groups (42). The NIA Baltimore Longitudinal Study of Aging provides the only data to assess individual variations in intake, biochemical, anthropometric, and functional parameters.

Many surveys lack documentation of dietary supplement usage. There has also been minimal nutrition surveillance and monitoring among institutionalized elders (those in ambulatory care centers and long-term care facilities), homebound, or homeless older persons. Likewise, little is known about older persons in defined ethnic groups such as Asian Americans, native Americans, and, until recently, Hispanics. Nutritional data on subgroups of older persons, such as those over 80 years of age, in whom malnutrition may be more common, are also missing. It is often difficult to compare nutritional surveys which include or focus on older persons because of differences in dietary methodology and standards (43).

To date, the nutrition surveys of older persons in the U.S. have been very limited in scope, have frequently excluded the oldest old age groups, and have used varying standards of comparison in presenting the frequencies of nutrient deficiencies (33). In the NHANES I and NHANES II, adults ages 65-74 years comprised approximately 6-8% of the sample. The USDA Nationwide Food Consumption Surveys (NFCS) also collects data on the food intakes of individuals ages 65-74, representing

approximately 10% of the 1977-78 NFCS. No information on individuals older than 75 was gathered from either survey.

- Comparisons of independently-living and institutionalized older persons

The nutritional status of long-term institutionalized and independently living older persons needs to be compared. Older persons in institutions are usually subject to fixed meals which may not accommodate their individual food preferences, though they often adhere to specified dietary regimens. Often, individuals in these settings lose interest in foods and eat sparingly. A national survey of geriatric patients in institutions in the U.S. and of homebound individuals would be instructive. Major areas to research include (44):

1. Food-energy and nutrient needs of sedentary and bedridden patients;
2. The means to best carry out nutritional screening and assessment of geriatric patients in these facilities;
3. The interpretation of clinical, anthropometric, hematological, and biochemical indices of nutritional status in chronically sick older patients, with or without age-related conditions (i.e., skin disease, renal dysfunction, anemia, and muscle wasting);
4. The responsiveness of patients showing one or more indices of malnutrition to nutrient supplementation; and
5. Acceptable values for nutritional status indicators in nursing home patients.

- Methods of nutritional assessment

Dietary intakes documented later in life may not correlate with anthropometric, biochemical measurements, or clinical evaluations taken at the same time. Often these measurements more closely describe a myriad of historical experiences and long-term food intakes. Longitudinal studies provide information that begins to explain possible relationships of intakes to other measurements. To standardize the results of geriatric nutritional studies, a core set of assessment tools needs to be identified and then used routinely (as a minimum) for all studies or surveys.

Nutrient and energy intakes are determined using 24-hour recalls, food records, food frequencies and dietary histories. Interpretation of the histories requires standards. Appropriate standards for various age-subgroups of older persons do not exist. Comparisons are made to nutritional data from NHANES I and II and the 1977-78 NFCS despite limitations identified earlier. Reliability of information in these dietary histories has also been questioned. Memory, vision, and hearing may decline with age, making it more difficult to recall accurately foods previously eaten. Likewise, arthritis may impede record keeping.

Anthropometric measurements (e.g., height, weight, and skinfolds) are affected by aging. For example, height decreases over time due to changes in the integrity of the skeletal system. Measurements are often hard to obtain because of poor posture, or the inability of the older persons to stand erect unassisted. For these individuals, recumbent length, total arm length, knee height and arm span have been proposed as alternative methods to estimate stature (45, 46). More research on the reliability of these measurements is needed before they can be recommended as routine clinical practice.

Actual weight is less difficult to measure than height. For ambulatory people, a calibrated balance beam scale is used. For the non-ambulatory, wheel chair or bed balance beam scales are available. Before weighing, the patient's hydration state should be noted, as severe edema or dehydration can distort actual weight and anthropometric measurements (47). Skinfold measurements are also affected by the age-related decrease in lean body mass that results in a larger proportion of body weight as fat. Fat stores are also redistributed truncally. Changes in skin compressibility and elasticity hinder interpretation of skinfold measurements (33).

Biochemical parameters may be affected by an age-related decline in renal function, by shifts in fluid balance, by drug-drug or drug-nutrient interactions, by the long-term effects of chronic or coexisting disease, and by malnutrition. For example, low serum albumin levels often indicate poor nutritional status; however, kidney and liver disease, cancer, congestive heart failure, and other diseases (common among older persons) cause marked reductions in serum albumin (37). Ruling out these conditions must be done before low serum albumin concentration is associated with malnutrition alone. For accurate results, biochemical analysis should use several blood and void samples (48, 49, 50).

The most effective clinical methods of nutritional assessment are based on physical examinations and observation, and reflect long-term nutritional status. Clinical evaluations must be highly scrutinized because of the potential for human error, especially when large numbers are evaluated. For example, several age-related changes in clinical appearance--dry skin, sensory loss, and sparse hair -- may appear to be representative of one or more nutrient deficiencies (47). Other limitations in assessment methodology are discussed later.

