

Nutritional Assessment and Intervention to Prevent and Treat Malnutrition for Fall Risk Reduction in Elderly Populations

Abstract: *The aging US population is increasing, and it is estimated that adults older than 65 years will make up 20% of the population by 2029 and the proportion of individuals in the United States older than 65 years will outnumber individuals younger than 18 years. In older adults, accidental falls are the leading cause of fatal and nonfatal injuries. Prevalence of chronic conditions such as sarcopenia and frailty contribute to the increased risk for fall observed in this population. Nutritional status in elderly individuals is a key predictor of both frailty and sarcopenia, thus ensuring adequacy in these populations has the potential for preventing falls. Poor nutritional status is associated with the onset of frailty. Nutrition screening, assessment and interventions can be targeted at this age group to overcome treat and prevent malnutrition to minimize fall risk.*

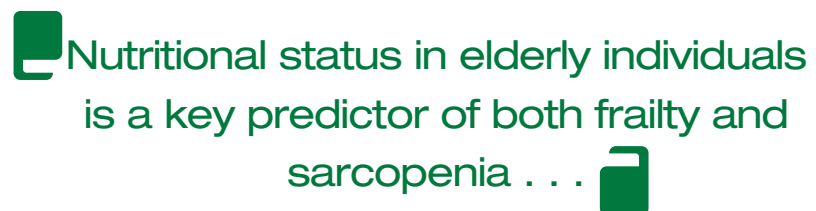
Keywords: nutrition, malnutrition, aging, frailty, elderly

The aging US population is increasing, and it is estimated that adults older than 65 years will make

up 20% of the population by 2029 and the proportion of individuals in the United States older than 65 years will outnumber individuals younger than 18 years.¹ In older adults, accidental falls are the leading cause of fatal and nonfatal injuries.² In 2015, accidental falls were the cause of approximately 3 million emergency room visits with 851 715 of those individuals sustaining injuries that resulted in hospitalization.³ Approximately 5% to 10% of falls result in major injury

fall.^{8,9} These cases can lead to secondary complications such as dehydration, rhabdomyolysis, pressure sores, and pneumonia.⁸ Accidental falls that result in even minor injury are associated with a heightened fear of falling which can lead to self-imposed limitations, loss of self-confidence, avoidance of activity, and diminished quality of life.^{7,10}

Many factors affect risk for fall, and these factors can be environmental hazards and individual susceptibilities.¹¹


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such as traumatic brain injury and hip fracture with mortality rates of 46% and 25%, respectively.^{4,6} These severe injuries contribute to significant declines in mobility and ability of individuals to perform activities of daily living.⁷ A larger proportion of falls, 30% to 50%, result in less severe injuries but among these, up to half of older adults are unable to get up and remain on the ground following a

The focus of this article is on individual susceptibilities in elderly populations. Prevalence of chronic conditions such as sarcopenia, frailty, polypharmacy, Parkinson's disease, dementia, arthritis, cognitive decline, and vision impairment in individuals older than 65 years contribute to the increased risk for fall observed in this population.¹⁰ Furthermore, the presence of these

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conditions can have a major impact on an individual's injury and long-term prognosis in recovering from accidental falls.¹⁰ For example, frailty is a multisystem disorder observed in elderly populations.¹² It includes significant declines in both mental and physical functioning and falls are especially dangerous in individuals suffering from frailty as they are at significantly greater risk of mortality.¹² Sarcopenia, the decline in skeletal muscle mass associated with aging, is a key contributor to frailty and is often associated with decreases in energy (calorie) intake, muscle fiber denervation, and oxidative stress.¹³

Nutritional status in elderly individuals is a key predictor of both frailty and sarcopenia, thus ensuring adequacy in these populations has the potential for preventing falls. Poor nutritional status is associated with the onset of frailty.¹⁴ Fallers are more often malnourished than nonfallers, one study finding that fallers are almost twice as likely to be malnourished (odds ratio 1.978; 95% confidence interval 1.340-2.920).¹⁵ Furthermore, elderly who are malnourished often experience a decline in health-related quality of life that can be exacerbated by an accidental fall.¹⁶ Aging individuals face unique social, biologic, medical and physiologic factors that play key and interrelated effects on nutritional status. Screening and early diagnosis of malnutrition and frailty in elderly people can help to prevent the onset of disability that contributes to fall risk. This article aims to outline nutritional issues unique to the elderly population that have the potential for contributing to the decline in nutritional status and subsequently increased risk for falls. Attention is focused on interventions to address these high-priority nutritional issues.

