Nutrition and Weight Management in the Elderly

Carolyn Newberry, MD[a,*], Gregory Dakin, MD[b]

KEYWORDS

• Digestion • Metabolism • Aging • Nutrition • Malnutrition • Obesity

KEY POINTS

- Changes in the digestive tract and metabolism occur throughout the life cycle and may alter swallowing function, digestive capabilities, and prevalence of gastrointestinal symptoms in elderly populations.
- These changes, coupled with alterations in oral intake, can predispose older persons to developing malnutrition, sarcopenia, and sarcopenic obesity.
- Physicians should recognize the complex nature of nutrition and weight management planning and screen early and often for malnutrition in this population.

INTRODUCTION

Aging changes the way the body digests food and absorbs nutrients as well as how it stores energy in the form of muscle and fat. The natural aging process is characterized by gradual loss of lean muscle mass with concomitant increase in adiposity, a process known as sarcopenia. This process can be exacerbated by other environmental pressures including alterations in dietary intake and physical activity in addition to inherent changes within the digestive tract itself (**Table 1**). The following is a review of these factors and how they are implicated in nutritional status and weight management in the elderly.

DIGESTION AND METABOLISM IN AGING

Deglutition

Swallowing is divided into 3 phases, which can all be affected by aging as well as concomitant medical conditions and medications. The oral phase of swallowing begins with food entering the mouth and is characterized by manipulating this food via mastication and salivary lubrication into a bolus that is transferred into the pharynx. Decreased jaw strength, changes in dentition, and reduction in salivary production

[a] Division of Gastroenterology, Weill Cornell Medical Center, 1305 York Avenue, 4th Floor, New York, NY 10021, USA; [b] Division of GI, Metabolic, & Bariatric Surgery, 525 East 68th Street, Box 294, New York, NY 10065, USA
* Corresponding author.
E-mail address: can9054@med.cornell.edu

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Table 1
The effect of aging on the gastrointestinal tract and nutritional status

	Age-Related Changes	Effect on Oral Intake/Nutritional Status
Deglutition	Poor dentition, reduced muscular coordination and strength, decreased salivary production, reduced peristaltic pressures, increased esophageal sphincter tone	Poorer tolerance of certain food textures, increased time to feed, increased rates of dysphagia and aspiration
Digestion	Reduced gastric accommodation; reduced gastric, small intestinal, and colonic motility; alterations in pancreatic enzymes secretion; enhanced rates of small intestinal bacterial overgrowth	Increased gastrointestinal symptoms with oral intake, reduction in digestion and absorption of nutrients
Metabolism	Reduced total energy expenditure, decreased adaptability to changes in calorie intake, increased fat deposition	Excessive weight loss or gain with changes in oral intake, changes in body composition (sarcopenia, sarcopenic obesity)
Appetite	Reduced drive to eat, reduced pleasure associated with eating	Decreased overall intake
Social factors	Isolation, dementia, food availability, poor functional status	Increased food insecurity/ embarrassment during meals leading to decreased overall intake

can reduce the efficacy of the oral phase in older persons.[1] The second phase of swallowing, known as the pharyngeal phase, is involuntary and includes projection of the food bolus into the esophagus. This is where the involuntary esophageal phase of swallowing occurs, which includes propulsion of the bolus via peristalsis into the stomach.[2] Aging has been shown to lengthen the time of both the pharyngeal and esophageal phases.[3] Reduced peristaltic pressures and development of hiatal hernias may also occur, further limiting swallowing efficacy.[4]

This deterioration of the natural swallowing mechanism along all phases is associated with enhanced rates of dysphagia and aspiration in seniors. This phenomenon coupled with increased rates of neurologic and musculoskeletal disease leads to high rates of swallowing dysfunction in this population.[5] Epidemiologic studies have shown the prevalence of dysphagia in community dwelling individuals older than 50 years is between 15% and 22% and that this number increases to to 40% to 60% in nursing home and assisted living communities.[2] These rates are expected to increase with increasing numbers of persons older than 65 years in the general population. Because of their complicated nature and diverse origins, swallowing dysfunction may be insidious in onset and go unrecognized.[6] Swallowing abnormalities alter an individual's ability to eat by limiting the textures and quantities of food that can be consumed. Dysphagia diets are difficult to follow and associated with embarrassment regarding the need to change eating patterns in social settings. These factors can lead to isolation and further reduction in intake.[7] Proper management of swallowing dysfunction is imperative in both community dwelling and institutionalized persons. Compensatory management strategies include postural adjustments and alterations in swallowing maneuvers, which can be used before dietary modifications, which

are less tolerated. Alternative feeding strategies including hand feeding may also be appropriate for patients who are unable to feed themselves.[8]