### Emerging research issues

Nutrition and aging research focuses on two general areas: issues related to interaction of diet and aging functions (i.e., physiological, psychological, sociological) and dietary relationships with pathological conditions common to old age. More specifically, much of the current research is directed toward the following topics:

- 1) The effects of aging on nutrient digestion, absorption and utilization and the relationship between these effects and nutrient requirements.
- 2) The role of dietary restriction in modifying age-related physiological changes or the role of diet in treating conditions associated with changes in immune and endocrine functions and changes in body composition.
- 3) The influence or effects of neurological, environmental, and dietary factors on senile dementia or sensory deficits in older persons.
- 4) The influence of physiological, behavioral, and environmental factors (e.g., sensory function, dental status, culture, cognition, and economics) on the quality and quantity of food eaten by older individuals, and on the relationship between various patterns of dietary intake and nutritional and health status.
- 5) The nutritional changes including changes in food intake which accompany chronic diseases common in the older person.
- 6) The role of nutrition and nutritional status during adult years in the etiology and pathogenesis of diseases and problems of older persons.
- 7) The effect of therapeutic regimens (i.e., drugs, surgery) on nutritional status and the effects of nutritional status on the efficacy of therapeutic agents.
- 8) The association between nutritional status and morbidity and mortality -- examining patterns of dietary intake and mortality.
- 9) Valid methodologies for use in assessing nutritional status in older persons and in establishing age-appropriate norms.

Although recent estimates suggest that 20% of the population in the year 2010 will be over 60, and that one half of those will be at least 75 years of age, much of the research base on nutrition, aging, and health is quite immature. An increase in the understanding of these dynamic interrelationships can improve the quality of life of the aged, provide more effective health care, and lessen the impact of aging on the health of older persons.

A balance of animal experiments, epidemiologic research, and clinical trials is needed to study the nutritional status and requirements of geriatrics. To assess nutritional status ideally requires 1) determining daily consumption of energy and nutrients, 2) measuring tissue levels of nutrients, 3) clinical examinations including anthropometric measurements, and 4) evaluating physical and mental function. Current assessments of older persons are handicapped by a lack of appropriate age-related biomarkers and valid standards for intake and biochemical and anthropometric values to which survey results can be compared. The related limitation in methodology and gaps in research knowledge were discussed under the nutrition surveillance section.

Many of the gaps in our knowledge about nutrition and aging are being investigated by NIA-supported researchers and by researchers at the NIA, the USDA Human Nutrition Research Center on Aging, and other government and private research centers around the country.

#### • Effects of aging on dietary intakes and eating patterns

The need for research on socioeconomic influences on eating behaviors of older persons and the biopsychosocial antecedents of age-related changes in eating habits will be discussed in this section. There is a need to clearly differentiate generational patterns in selection and eating of foods from changes in eating habits which are age-specific. Since previous educational, social, economic, and cultural experiences vary widely among various cohorts of individuals over age 65 years, these influences on food use and preparation patterns need to be separated from late life modifications in eating habits that result from age-related physical changes, chronic diseases, and lifestyle changes (51). Little is known about the diets and nutritional status of individuals 75 years of age and older, who are part of the most rapidly growing and frailest segment of the U.S. population.

Future research also needs to address the differences in dietary patterns associated with various stages in the late life cycle and with the variety of settings within which older persons live (i.e., alone, with family, or institutionalized). In addition, the effects of interventions, social or nutritional, at these various stages and in these settings need to be evaluated (51).

Among the socioeconomic factors, the type and level of income are particularly important. Poverty, for example, can restrict the amount and frequency of food purchases and also influence housing, cooking facilities, and overall health (3). Eating patterns and food choices are also determined by family structure, social situations, emotional status, cultural and religious beliefs, and living arrangements. Therefore, retirement, children leaving home, divorce or death of spouse, a

move to an institution, a new community, or a residence with limited cooking facilities, or entering or re-entering the labor force later in life can introduce changes in the food purchases, food preparation methods, and eating environment. These changes, along with social isolation and psychological problems, may cause anorexia or disinterest in food. Boredom can lead to over eating or snacking. Lewin's (52) social network analyses and Giff's (53) examination of nutrition, behavior, and change provide approaches to determine what social interactions change with age and how these changes effect nutritional status. Research that has identified food- and nutrition-related attitudes and knowledge of older persons will be discussed in the last section.

Age-related sensory impairments and prescriptions for special diets further affect food choices. Loss of vision may restrict ability to prepare food or obtain food. Loss of hearing may constrain socializing at mealtime or may make it difficult to get information on menu items or food products. Loss of smell and taste acuity may directly affect appetite and decrease the desire to eat (54, 55). Professionally prescribed diets such as low sodium, low fat, and low sugar may further depress appetite and increase anorexia. Future research should investigate the effect of special diets on food intakes and new ways to formulate appetizing foods lower in specific nutrients, yet acceptable to the target population. Answers to these questions will certainly require cooperation among gerontologists, physiologists, and food scientists.

#### • Aging, and energy and nutrient requirements

The nutritional requirements of those over 65 are difficult to determine and are largely unknown. Undetected disease and use of dietary supplements or medication complicate the task of defining population samples that are representative of various strata of older persons. In addition, there are few controlled metabolic studies in humans related to micronutrient metabolism in aging (21). An examination of long-term diets of very old people who have remained healthy until an advanced age may shed light on nutrient needs of older persons.