Etiology of Malnutrition in Elderly

Malnutrition in aging populations is a result of a combination of interdependent variables, including physiologic changes in satiety, altered

absorption, polypharmacy, dysguesia, dysphagia, poor dentures, and food access that yields inadequate intake of essential nutrients.¹⁷ While it is difficult to project how individuals will age and the rate at which these changes will become significant, factors such as genetics, physical activity, food insecurity, social circumstances, access to health services, and other environmental factors have the potential to contribute to the process and should be noted in assessment and intervention efforts.¹⁸⁻²⁰

Food Access

Food access insecurity in aging population can have detrimental effects on diet quality and can interfere with aging individuals achieving adequate dietary intake of vital nutrients and energy. The senior population accounted for approximately 9% of all food insecure homes across the United States.²¹ During times of limited resources, individuals may employ various strategies to ensure they obtain adequate food for example; attempt to restrict personal intake of food, overeat when food is available, consume primarily low-cost foods, or eat the same foods regularly, which may all contribute to an overall decline in essential nutrient intake.²² Chronic undernutrition and lower cognitive function are both associated with food insecurity and the condition may have serious consequences in vulnerable populations, such as the elderly, by exacerbating health conditions.^{23,24} In addition to financial barriers to achieving food security, issues in elderly can decrease access to food, such as transportation, physical limitations, and cognitive declines also contributed to decreased food access in elderly groups.²⁵ Interventions aimed at ensuring adequate intake in elderly individuals should first assess affordability, accessibility and an individual's ability to prepare their food.

Dentures

Declines in dentition and dental hygiene have the potential to contribute to malnutrition via inadequate intake. Oral factors such as tooth loss, ill-fitting

dentures, systemic diseases, and some types of medication can yield dental problems and declines in diet intake. Epidemiologic data have shown that poor dentition and the inability to chew directly decreases calorie/energy intake.²⁶ Age-related decreases in bone mineral density could lead to inadequate mandibular bone mass, loss of teeth, and an inability to wear dentures alongside declines in general function and mobility contribute to limited food choices and nutritional quality in this population.^{27,28}

Anorexia of Aging

Physiologic changes in aging can lead to a decrease in appetite and food intake, sometimes referred to anorexia of aging. Changes include decreased metabolic rate due to loss in lean muscle mass, decreased immunity, hearing loss, taste and reduced salivary function, possibly delayed gastric emptying, gastric acid secretion, pancreatic enzyme secretion, liver function changes, and small intestinal functioning (ie, mineral absorption). With little consensus on how to best diagnose this form of anorexia in elderly, determining the prevalence is difficult. Medication use and chronic illness are other factors that can cause anorexia and are associated with aging individuals; however, anorexia in elderly is unique in that it contributes to decreased food intake of protein-rich foods more often than other food types. This decreased intake of meat, eggs, and fish, all sources of high-quality protein, put elderly at greater risk for protein energy malnutrition and can exacerbate losses in lean muscle mass and strength, compounding the risk for fall.²⁹

Medication

The presence of multiple diseases confounded by age-related changes in pharmacokinetics and pharmacodynamics can have negative effects on the nutritional status in aging populations. Physical changes related to aging such as an increased ratio of adipose to lean muscle mass, decreased liver mass and blood flow, and impaired kidney function increases the risk for

food and drug interactions can affect nutritional status. The long-term use of multiple medications create greater nutritional risk in these older adults as drugs can have consequences on dietary intake as well as how the body absorbs, metabolizes, and excretes nutrients. Many medications have side effects that have detrimental effects on nutritional status including alterations to taste and smell, gastrointestinal effects like irritation, nausea, vomiting, diarrhea, or constipation, or appetite changes.³⁰

Nutrition Screening and Assessment

Adequate and timely nutrition screening is pivotal in identifying elderly individuals who are malnourished or at risk for malnutrition and may benefit from nutrition intervention and services.³⁰ Valid and reliable nutrition screening tools are available for the elderly population; these tools include questions on changes in diet intake, weight loss, mobility, and mental status.³¹ When concern over malnutrition arises, further assessment is warranted. A comprehensive nutrition assessment requires a Registered Dietitian Nutritionist (RDN) to obtain, verify, and interpret data related to the patient's food- and nutrition-related history, anthropometry, medical tests and procedures, nutrition-related physical examination, and history. This information is collected from screening or referral forms, patient interview, medical and health records, and/or caregivers of family members of the patient. Collectively, these data are used by the RDN to identify problems that can be solved through nutrition-based interventions. In elderly populations, special considerations are required when collecting and assessing nutrition-related data as there are limitations and specific methods required.

