

Nutritional Assessment in Geriatric Practice

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Nutrition is a prime concern for the optimal health of older persons. Nutrition, aging and health form an inseparable triad. Nutrition modulates aging and also contributes to the development and progression of degenerative diseases and disorders that are associated with aging.¹ Caloric restriction is the only intervention known to delay aging. Dietary alterations even in later life may be effective in reducing further progression of certain diseases and improving nutritional status. Nutritional status in the elderly can be influenced by a variety of risk factors, including inactivity, inadequate funds or resources, mobility and transportation issues, poor or restricted diets, chronic disease, poverty, social isolation, functional limitations, dementia, depression, poor dentition, polypharmacy, alcohol or substance abuse. A working knowledge of age related pathophysiological changes influencing nutritional requirement, and screening tools can assist the practitioner in providing quality care for the older patient.

Age related pathophysiological changes

Older people tend to lose height with age due to various reasons. Body weight also changes with age. It increases in both men and women until the late sixties and tends to decline thereafter. Aging is associated with changes in body composition. There is a decline in skeletal muscle mass called sarcopenia.² Many older persons also exhibit an increase in total body fat with greater intra-abdominal (visceral) fat stores.³ The consequence of these changes in body composition is that well-standardized nutrient requirements for younger or middle aged adults cannot be generalized to older adults.

The Basal Metabolic Rate (BMR) decreases by about 20% between the ages of 20 and 90 years. Sarcopenia, decreased level of physical activity,

decreased maximum breathing capacity and vital capacity, and increase air flow resistance in the peripheral airways contribute to a decreased BMR.⁴ The ability of the body to eliminate metabolic waste products may be limited by decreased GFR, decreased renal plasma flow and reduced ability to regenerate nephrons.⁵

Poor appetite and hunger, reduced appreciation for food, and diminished physical activity are the features of the anorexia of aging.⁶ A diminished sense of smell and altered taste perception can blunt appetite and the enjoyment of eating. Depression and senile tremors in elderly may be the additional contributory factors.

Notable aging changes in the oral cavity may affect nutritional status adversely.⁷ An edentulous state or ill-fitting dentures can make chewing difficult. Of older persons, 40% complain of dry mouth, commonly due to medical conditions, medications and compromised fluid intake.⁸ Owing to subtle neuromotor changes in the swallowing mechanism, the oral phase of swallowing takes 50% to 100% longer.

Modest changes in esophageal motility like decreased upper and lower esophageal sphincter pressures with a reduced amplitude of peristaltic contractions, incomplete sphincter relaxation, delayed esophageal emptying, frequent tertiary contractions, and esophageal dilation are observed in asymptomatic older persons.⁹ However clinically significant impairment in esophageal motility generally is observed only in the setting of an underlying pathologic condition, such as diabetes mellitus or neurologic disease.¹⁰

With the exception of chronic atrophic gastritis, gastric acid secretion, whether basal or stimulated, appears to be preserved with aging. Mucosal prostaglandin synthesis declines and secretion of bicarbonate, sodium ion, and nonparietal fluids is decreased, leading to increased risk of nonsteroidal anti-inflammatory drug (NSAID) gastropathy.¹¹ Impaired gastric motility and emptying are observed with aging.¹²

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The structure and absorptive function and motility of the small intestine appear to be well preserved with aging.¹³

The colon may undergo many structural changes that adversely affect tensile strength and function with aging. Increased numbers of collagen, elastic, elastin and oxytalan fibers are observed in the colonic wall with decline in neuronal density. This may explain why diverticulosis is commoner in the elderly than in the young. Self report of constipation increases with age and is more prevalent among women.¹⁶ There is an increased frequency of fecal incontinence among older persons.

Nutritional requirements of elderly

It is difficult to define "Ideal" requirement in elderly. Many studies and survey have been conducted over the years to determine levels of various nutrients with varied recommendation.

Caloric requirements

Total energy expenditure (TEC) is determined by basal metabolic rate (BMR) and physical activity. Due to decrease in metabolic rate and energy expenditure caloric requirements decline by approximately 22% from age 30 to age 80.