At present, most nutrient requirements are generally age invariant. However, RDAs for all persons over 51 are extrapolated from data collected mainly on males ages 20 to 30 years of age (48, 56). Current research on the vitamin nutriture of older persons may provide data to modify the current recommendations, especially as the relationships between specific nutrients and chronic diseases unfold or if newer RDAs optimize health and tissue function.

Energy needs decline with age because of decrease in metabolism related to a decrease in physical activity and loss of lean body mass. Since energy needs decline while nutrient needs remain stable or perhaps increase, recommending nutrient levels in terms of weight of the nutrient per 1000 kcal or per unit of lean body mass may be particularly useful for those over age 65 years. Conversely, energy intake restriction and exercise affect aging. This topic will be addressed later.

Protein synthesis appears to decline with age (44, 57), as does the synthesis of muscle tissues, organ tissue, and other protein moieties (e.g., collagen, immune system components, and enzymes) (33). Declining protein intakes do not appear to affect deleteriously older populations who have no evidence of wasting diseases (57). Nitrogen and dietary protein requirements may, however, be increased in response to physiological stress common in older persons (i.e., infections, fractures, surgery and burns) (56). Preventing protein deficiency with attendant hypoalbuminemia is most important in older persons when protein-bound drugs are taken (44). Patients with renal or hepatic disease may require protein restrictions. However, the quantity and type of protein best able to meet the needs of older people has not been ascertained, even for healthy populations.

Present evidence indicates that vitamin A and riboflavin absorption or tissue levels do not decline with age, despite intakes that are lower than the present RDA (17). Research on the role of carotenoids in cancer etiology may indicate advantages of increased intakes. Age does not appear to affect folate absorption and/or metabolism, except in individuals with atrophic gastritis (58). Individuals with hypo- and achlorhydria may compensate for the malabsorption through increased bacterial folate synthesis.

Some research suggests that the RDAs for vitamin D, B6, and B12 might be too low, at least for certain groups of older persons (21). Reduced vitamin D synthesis in the skin, lack of sun exposure, low intakes, and impaired 1- $\alpha$  hydroxylation depress vitamin D production in older persons (59). For now, increased sun exposure combined with low-dose supplementation (i.e., 10 ug/day) (21) or twice-per-year regimen of 2.5 mg vitamin D2 (60) are recommended for housebound older persons to maintain adequate serum vitamin D. Both human and animal research suggest age-related reductions in vitamin B6 absorption and metabolism (e.g. impaired pyridoxal phosphate formation or increased urinary excretion), but more conclusive data are needed to suggest changes in the RDA (21). Serum vitamin B12 levels appear to decline with increasing age, perhaps because of pernicious anemia and/or atrophic gastritis-related malabsorption (21). Negative health consequences of these changes have not been documented (61).

There is no consistent evidence for linking vitamin E, thiamin, or vitamin C requirements with age. The effect of increasing dietary vitamin E levels on tissue lipid peroxidation and platelet

vitamin E levels (and function) needs further exploration (21). Age-related changes in thiamin absorption vary depending on the assessment method used; however, it is well known that alcohol interferes with thiamin absorption and phosphorylation. Age-related declines in vitamin C levels in the blood, plasma, and leukocytes are reported in most studies; however, changes in tissue levels are less consistent (21). Smoking (62), medication (63), and environmental stress (64) combined with low intakes, can compromise vitamin C status, but the health consequences of these observations are not well-established (34).

Until improved methods for biochemical evaluations of vitamin K and niacin nutriture are available, it is difficult to determine changes in nutrient requirements for these vitamins. Incomplete food tables handicap studies on zinc, copper, chromium, and selenium status of the older persons. Fluid intake, especially water, declines in older persons along with a age-related loss of body water. Adequate water intake (e.g., 30 ml/kg of body weight) or approximately 1 ml of water for each calorie ingested (64) is reasonable and important to normal renal and bowel function (5, 65).

Several questions are important to consider in setting nutritional requirements for the aging (44):

1. Can we formulate dietary recommendations that mitigate against development of aging changes in body composition?
2. Since diseases such as osteoporosis, atherosclerosis, and cancer are in part age-related and appear to have long latency periods, can we offer guidelines for the diets of younger people which will protect them from the development of these diseases?
3. What criteria should we use to determine the nutrient needs of elders?
4. What are the specially formulated preventive health goals for the elderly? Should they change with successive age strata over 65 years?

• Effects of energy intake and expenditures on the aging process

Although some older persons seek the "fountain of youth" in dietary supplements, the answer to deceleration of the aging process may be found in caloric deprivation or increased energy expenditure. Energy intake restriction (ER) without essential nutrient deficiency has been the only intervention in animals that extends maximum lifespan in all species tested and across wide phylogenetic differences. Long-term national studies of persons on low calorie diets are often confounded by low levels of nutrients and/or poor personal health habits.

Walford et al. (66) described four phases that trace the history of ER in the study of aging. Initial work showed that ER slows the biological aging process and favorably affects the incidence and age of onset of malignancies, arthritis, renal disease, and osteoporosis in animals. Secondly, animal studies demonstrated that ER animals had slowed age-related changes (not necessarily disease related) in the immune system, liver enzymes, age pigments, behavioral and psychomotor patterns. The third phase is a search for mechanisms that suggest causality that might include altered gene expression, thymic hormone levels, protection against free radical injury, and DNA repair. Descriptions of the effect of ER on circulating levels of insulin, somatostatin, thyroxine, and other hormones are needed. Exploring energy restriction in humans is the next phase.