Digestion

In addition to swallowing dysfunction, the digestive process itself changes during aging. For example, in the healthy digestive tract, a set of stereotypical responses occur within the stomach after receiving a food bolus. These include accommodation of the bolus into the gastric fundus followed by mechanical mixing of the contents with gastric secretions such as stomach acid.[9] The ability for the stomach to accommodate decreases over time, with delays in emptying leading to enhancement of nausea and reflux in older individuals.[4] Although gastric acid secretion remains constant in elderly persons with healthy digestive tracts, concomitant medical conditions (including increased prevalence of pernicious anemia and *Helicobacter pylori* infection) may reduce secretion capabilities. Gastric acid secretion may also be affected by medications including antireflux drugs that are commonly prescribed.[10]

Beyond the stomach, foregut and intestinal motility as well as hepatobiliary digestive enzyme secretion may be altered. The normal small bowel receives partially digested food particles and continues to mix these with digestive enzymes to facilitate more distal absorption. Aging reduces small bowel motility, with reduction in migrating motor complexes and physiologic contractions after eating.[4] Reduction in motility can further enhance gastrointestinal distress and predispose patients to small intestinal bacterial overgrowth. Common complaints include bloating, distention, and diarrhea, which are most severe postprandially.[11] Pancreatic enzyme secretion decreases over time, leading to fat and carbohydrate malabsorption and loose stools. The gallbladder becomes less responsive to cholecystokinin, leading to reduced contractions and bile secretion and subsequent steatorrhea.[12] The mass of the liver decreases with aging due to decreased hepatic blood flow and hepatocyte degradation. Whether this leads to reduced liver function itself is controversial, although predisposes the elderly to liver injury secondary to ingestion of hepatotoxic medications or additional alterations in blood flow.[13]

In terms of colonic activity, although diarrhea is common due to previously stated foregut and hepatobiliary changes, abnormal bowel patterns may also be defined by constipation. Normally, the colon contracts segmentally resulting in propulsion of contents into the rectum for excretion.[14] Reduction in nerve endings with aging leads to reduced propulsions and stasis of stool.[15] Bowel habits in the elderly may fluctuate between diarrhea and constipation due to these physiologic changes as well as alterations in dietary intake to compensate.

Metabolism

Metabolism is altered in aging and may affect the ability of seniors to regulate overall energy intake. Total energy expenditure (TEE) decreases with time, with a large prospective cohort study using calorimetry noting a drop in TEE of 274 kcal/d over a 7-year time period in participants aged 70 to 79 years. Expected compensatory mechanisms to achieve weight and body composition homeostasis are also blunted. Metabolomic studies have demonstrated elderly volunteers are unable to adjust their resting energy expenditure levels to the same degree as younger participants in response to changes in caloric intake.[16] This inability to metabolically adapt can lead to enhanced weight fluctuations after times of altered calorie consumption.[17] Neurohormonal alterations are prevalent, affecting regulators of blood sugar levels and appetite.[16] Plasma insulin has been found to be correlative to adipocyte density and volume. Insulin insensitivity increases with aging and can lead to enhanced fat

deposition. Effectiveness of satiety hormones including Leptin and neuropeptide Y is variable with aging and may alter hunger pathways. Coupled with alterations in previously mentioned gastrointestinal hormone secretion and physiologic adaptations, the elderly may have persistent changes in eating patterns that can lead to both inadequate and overconsumption of calories.[18]

NUTRITIONAL STATUS IN THE ELDERLY

Body Compositional Changes

Normal aging is associated with a gradual increase in adipose tissue with a concomitant reduction in muscle, a process termed "sarcopenia." Muscle is defined by both the amount (ie, mass) that is present and its associated function (ie, power).[19] Accelerated redistribution of these tissues can occur as a response to sedentary lifestyle, certain eating patterns (ie, western diet), and genetics.[20] This tissue redistribution and its functional change can also be enhanced by chronic disease processes. Although some degree of muscle loss and fat gain is expected in the setting of aging (ie, primary sarcopenia), accelerated states due to lifestyle, medications, and diseases is common and can lead to increased morbidity and mortality, a process termed "secondary sarcopenia."[21] Frailty, which corresponds to performance on the hand grip strength test and 6-minute walk test, considers muscle mass and performance.[22] The increased development of frailty and sarcopenia secondary to adoption of western lifestyles is of growing public health concern and is especially pertinent in the elderly. Sarcopenia has been found to be associated with increased risk of disability and mortality in older individuals.[19] Because of its relationship to these health outcomes, body composition has more recently been defined as a better marker of health than weight or body mass index (BMI) alone and may be used to assess vitality in elderly populations.[23]