Macronutrient requirements

Lean body mass declines with age leading to depletion of protein stores. In elderly, rate of protein synthesis is decreased and there is increased catabolism. More over, protein requirement go up during acute illness e.g. Pneumonia, UTI, fracture as well as in patients with chronic illness like CHF, CRF etc. The ICMR, RDA (recommended daily allowances) for proteins is 60 gm per day in male and 50 gm per day in females. It is safe to recommend protein intake up to 1.25 gm per kg per day in elderly. Certain diseases, such as renal or hepatic insufficiency, may necessitate protein restriction. In general, hospitalized older patients without signs of protein intolerance warrant a protein intake of 1.5 g/kg of body weight/d if under stressful conditions. It is suggested that not more than 30% of total energy is derived from fat, with not more than 10% from saturated fat sources. Many undernourished older persons insist on following ill advised low fat diets even when in dire need of increased energy intake. At least 10 gm fat per day is required to provide necessary essential fatty acids. Energy obtained from carbohydrates should approximate 55% to 60% of total caloric intake

per day, with a greater emphasis on complex carbohydrates than on simple sugars.¹⁷

It is advisable to take 20-40 gm of dietary fiber per day. Fibers increase gastrointestinal transit time, reduce colonic concentrate and prevent dyslipidemia, diabetes, and cardiovascular diseases.

Micronutrient requirements

The reduce energy requirement in old age, hence reduced total volume of food is associated with depleted intake of micronutrients and vitamins. This problem can be best addressed by recommending "Nutrient – dense food" and dietary diversity. It is generally agreed that requirement in elderly for most vitamins and minerals are same, if not higher, than for younger people. Elderly who are bed ridden, hospitalized or with restricted mobility have poor exposure to sun light, are deficient in vitamin D. Elderly with poor intake of food and vegetables are at increase risk of vitamin C and various vitamin B deficiencies. Significant number of elderly have age related hypochlorhydria leading to impaired absorption of vitamin B₁₂. Absorption of calcium, iron decreases with age. Calcium supplemental may be required for elderly to maintain bone mass and reduce osteoporotic fractures. Similarly iron supplement may be needed for short term to meet the deficiency on account of various bloods loss from GI tract and dietary deficiency.

Trace elements like zinc, iodine, copper, and magnesium are valuable components of several enzymes and hormones, influencing body's immune status. Revisions to the Dietary Reference Intakes offer recommended daily allowances with more specific guidelines for older persons.¹⁸ For the first time, the RDAs have been split into two groups, those for persons aged 51 to 70 years and those for persons older than age 70. Recommendations for selected nutrients have been adjusted in view of new research findings. As compared to 51-70 years, for elderly >70 years of age there is more requirement of calcium, magnesium, vitamin D, fluoride, thiamine, niacin, folate, vitamin B₁₂, pantothenic acid, biotin, choline, vitamin C, vitamin E and less of phosphorus, riboflavin, vitamin B₆, and selenium.

Fluid requirement

Fluid requirement warrant close attention because dehydration is a common problem among older persons. The aging process is associated with a decreased

perception of thirst, impaired response to serum osmolarity, and reduced ability to concentrate urine after fluid deprivation.²¹ In general, fluid needs of older persons may be met with 30 mL/kg body weight/d, or 1 mL/kcal consumed. Fluid needs may be increased during episodes of fever or infection and with the administration of diuretics or laxatives.

In assessing an elderly patient, signs of dehydration should be noted, including a decreased urine output, elevated body temperature, constipation, mucosal dryness, skin turgor changes, and mental confusion. Altered fluid status, either overhydration or underhydration, may affect anthropometric and biochemical measurements, resulting in unreliable assessments.

Clinical assessment of elderly

Effective appraisal of nutritional status and nutritional needs in elderly is essential.²² Systemic assessment of nutritional status includes dietary history, physical examination, anthropometric measurements, biochemical analysis and dietary assessment.

History

The nutritional history begins with history of recent unintentional weight gain or weight loss, recent surgery, or trauma; a history of any chronic illness such as diabetes, hypertension, renal failure, hepatic failure, heart failure, malignancy, or peptic ulcer disease; a history of any recent illness such as recurrent nausea, vomiting or diarrhea, drug or alcohol abuse; use of multiple medications; and a detailed social history. The patient's recent dietary intake is estimated as accurately as possible from either a diet history or, if possible, an actual calorie count based on meals eaten, preferably spanning a period of the previous 5 to 7 days.

General physical examination

A careful physical examination including a search for signs of nutritional deficiencies is important in performing a nutritional assessment. Evidence of body fat and muscle wasting is characteristic of marasmic malnutrition. Loss of skin turgor, loss of hair color and softness, pitting edema, and enlargement of the liver and parotid glands are more characteristic of a kwashiorkor type of malnutrition. Findings characteristic of trace element deficiencies should also be recognized. Examples include the association of zinc deficiency with diarrhea, dermatitis, hair loss, poor wound healing, and alteration in the senses of taste and smell;

chromium deficiency with weight loss, glucose intolerance, and diabetic neuropathy; copper deficiency with anemia and leukopenia; and iron and iodine deficiency with anemia and goiter, respectively.