Increasing energy expenditure through exercise also appears to influence mortality and morbidity through a number of complex physiological mechanisms. The effects of inactivity mimic the effects of aging (67); almost 50% of the functional decline attributed to aging may in fact be related to inactivity (68). Combined with a calorie-appropriate diet, exercise maintains a reasonable body weight, lean body mass and good physical performance. This combination also helps to prevent or reduce fat cell hypertrophy, production of high density lipoproteins (HDLs), hypertension, osteoporosis and insulin resistance. [A separate background paper explores exercise in more detail.]

With the increasing interest in the effects of peroxidation processes on aging, intervention with various antioxidants, including vitamins A, C, and E and selenium has been tried in both animal and human trials but the results have been mixed or inconclusive. More research is needed in this area.

• Drug and nutrient/food interactions

The high use of drugs among the aging may further compromise their health. The average older person receives more than 13 prescriptions a year and may take as many as 6 drugs at a time. Cardiac drugs (e.g., diuretics) are most widely used by the aging population, followed by drugs to treat arthritis, psychic disorders, and respiratory and gastrointestinal conditions. Many of these diseases are diet-related, and the use of drugs may complement, supplement, or supplant diet therapy.

Long-term use of a variety of drugs (often at high doses) raises the risk of drug-nutrient interactions. Individuals with nutritionally inadequate intakes and impaired nutritional status are at the highest risk. Use of high-potency nutrient supplements may also affect drug efficacy.



Physicians need to explain carefully the potential side-effects when certain drugs and foods/supplements are taken together. For some older persons, altering the drug therapy may be more appropriate than recommending dietary changes or food restrictions. Periodic assessments can identify borderline nutritional status that require appropriate dietary recommendations, nutrient supplementation, or change in drug regimen.

Roe (44, 69) has detailed several areas of drug-nutrient interactions. These include 1) diet effects on drug disposition, 2) drug disposition in malnourished subjects, 3) drug induced malnutrition, and 4) drug-food and drug-nutrient incompatibilities. Key interactions relevant to the aging population are discussed below and more detail on drug use is provided in a separate background paper. More research is needed to explain these interactions and to determine their clinical significance in the aging population.

Foods components and nutrients can affect drug absorption and metabolism. Heavy metals, high fat intakes and, to a lesser extent, high protein foods delay gastric emptying and, thus, delay the passage of drugs into the small intestines. High protein diets may also accelerate hepatic drug metabolism. A fasting state may hasten drug absorption from an empty stomach.

Malnutrition also alters drug absorption, protein binding, drug metabolism and drug clearance. Protein-bound drugs such as warfarin and diazepam may be more toxic in patients with hypoalbuminemia. On the other hand, some drugs decrease absorption of nutrients or cause mineral depletion. Such drugs include laxatives, antacids, anti-inflammatories (e.g., aspirin), diuretics, antibiotics, analgesics (e.g., indomethacin), and hypocholesterolemic (e.g., cholestyramine). Appetite can be enhanced by tricyclic antidepressants, reserpine, antihistamines, and anabolic steroids, whereas amphetamines and related drugs depress the appetite. But the aging process can reverse these effects. Phenothiazine, a psychotropic agent, that usually increases food intake may decrease appetite in older persons whose rate of drug metabolism is slowed. Specific foods or alcoholic beverages can precipitate adverse reactions to drugs. Some reactions such as the tyramine reactions with monoamine oxidase inhibitors may be life-threatening, while others such as the reactions caused by disulfiram and hypoglycemic agents to alcohol are extremely unpleasant.

Guidelines for drug development are needed that include studies in the elderly and consideration of various drug and food/nutrient interactions. Initially, research must determine how much drug efficacy and safety might improve with proposed guidelines (70). The quality of such research depends in part on the reliability of nutritional status assessments conducted and nutritional standards applied. Education-information transfer about drug-nutrient interactions for the public and the caregivers also needs consideration (70).

#### • Diet and chronic degenerative conditions

The prevalence of chronic conditions, such as osteoporosis, gastrointestinal disorders, diabetes, cardiovascular disease, and central nervous system disorders, increases with age. Questions about the role of nutrition in delaying the onset or mitigating the consequences of these conditions are the focus of NIA-sponsored research and conferences. The following examples are illustrations of aging and nutrition research topics:

**Osteoporosis:** Osteoporosis is defined as an absolute decrease in the amount of bone, leading to fractures after minimal trauma. Although age-related bone loss is common, certain older persons are at higher risk of developing fractures than others. Riggs (71, 72) suggests that osteoporosis may be two distinct bonethinning syndromes: 1) a "postmenopausal" form (Type I), associated with estrogen deficiency and 2) a "senile" form (Type II), highly correlated with aging. Type I, occurring predominantly in females 15-20 years after menopause, thins trabecular bones (e.g., vertebral bodies, ultradistal radius (forearm), and mandibles) that lead to fractures and tooth loss. Type II, occurring mainly in persons of both sexes over 75 years, thins both the cortical bone and trabecular bones proportionately, leads to fractures of hip, femur, tibia, and pelvis.