In terms of protective measures against sarcopenia and frailty, diet quality and physical activity have been found to play a large role. This correlation has been analyzed in a systematic review of 23 studies, which reported the positive relationship between poor diet quality as defined by vegetable intake and enhanced rates of sarcopenia.[24] A common marker for diet quality is the Healthy Eating Index (HEI), which considers intake of vegetables, fruits, nuts, soy, white meat in comparison to red meat, cereal fiber, trans fat, polyunsaturated fatty acids in comparison to saturated fatty acids, multivitamin use, and alcohol.[25] Higher quality diets defined by the HEI have been shown to be protective against sarcopenia as well as overall mortality. In the same vein, physical activity in the setting of adequate protein intake enhances muscle mass and has positive metabolomic effects.[26] Lifestyle interventions in these populations is important to reduce morbidity associated with body compositional changes.

Nutritional Assessment

Conducting a nutritional assessment in elderly individuals includes anthropometrics (such as weight, height, waist, and hip measurements), dietary recall, and laboratory investigation (including total protein and albumin levels and inflammatory markers) (**Box 1**). Nutritional screening tools have also been developed, which risk stratify persons after assessment of current body weight and BMI, recent oral intake, feeding abilities, concomitant medical problems, and presence of acute illness.[27] The most validated nutrition screening tool in the elderly is the Mini Nutrition Assessment, which has both short and long forms. This survey considers both standard screening parameters (BMI, weight loss, recent oral intake, and presence of disease) as well as

Box 1
Basic tenets of nutritional screening in elderly patients

- Limitations to oral feeding (structural, cognitive, accessibility)
- Recent oral intake
- Current BMI
- Percentage of recent total body weight loss
- Laboratory evaluation
- Anthropometrics
- Comorbid health conditions and medications

assessment of immobility and neuropsychological disease.[28] Screening identifies high-risk patients for further diagnostic testing and management.

Malnutrition and Nutritional Intervention Planning

Elderly persons often do not meet nutritional requirements as defined by nationally set Recommended Daily Allowances, which themselves may underestimate need in older individuals.[29,30] The most frequent changes in eating behavior in this population include reduction in overall intake and type of food consumed.[4] Fresh foods including fruits and vegetables may be consumed at lower frequencies, a result of accessibility and tolerance. This predisposes these persons, who already have high rates of medical comorbidities and medication use, to poorer nutrition statuses.[31] Elderly patients who are noted to be at high nutritional risk on malnutrition screening tools and/or clinical assessment should undergo a more comprehensive nutritional analysis. This includes a further investigation into underlying causes, individual food preferences, and limitations to normal eating patterns. Dietary intake can be monitored for several days after which intervention planning should take place.[27] A multidisciplinary team comprised of physicians, nurses, dietitians, and occupational therapists has been found to be the most effective in implementing nutritional protocols in both nursing home and home care persons and should be used when possible.[32] In terms of dietary approaches to increase oral intake, these are individualized. Important considerations for teams include the patient's underlying medical history, personal food preferences, allergies and sensitivities, food accessibility, living situation, and overall health status. Intervention options include augmentation of oral intake through dietary counseling, meal enrichment, and feeding protocols as well as formal nutritional support through feeding tubes and/or infusion.[33]

Obesity and Weight Management

Aging causes gradual loss of muscle mass with increased propensity to store excess energy as fat. Older individuals are less able to adapt metabolically to changes in caloric consumption. These factors, along with increasing life expectancy and prevalence of overweight and obese individuals in the population, necessitate discussion of obesity and sarcopenic obesity management in this population. In terms of defining obesity in the elderly, this proves challenging, as BMI cutoffs set by the World Health Organization do not differ by age despite known anthropometric changes over time. Normally, a BMI between 18.5 and 24.9 is considered healthy, 25 and 30 overweight, and greater than 30 obese; however, some geriatric literature suggests a normal BMI for persons older than 65 years is 24 to 29.[34] Notably the relationship between

mortality and obesity in patients older than 65 years is also controversial with a well-reported "obesity paradox" that notes neutral or even improvement of length of life with obese status.[35]