Some of the characteristics of kwashiorkor and marasmic malnutrition as listed in the American Medical Association's International Classification of Diseases (ICD-9-CM) are outlined in table 1. Signs and symptoms of various nutrient deficiencies are outlined in table 2.

Anthropometric measurements

Weight

Weight loss is considered the strongest predictor of morbidity and mortality in hospitalized and institutionalized patients.²³ A useful indicator of nutritional risk and morbidity is a weight loss of 5% or greater in the past month or a 10% or greater loss in the past 6 months. Expressing body weight as a percentage of the ideal weight is one method of assessing optimum body weight. Use of the patient's own best weight for a reference standard is preferable for nutritional assessment because it allows a more accurate determination of recent or chronic weight loss than a weight as a percentage of the ideal. This weight is also called the percentage of usual body weight (UBW). The best source of this information is the patient's previous medical record.

Body mass index (BMI), defined as weight (kg)/height (m²), is a practical measure of body size and indirect measure of body fat that does not require use of a reference table of ideal weights regarding body size.

BMI of 23 or less and 30 or more have been shown to be associated with increased mortality in the 60-year and older age group.²⁴ In other words, the association of BMI and mortality is a U-shaped curve in people 60 years and older. Furthermore, the BMI associated with minimal mortality increases with advancing age. Therefore, a BMI that may be considered excessive in a 20 year-old person may be normal for a person who is 60 years old.

Skin fold and muscle mass measurements

The mid-arm circumference can be used to estimate the body's skeletal muscle mass, whereas the triceps skin fold and subscapular skin fold thickness can be used to estimate the subcutaneous fat reserves.

Table 1: ICD-9-CM codes for classification of malnutrition

ICD-9-CM Code	Diagnostic Category	Selected Diagnostic Criteria
260	Kwashiorkor	<ol style="list-style-type: none"> 1. Body weight >90% of ideal 2. Transferrin <200 mg/dL, or albumin <3.5 g/dL 3. Decreased oral intake for more than 2 weeks 4. Anorexia, nausea, vomiting for more than 2 weeks
261	Marasmus	<ol style="list-style-type: none"> 1. Body weight <90% of ideal or <90% of usual 2. Transferrin >200 mg/dL or albumin >3.5 g/dL 3. Weight loss >10% in 6 months 4. Decreased oral intake for more than 2 weeks 5. Anorexia, nausea, vomiting, diarrhea for more than two weeks

From International Classification of Diseases, Clinical Modifications, 9th revision: Dover, DE, American Medical Association, 1996.

However these measurements are less reliable in people 60 years and older due to age-related declines in lean body mass and increases in body fat.

Alternate methods for measuring height and weight in patients with disabilities and deformities

In patients who have lost a body part, estimation of desirable body weight is more difficult. Total arm length measurement, arm span measurement, and knee height measurements are alternative methods in patients with disabilities and deformities. The following list of percentages of total body weight contributed by individual body parts, described by Grant and Dehoog, can be used to estimate desirable weight in these patients.²⁵

- Lower leg with foot 7.1%
- Entire leg 18.6%
- Trunk without limbs 42.7%

Biochemical Indicators of nutritional status

Several biochemical indicators can be used to assess nutritional status. Kwashiorkor-type malnutrition is associated with depletion of the visceral protein mass. Affected patients may not have any evidence of weight loss and may even be overweight. Because visceral protein mass cannot be measured directly, the serum concentration of proteins synthesized by the liver is used as an indirect method of determining visceral protein mass. Serum transport proteins that have been found useful for this purpose include albumin, transferrin,

thyroxine-binding prealbumin, and insulin-like growth factor-1 (IGF-1).