Definitive etiologies for either the early deficit in trabecular bones in Type I or gradual thinning in Type II need to be determined. Pharmacokinetic studies using calcitonin and diphosphonates have begun to explain the cellular mechanisms of bone resorption. Other studies (73, 74) have suggested risk factors including insufficient bone density at maturity, low levels of endogenous estrogen and other hormones, prolonged immobility and weightlessness, long term use of corticosteroids, family history, impaired intestinal or renal function, and diet. Prevention of osteoporosis has become a public health concern and has brought the promotion of foods high in calcium (e.g., milk products), calcium fortified foods (e.g., cereals, breads, and soft drinks), high potency calcium supplements, and other nutrient supplements. NIH Consensus Conference (75) recommended calcium intakes at a level of 1000 to 1500 mg, estrogen therapy, and exercise for women.

Questions remain about 1) what levels of calcium intakes are most protective against age-related bone loss and do these levels vary with age or sex of individual, 2) do calcium requirements vary with the level and type of physical activity, 3) how does calcium intake/supplementation interact

with estrogen status, 4) do calcium, fluoride, and vitamin D metabolites protect bones independently or in conjunction with estrogen therapy, weight-bearing exercise, or other approaches, and 5) how do vitamin D, protein, phosphorus, and even alcohol affect calcium requirements. Lastly, designing precise methods for measurement of bone mass is critical for determining relationships between diet and bone loss for the population or assessing the risk of bone fractures in individuals so as to use prophylactic therapy most effectively (76).

Osteoarthritis (OA) also causes great pain, immobility, and loss of independence for many aging individuals. Although nutrient deficiencies or excesses have not been implicated in this disease, obesity has been found to be associated with OA of the knee and hip but not of the sacroiliac joint (77).

**Glycation in diabetes and cardiovascular disease:** Glycation or non-enzymatic glycosylation may well be involved in the etiology of a number of age-related diseases. Glycosylation describes the process whereby glucose, fructose, or galactose react with proteins or nucleic acids to form a Schiff base. The Schiff base undergoes further changes to form advanced glycosylation end (AGE) products. The excessive accumulation of AGE products in the tissues, especially in the arterial walls, accelerates progressive stiffening or rigidity of these tissues. This rigidity may be caused by the cross-linking of proteins (e.g., collagen) and increases with age.

Elevated glucose concentrations characteristic of diabetes promote advanced glycosylation, thus accelerating stiffness of the tissues. Such rigidity may lead to reduced elasticity in the cardiovascular system. As a result, cardiac function declines, renal blood flow decreases, and vital lung capacity and oxygen uptake also decline. Further studies on advanced glycation may elucidate the mechanisms involved in the formation of senile cataracts, aging peripheral nervous system, and etiology of atherosclerotic plaques.

**Hypochlorhydria:** New research initiatives are studying the effects of aging on gastric secretions and the subsequent impact on nutritional status of the older persons. Hypochlorhydria incidence increases with age and may affect up to one-third of those people over 60 years of age. Women are more often affected than men, but the current extent of the problem and those at highest risk for disease are not known. Future epidemiologic studies of hypochlorhydria must be based on a common standardized case definition in order to assess the impact of aging on the disease. The causes of hypochlorhydria and the commonly associated atrophic gastritis are also largely unknown, yet these disorders have far reaching implications for health maintenance in the older population.

The major clinical implications of hypochlorhydria are altered absorption of nutrients and drugs in the upper gastrointestinal tract, bacterial over growth resulting in infections and changes in the immune response, and the predisposition to other diseases and disorders. Defective absorption of calcium, iron, folate, and vitamin B12 and the related deficiency diseases are of particular concern in hypochlorhydric patients. Reduced production of hydrochloric acid may affect the development of gastric cancer.

**B-vitamins and central nervous system function:** Current knowledge of the extent of interactions of nutrition and neurology is limited. The effect of B vitamins and other nutritional factors on brain function, including dementia and motor control, is better established. Deficiencies of various nutrients, particularly vitamin B12, thiamin, niacin, and folate impair cognition. Rigorously controlled, double-blind, prospective trials may elucidate the cognitive effects of malnutrition, especially subclinical, or multiple deficiencies of B-vitamins. To date, much information in this field is based on animal studies that may have limited applicability to human conditions, or on clinical pathology complicated by advanced age, alcoholism, and disease.

In addition, analytical methods specific and sensitive enough to measure the levels and metabolism of B vitamins are only beginning to be developed. However, still more basic methodological research is needed before further refinement in study design can be attempted. For example, based on new evidence using updated technology, it appears that folic acid as a naturally occurring excitatory agent found in the brain may have a mechanistic relationship to neuropathological conditions such as epilepsy-related brain damage, lithium neurotoxicity, tardive dyskinesia, and neuronal degeneration associated with aging.