In terms of weight management planning, efforts may concentrate more on weight maintenance, especially maintenance of muscle mass, than overall loss in contrast to younger individuals. Notably, large dietary and lifestyle fluctuations over time leading to weight cycling have been correlated with enhanced rates of sarcopenic obesity in aging populations, further highlighting the need for consistency of care.[36] In general, aggressive weight loss efforts are associated with reduction in both fat and lean body mass, which may be detrimental to older persons.[34] Emphasis on medical optimization including management of chronic conditions and, when possible, elimination of medications associated with weight gain is important. In terms of diet, limited research exists on optimal patterns to promote weight maintenance and/or loss in elderly populations, and this should by individualized based on preference and accessibility. A nutrient-rich isocaloric diet is generally the best approach, although moderate hypocaloric diets (no more than a 500-kcal deficit per day) can be considered. Ensuring adequate protein intake is important, with a recommendation of at least 1 g per kilogram of body weight per day in healthy individuals and higher amounts in those with acute or chronic illness.[33,37] Any reduction in caloric intake should be coupled with adequate physical activity to promote maintenance of lean muscle mass. Aerobic exercise including walking, cycling, and swimming is appropriate and has additional cardiovascular benefits.[34]

The role of medically supported weight loss through bariatric procedures in elderly populations is still unknown, although can be considered in select individuals. It is estimated that 20% of the elderly population are eligible for bariatric surgery. The National Institutes of Health guidelines for bariatric surgery established in 1991 initially limited the procedure to patients younger than or equal to 60 years but later lifted this restriction in 2006. Despite this change, procedures in the elderly remain controversial, and prospective, controlled, interventional trials comparing surgery to medical and dietary management do not exist. A large retrospective review of the National Surgical Quality Improvement Program (NSQIP) database analyzed 41,475 patients who underwent laparoscopic gastric bypass between 2011 and 2015 and compared the outcomes for patients older than 65 years to patients younger than 65 years. Elderly patients undergoing Roux-en-Y gastric bypass (RYGB) had a higher rate of serious early morbidity but similar 30-day mortality. Elderly patients undergoing sleeve gastrectomy had both higher serious morbidity and 30-day mortality. The average length of stay was prolonged regardless of procedure type. Although complications were increased, the overall rate remained very low (4% and 0.29%, respectively) leading the investigators to conclude that elderly patients should be counseled in their higher risk but should not be denied surgery based on age alone.[38] Similar findings and conclusions have published in later large meta-analyses that confirmed although there is a higher morbidity and mortality rate in older individuals undergoing these procedures, rates overall are low, especially when undergoing sleeve gastrectomy.[39,40] In terms of risk stratifying surgical candidates, a large study of patients in the American College of Surgeons National Surgical Quality Improvement database comparing those older than and younger than 70 years correlated higher complication rates with impaired functional status and the RYGB procedure.[41]

Weight loss data after surgery in the elderly population is similarly sparse. One study showed a 26.9% total body weight loss at 1-year follow-up, but this was significantly lower than that of the younger patient cohort.[42] Other studies have reported significant weight loss in elderly populations.[43,44] It is reasonable to conclude that older persons

stand to gain substantially from the benefits that bariatric surgery may offer. However, this population is at higher risk for surgical complications, and thus each patient must be considered on an individual basis with attention not directed to age, but rather functional status and the presence of comorbid conditions.

SUMMARY

Elderly persons are at increased risk of malnutrition and changes in body composition including sarcopenia and sarcopenic obesity. This increased risk is secondary to alterations in deglutition, digestion, metabolism, and dietary patterns over time as well as higher prevalence of comorbid disease and medication use. Older individuals should be assessed early and often for malnutrition, with more formal assessment and nutritional planning in those who are deemed high risk. Although nutritional protocols should be individualized, basic tenets including promotion of high-quality foods, aerobic exercise, and early intervention guided treatment plans.

CLINICS CARE POINTS

- Aging can negatively affect swallowing function, digestion, and metabolism, which may lead to reduced oral intake, development of gastrointestinal symptoms, malabsorption, and alterations in weight homeostasis in elderly individuals.
- Elderly patients should be screened with the Mini Nutritional Assessment Tool on a regular basis to identify nutritional complications early and aid in care planning.
- Aggressive weight management programs are generally not recommended in persons >65 years old, however some patients may be able to pursue hypocaloric diets and even bariatric procedures with close medical supervision.

DISCLOSURE

The authors have nothing to disclose.

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