Anthropometric Assessment in Elderly

Malnutrition and frailty require anthropometric assessments, which include weight, height, mid-arm muscle

circumference, and triceps skin fold. For those elderly who are unable to stand or are bedridden, knee height can be used to estimate height; knee height is not affected by aging. Mid-arm muscle circumference and triceps skinfold can help assess muscle mass and wasting in elderly populations. Variation from usual weight is vital in determining risk for malnutrition and frailty. With inadequate energy intake and malnutrition body weight is expected to decrease. In assessing changes to patient weight hydration status as well as the risk for edema should be considered. Severity of weight loss is classified as mild, moderate, or severe depending on the percentage of total body weight loss and patient body mass index as listed in Table 1.^{30,32}

Biochemical Assessment

Laboratory or biochemical data are collected and monitored in a comprehensive nutrition assessment for elderly individuals at risk of malnutrition. Data can give clues on protein status (albumin, prealbumin, blood urea nitrogen), anemia (hemoglobin, hematocrit, serum ferritin, serum iron, serum folate, serum B₁₂), inflammation (C-reactive protein), hydration (blood urea nitrogen, electrolytes) and vitamin D status. Vitamin B₁₂ in the elderly is most often associated with inadequate absorption, with deficiencies contributing to anemic status. In particular, vitamin D

deficiencies are common in older adults and low levels of active vitamin D are associated with poor physical performance, strength, and falls in elderly.³³

Nutrition-Focused Physical Examination

During assessment, a nutrition-focused physical examination can provide supporting evidence of nutrient deficiencies, compromised nutritional status, as well as factors that could affect diet intake. For example, dull, dry hair, banding on nails, and bilateral edema are physical signs of potential protein-energy malnutrition. In addition, the RDN should have the older adult remove dentures, if present, to conduct an inspection of the oral cavity. This physical examination could yield signs of vitamin and mineral deficiencies or oral health problems that may prohibit diet intake. For example, elderly patients with riboflavin, iron, or zinc deficiencies may show signs of glossitis or inflammation of the tongue, which may prevent the patient from eating acid fruits or vegetables.³²

Dietary Assessment

Assessment of diet intake and adequacy should consider nutrition implications of other disease/conditions (ie, hypertension, coronary heart disease, congestive heart failure, chronic

Table 1.

Severity of Weight Loss Is Classified as Mild, Moderate, or Severe Depending on the Percentage of Total Body Weight Loss.^{30,32}

Time	% Weight Loss	
	Moderate Malnutrition	Severe Malnutrition
7 days	1-2	>2
1 month	5	>5
3 months	7.5	>7.5
6 months	10	>10
1 year	20	>20

kidney disease, osteoporosis, diabetes mellitus). In the elderly, identifying sudden or drastic losses in appetite can yield early and necessary interventions to prevent malnutrition and unintentional weight loss.³² Typical methods for determining dietary intake include methods such as 24-hour food recalls and food diaries with the purpose of determining the types and amounts of foods an individual has consumed to assess if those foods have provided the variety of nutrients required to meet their needs. Questions can focus on meal patterns, mealtime hours, portion sizes, avoided foods, and information on food security. The accuracy of this information relies primarily on an individual's ability to recall the information or the availability of a surrogate reporter, such as a family member or caregiver.³²

Determining adequacy of diet requires knowledge of an individual's dietary requirements. Energy needs are often decreased in elderly populations due to a decline in resting metabolic rate and losses in lean body mass, therefore equations used in other populations may not be accurate in elderly. While energy needs may decline, vitamin and mineral needs are often increased. The dietary reference intakes (DRIs), also include specific nutrient requirements for individuals between 51 and 70 years old and those older than 71 years. The DRIs for older adults are higher for nutrients like calcium, vitamin D, and vitamin B₁₂, which take into account physiologic needs and changes that occur in elderly, therefore special attention should be given to these nutrients when assessing dietary intake.³²