The study of nutrients' effect on brain function has not received widespread attention because it was commonly believed that the brain was well protected from fluctuating plasma levels of dietary nutrients by the blood-brain barrier (BBB). Now, it appears that food constituents affect the synthesis of brain neurotransmitter and thereby modify brain function (e.g., alertness or depression) and behaviors (e.g., sleep). Fernstrom (78) and Wurtman (79) have shown that the levels of serotonin, an appetite-controlling neurotransmitter, can be increased by a high-carbohydrate, protein-poor meal that elevates brain tryptophan, accelerating serotonin synthesis. They report similar regulation of brain acetylcholine by ingestion of choline-containing compounds and of brain dopamine by tyrosine-containing compounds. Besides macronutrients, levels of trace minerals in the brain affect formation of synapses, nerve impulses, and other brain activity in neurotransmitter systems (80). Since the blood-brain barrier serves as

the interface between brain metabolism and diet, understanding the BBB nutrient transport processes provide insights into the mechanisms by which diet may influence brain functions (81). Research in this area is still too young to attribute altered behavior solely to nutrient-induced changes in neurotransmitter levels. Improved study designs are needed that use standardized methods for measuring behavioral responses and that adequately evaluate the dietary components and nutritional status of subjects and controls (82).

Although clinical research has not associated the severe senile dementia in Alzheimer's disease with aluminum toxicity (83) or other nutritional imbalances, future research in this area may be promising. Appropriate biochemical testing of individuals suffering mental loss or other central nervous system dysfunction may be required for differential diagnosis of these problems.

Also of research interest is the effect of aging on the interaction of B vitamins with other nutrients in the brain and nervous system. For example, alcohol consumption which can cause Wernicke's encephalopathy compromises thiamin pyrophosphate-dependent enzymes and interferes with thiamin absorption and phosphorylation. The drug, Dilantin, can increase folate requirements and Sinemet, used to treat Parkinsonism, can cause niacin deficiency.

#### Nutritional services in the health care of the older persons

About 85% of older persons have one or more chronic, potentially debilitating diseases and could benefit from nutrition services. Up to half of older individuals have clinically identifiable nutrition problems requiring professional intervention (3). If the goal of health promotion is to assure the older persons' health, independence, and quality of life, incorporation of nutritional services into the continuum of health care -- institution, ambulatory, and home-based care -- for older persons is paramount. Since older persons are more susceptible to foodborne poisoning than younger people, proper sanitation practices are needed in food preparation and service in all these health care settings.

##### o Nutritional Assessments

Nutritional services, whether therapeutic, rehabilitative, or maintenance services, include clinical, educational and foodservice components. As part of clinical services, nutritional assessments should become routine parts of physical examinations for all older residents of health care facilities, nursing homes, or community health centers (84). In turn, the findings of these assessments should guide medical orders including drug regimens, scheduling surgery, dietary guidance, and other nutritional therapy. (The limitations of assessments were discussed earlier.)

Complete diet histories provide information on eating habits that can identify nutrient inadequacies early. Since the food habits of the older persons reflect long-term patterns, special attention to the food preferences, cultural and religious beliefs, economic status, drug and supplement use, and lifestyles can enhance compliance with specific dietary regimens, while ensuring they obtain enough food and enough of the food they like.

For hospitalized or institutionalized patients, regular documentation of food intake may alert health professionals to potential nutrition problems (5). Anorexia, induced by drug or radiation therapies or resulting from surgery or chronic conditions, can quickly lead to nutrient deficiencies, especially in frail older persons. Nutritional therapies, either enteral or parenteral, formulated feedings, have minimized attendant medical complications (e.g., infection), improved therapeutic responses, and sped recovery in some patients. However, the prospective payment system of financing health care (discussed below) may be a disincentive to use of nutritional support in hospitals.

For the hospitalized or frail older persons who cannot eat, providing adequate nutrition support through tube or intravenous catheter can contribute to regaining health and independence. Enteral and parenteral feedings can sustain life for patients who are physically unable to swallow, digest, or absorb food and fluids taken by mouth and for patients who refuse to eat.

The efficacy of these therapies is not universal across all diseases. Little is known about the efficacy in older persons, partly because of the lack of information on the nutritional requirements and standards for the older persons. Nutritionists and other health care professionals will more frequently participate in debates about withholding and withdrawing nutritional support and hydration from terminally ill, comatose, and severely debilitated people. In addition, health care providers will be faced with questions about when and if to use these treatments with severely demented persons who cannot decide on the course of their therapy and may need to be physically restrained (85).

##### • Education and training for working with older persons

With the emergence of diverse health problems among the fast-growing numbers of older persons, the number of education and training programs on aging and geriatric nutrition have grown. NIA sets

as two high priorities: 1) training of clinicians and biomedical researchers to specialize in nutrition and aging issues and 2) development of centers of excellence in nutrition and aging research.

Professional societies (86), research centers (87) and programs for medical, nursing, and nutrition students (88, 89) have offered courses or seminars to address ethical concerns in nutrition for long-term care patients and to encourage positive attitudes toward the older persons. Although it may be necessary to train some health professionals to be geriatric specialists, the benefits of "main-streaming" older persons into generic health care services outweigh the hazards of stigmatizing and stereotyping their health problems (89). Appropriate funding for ambulatory and health care services for older persons may also change the perception of students that these jobs are often low paying.

- Impact of health care financing on nutritional care of older persons

As the population ages and individuals live longer, health care expenditure will increase. The major reason for this increase is that health care utilization is greatest among the older persons, especially the oldest old -- the segment of our population that is growing the fastest. To date (1984) major sources of financing the health care of older persons in the United States are: 1) medicare (49%), 2) out-of-Pocket (25%), 3) medicaid (13%), 4) insurance (7%), and 5) other government sources (6%). The federal government pays for about 68% of all health care expenditures (90).

Government expenditures are dispersed as follows: 39% to hospital costs, 20% to personal health and physician services expenditures, and 21% to nursing home and other expenditures. In 1983, due to escalating health care expenditures, Congress and the Administration proposed reform -- the prospective payment system (PPS) for Medicare reimbursement of hospitals.

Under the PPS, Medicare pays for each hospital admission, a rate predetermined on the basis of the patient's principal diagnosis and certain other factors. Each admission is assigned to one of 468 diagnosis related groups (DRGs) for payment. PPS is intended to discourage extended inpatient stays and encourage the substitution of less expensive care outside of the hospital (91). As a result of the PPS there has been a decline in the average length of stay for Medicare patients, and therefore an increased demand for postdischarge services. The prospective payment system provides a financial incentive for hospitals to cut costs below the reimbursable level and adjust inputs, such as tests, personnel time, and special procedures (92). Studies are determining the impact of PPS on the quality of care (92) and on access to in-hospital nutritional support services (93).

The impact of PPS on the nutritional status of post discharge patients also needs examining. Patients are discharged early in what appears to be poorer states of health and needing extensive care (94). Health providers are finding it harder to retain patients requiring long term nutritional support for a long enough time to monitor their status and train them before discharge. Since October 1983 greater numbers of these patients (40% increase in discharges) are being transferred to skilled-nursing homes or requiring home health care (95). Often these facilities do not have the proper equipment, supplies or trained personnel to deliver safe and appropriate tube or intravenous catheter feeding (5). Hospice programs and some home health care programs include nutritional services; however, the majority of alternative community-based services do not include nutritional services (3). The costs of nutrition services provided by hospice programs are absorbed under the organization's administrative overhead (3) because medicare and most third party payment services do not reimburse nutrition services directly.

Cost containment pressures are projected to shift more demand from the hospital to the community, especially to home care services traditionally provided through the nonprofit sector. The number of Medicare certified home health agencies increased from 2,212 in 1972 to 5,755 in 1985. The growth has primarily taken place in facility-based and for-profit home health agencies, while the number of more traditional nonprofit providers -- visiting nurse associations and government agencies -- has declined slightly (96). Questions arise as to how the communitycare nonprofit sector will cope with the increasing demands for delivering of highly technical in-home health care that drains resources from delivery of more traditional, community-decided, multi-services (e.g., transportation, food preparation assistance, primary health care) (97).

#### Technological advances and feeding the older persons

Changes in the physiology and organ systems of older persons challenge the food industry as it attempts to serve the growing market of elders. Creativity will be needed to formulate products that are flavorful, visually attractive, and have high nutrient densities. Products will need to supply high nutrient levels for their caloric value. Fortified products need to assure high bioavailability of the added nutrients. For several years, food manufacturers have been gradually lowering the salt, fat, and sugar content of food, while retaining good flavor in most products. Manufacturers have also addressed current nutrition research concerns by increasing the fiber, calcium, and vitamin D content of cereals and other foods. Special diet products that are low

protein, cholesterol-free, lactose-free, or very low in sodium are also available (35, 98). An earlier section also discussed the use of parenteral and enteral feedings.

Supermarkets and food stores are recognizing their responsibilities toward their aging clients. Some grocery stores are establishing specific shopping hours for senior citizens complete with bus service, bargain sales, and refreshments. Other ways to reduce barriers to food shopping include: 1) sales on small packages and at off peak-hour times, 2) educational materials written in larger print that suggest tips for meal planning, budgeting and food preparation for single-person households; 3) take-home product listings to use with telephone orders, 4) shelf-labels with large print, 5) uncluttered aisles, and 6) convenient benches and rest rooms (81).

#### Nutrition and food assistance programs

Over the past 20 years, both the public and private sector have initiated and reformed food assistance programs to respond to evidence that nutritional deficiencies were prevalent in older persons, especially those with low-income or who are socially isolated. A variety of services are now available to elders with a continuum of functional capacity (99). The Continuum of Community Nutrition Services model developed by Balsam (100) describes this variety.

Federal nutrition programs include the food stamp program, the commodity supplemental food program, the congregate feeding program, and the home-delivered meal program. Private charities have teamed with the public programs to expand food service to elders. Soup kitchens offer breakfasts and suppers and food pantries provide emergency food boxes. Luncheon clubs (101) have permitted seniors receiving home delivered meals to congregate in neighbors' homes. Restaurants have cut prices for older persons and accepted their food stamps. Food industries have designed packaging and processing techniques to provide shelf-stable meals for evening and weekend use. Volunteers offer escort services to supermarkets or deliver groceries to many home-bound persons (102).