History

A thorough review of the patient's history should include reviews of social service notes, current and previous medical diagnoses, medications, cognitive status, ability to perform activities of daily living, social support systems, as well as mobility and skin status. Evidence provided by these data allows the RDN to determine potential interventions, factors that are

contributing to a decline in diet intake and malnutrition.³²

Nutrition Interventions

Nutrition interventions aimed at reducing malnutrition, frailty and risk of fall in this age group are centered on achieving adequate nutrition and correcting any nutritional deficiencies. Recommendations for this should take into consideration the individual's barriers and resources in addition to other medical related assessment data. Food access and dietary intake are the cornerstone to achieving this objective, interventions such as food assistance programs, modified diet, and social support should be considered.³²

A variety of programs are available that address food access in the elderly, either via monetary assistance or delivery programs. The US Department of Agriculture through the Older Americans Act Nutrition Service Program includes the Supplemental Nutrition Assistance Program (SNAP, formerly known as food stamps), Senior Farmer's Market Nutrition Program (SFMNP), Child and Adult Care Food Program (CACFP), Emergency Food Assistance Program, and Commodity Supplemental Food Program.³⁴ RDNs and members of the health care team can screen and refer patients to such programs to lessen food insecurity in this population. Participation has been shown to improve food and nutrient take, increase fruit and vegetable consumption, stimulate interest in healthy food, improve quality of life and nutritional status. Programs such as Meals on Wheels and other congregate feeding program for elderly individuals are also recommended for improving food access and nutrient intake. Socialization during congregate meals can also improve diet quality.^{32,35}

Alterations to food consistency, for example, ground, pureed, or chopped foods may help overcome physical barriers to food consumption. Mechanically altered diets have the potential for compromising food acceptability of the elderly, so food texture should be maintained to the

greatest degree possible. Additionally, foods that are particularly difficult to chew and swallow, hard, sticky, or tough foods, can be cooked longer or avoided. In long-term care settings, elderly with multiple chronic conditions receive little benefit from dietary sodium or sugar restrictions, so diets can be liberalized to encourage intake. With changes in olfactory and taste sensations in elderly stronger seasoning and flavoring of food can help to achieve adequate intake. This can be achieved through herbs, spices, seasonings, garlic, maple or vanilla extract, and other taste enhancers.³²

Adequate protein intake can be maintained with 0.8 to 1.0 g/kg body weight per day. In individuals with compromised kidney or liver function this should be decreased and increased for those with pressure ulcers, cancer, infection, or other conditions. In addition to ensuring adequate protein, interventions should aim to ensure vitamin B₁₂ and vitamin D intake is meeting individualized needs.³² In general, the MyPlate Food Guidance System is a useful tool in promoting adequate intake of essential nutrients. Elderly individuals need 3 to 4 servings of milk, dairy, or calcium-rich foods per day, 2 to 3 servings of protein-rich foods (meat, beans, fish, poultry, tofu), 3 to 5 servings of vegetables, 2 to 4 servings of fruit, and 6 to 12 servings of bread, grains, or cereals.³⁶ Patients who experience early satiety and decreased appetite may benefit from alterations in meal patterns, including additional snacks throughout the day, as well as efforts to increase energy density of foods provided. This can be achieved by adding cream to soups and sauces, protein powder supplements to beverages or puddings, and be offering nutritional shakes with snacks and meals.³²

Conclusion

Many factors affect risk for fall, factors can be environmental hazards and individual susceptibilities.¹¹ Nutritional status in elderly individuals is a key predictor of both frailty and sarcopenia,

thus ensuring adequacy in these populations has the potential for preventing falls. Poor nutritional status is associated with the onset of frailty; however, timely nutrition screening can be used to identify malnourished individuals and trigger nutrition intervention and services.³⁰ Nutrition interventions are aimed at reducing achieving adequate nutrition and correcting any nutritional deficiencies, including food assistance programs, nutrition education, altered consistency, meal patterns, and dietary supplements.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical Approval

Not applicable, because this article does not contain any studies with human or animal subjects.

Informed Consent

Not applicable, because this article does not contain any studies with human or animal subjects.

Trial Registration

Not applicable, because this article does not contain any clinical trials. [AJLM](#)

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