Revisions to the USDA Food Stamp Program extended benefits to low income elders by eliminating the purchase requirement and increased their benefits by allowing for medical and shelter deductions (103). Nonetheless, many older persons still receive only minimal benefits (\$10/month) and their participation rates are low (<50% of eligible) (90). For low-income, often frail, elders, who were uninterested in receiving food stamps and had difficulty in shopping, Congress authorized delivery of low-cost commodity packages under the Commodity Supplemental Food Program.

The DHHS National Nutrition Program for Older Americans, as specified in Title III of the Older Americans Act, includes food service for both the ambulatory old (congregate feeding) and the home-bound old (home-delivered meals) (3). Evaluations (103, 104, 105, 106) of the congregate feeding program and the home-delivered meals (107) generally show that participants have higher intakes of essential nutrients than nonparticipants.

During recent hearing on program reauthorization, the American Dietetic Association (ADA) (108) raised concern that future program budgets must account not only for the annual inflation but also for the annual rate of increase in the older population. The flexibility in funding for Title III concerns many because it permits shifting funds from meal programs to supportive services. Currently, the congregate feeding program reaches only 10% of the eligible population. The need for home-delivered meals has increased significantly (35% to more than 50% increase in persons receiving meals) in the first year after the implementation of the new prospective payment system of health care financing (3). As dietary restrictions become more complex, especially for those in their late 70s or 80s, demand for special meals and nutrition information will increase, requiring additional program resources and qualified professionals.

To formulate policies for food assistance programs requires attention to:

- a. Planning and conducting systematic evaluations of food programs to assure they meet the changing needs (nutritional, social, educational, and economical) of the heterogeneous older population;
- b. Developing new approaches to reach underserved groups of elders, such as the homeless and socially impaired elderly, minority and ethnic elders, and to extend food service beyond weekday lunches;
- c. Setting and revising (as needed) nutritional guidelines for meals served in senior citizen feeding programs;
- d. Establishing a clearinghouse for exchanging information on innovative programs that meet identified community needs;
- e. Assuring that educated and trained nutrition professionals assist with planning and monitoring these programs at all levels of government.

### Nutrition education and information

The tools that promote good nutritional health for older persons are most probably the nutrition information gained from mass media or education programs. Because of the myriad of nutrition messages received, sorting out consistent truths from half-truths or conflicting information frustrates people at all ages. Educators need effective ways to minimize the confusion and also to translate current, relevant research into dietary advice applicable to elders. The great heterogeneity among older persons and the reality that life-long habits are resistant to change make designing nutrition messages a challenge for educators.

Key to appropriate, effective nutrition education for this group is understanding the complexities of aging, applying knowledge of the change process, and assessing cognitive, affective, and nutritional status changes (109). Effective nutrition education also requires knowing the perceptions older persons have toward eating and foods. Many older persons, relate food to social interactions and entertainment and also recognize food as a source of nutrients that is important to health (110). More research on factors that facilitate learning and making dietary changes can improve nutrition education efforts (111).

Applying communication theory (112) and marketing principles (113) to nutrition education enhances the chances that the consumer will act on the research-based dietary guidance. Such an approach allows the audience to identify what they want to know, how they want to receive information, where they want to learn, and how often they want follow-up. For example, older persons have sought a uniform set of dietary guidelines, appropriate for most chronic diseases. They have also posed questions about health fraud, use of vitamin and other dietary supplements, and drug and food interactions (114).

Though not tailored specifically for older persons, the DHHS/USDA Dietary Guidelines for Americans provide essential information for motivating dietary changes that promote health. Modifying the text slightly to be more relevant for older persons, printing copies with large lettering, and distributing them through Title III programs could permit wider use. The Healthy Older People program conducted by the Office of Disease Prevention and Health Promotion promotes good nutrition, proper exercise, and other health messages through the media and consumer education materials (115). Combatting health fraud is a priority of the FDA, the Federal Trade Commission (FTC), and Congress. The two agencies have launched an educational/media campaign against health fraud, and recently sought stronger court actions against false advertisements for dietary supplements (115). Since nutrition education has been found to be negatively correlated with misconceptions about "vitamin/mineral supplements" (116), informing older persons about the benefits and hazards of dietary supplements could result in more prudent use of these substances. Food labels also provide good sources of nutrition information; but without close monitoring of the health claims on labels, older persons could be deceived or adopt false expectations of the food.

Title III of the Older Americans Act is the only federal nutrition program for older people that reimburses nutrition education. Based on the recent National Association of Area Agencies on Aging and the Administration on Aging's survey results (117), nutrition education, though often a high priority for some program administrators, is not routinely incorporated into all programs. Three reasons most frequently cited for lack of nutrition education are inadequate funds, the absence of qualified nutrition educators, and the lack of specific program standards and guidelines for nutrition education (118).

Other nutrition policy considerations might include (119):

1. What central nutritional message do seniors want - changing the amount of food eaten, eating more nutritious foods, understanding drug and food interactions, or learning about and using community nutrition programs?
2. How can the messages delivered by the federal government be better coordinated, and how can the government messages be coordinated with those of the private sector?
3. What format, language, and style for educational materials are most useful and appealing to older persons?
4. What medium (e.g., groups, mass media) is most effective to use in reaching older persons as a group and the various subgroups over age 65?
5. What should be done to assure that qualified nutritionists assist with planning, coordinating, evaluating, and monitoring nutrition education programs at the federal, state, and local level?

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