Albumin

Several investigators have shown that hypoalbuminemia (serum albumin levels of less than 3.5 g/dL) is associated with increased morbidity and mortality in hospitalized and institutionalized patients. It is easily measured and quite accurately reflects the visceral protein status in the absence of acute changes in hydration or stress. The total albumin pool varies from 3 to 4 g/kg for women and 4 to 5 g/kg for men. The half-life of albumin has been estimated to be 18 to 21 days. Protein undernutrition has been shown to be associated with a decrease in albumin synthesis by the liver. Because of its large body pool and long half-life, the serum concentration of albumin changes slowly with malnutrition, thereby limiting its clinical usefulness in hospitalized or institutionalized patients with acute malnutrition. Furthermore, several investigators have reported that because albumin is a negative acute-phase reactant, its concentration in the serum may decline during an acute illness. It is therefore not considered a reliable marker of nutritional status. However, this does not diminish the association of hypoalbuminemia with increased morbidity and mortality in hospital and institutional settings.²⁶

Thyroxine binding prealbumin

Prealbumin plays a major role in the transport of thyroxine and serves as a carrier molecule for retinol-

Table 2: Symptoms and signs of nutrient deficiency in elderly persons

Nutrient	Clinical Presentation
Vitamins	
A	Dryness of skin, xerophthalmia, Bitot's spots, increase in dark adaptation time
D	Osteomalacia
E	Anemia
K	Bleeding diathesis
C	Petechiae, ecchymoses, perifollicular hemorrhage, bleeding gums (scurvy)
Thiamine (B ₁)	Muscle weakness and pain, hyporeflexia, hypoesthesia, cardiomegaly, encephalopathy (beriberi)
Riboflavin (B ₂)	Angular stomatitis, cheilosis, magenta tongue
Niacin	Raw tongue, tongue fissuring, dermatitis, diarrhea, dementia (pellagra)
Pyridoxine (B ₆)	Glossitis, peripheral neuropathy, anemia
Folic acid	Pallor, glossitis, anemia, stomatitis
B ₁₂	Paresthesias, ataxia, memory loss
Minerals	
Calcium	Osteoporosis, osteomalacia
Phosphorus	Weakness, osteomalacia
Magnesium	Weakness, tremor, tetany seizures
Iron	Weakness, angular stomatitis, koilonychia, anemia
Zinc	Rash and scaling of skin, hypogonadism, delayed wound healing, hypogeusia
Iodine	Goiter
Copper	Anemia
Chromium	Glucose intolerance
Selenium	Cardiomyopathy, cancer

binding protein. It has a short half-life of 2 to 3 days, and its serum concentration changes rapidly with changes in protein nutrition status. It has also been shown that the prealbumin concentration increases with improvements in nutritional status. Therefore, it can be used not only as a marker of malnutrition but also as a method of monitoring response to therapy in patients with malnutrition. Prealbumin levels of between 10 and 15 mg/dL, 5 and 10 mg/dL, and less than 5 mg/dL are labeled mild, moderate, and severe visceral protein depletion, respectively.

Transferrin

Transferrin is a beta globulin that transports iron in the plasma. Its serum concentration appears to be less significantly altered by the state of hydration than that of albumin owing to its smaller body pool mass. Several conditions other than malnutrition can alter its serum concentration. The serum concentration of transferrin falls markedly with liver disease and in conditions that lead to protein loss. Its serum half-life ranges from 8 to 10 days. Because of the shorter half-

life and the smaller body pool, the serum concentration of transferrin is considered a better marker of protein malnutrition than the serum albumin level. Serum concentrations of transferrin of 150 to 200 mg/dL, 100 to 149 mg/dL, and less than 100 mg/dL are considered reflective of mild, moderate, and severe visceral protein depletion, respectively.

Insulin-like growth factor-1

Insulin-like growth factor-1 (IGF-1) is a peptide synthesized primarily in the liver (although smaller concentrations are secreted by a number of other tissues in the body) that mediates the growth-promoting effects of growth hormone. It has been shown that the serum concentrations of IGF-1 decline with malnutrition, falling as rapidly as less than 5 days after starvation, and they recover just as quickly with refeeding. Studies have shown that a rapid decline in IGF-1 level is associated with both protein and calorie undernutrition. It has also been shown that the IGF-1 level declines with aging. Therefore, its usefulness as a marker of nutritional status in older people remains to be defined.

Table 3: Body Mass Index (BMI) : Body size classification

Category	BMI (kg/m ²)
Underweight	<18.5
Normal weight	18.5-24.9
Overweight	25-29.9
Obesity	30.0-39.9
Extreme obesity	40

Adapted from: National Institutes of Health's Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, 1998

High technology body composition assessment

High-technology body composition assessments that are impractical for routine clinical use include water displacement, bioelectrical impedance, dual-energy x-ray absorptiometry, CT, nuclear MR imaging, and total body counting of the naturally occurring potassium isotope (⁴⁰K).

Multi item nutritional screening tools

The lack of a single assessment measure that is a valid indicator of a person's comprehensive nutritional status has prompted the development of multi-item tools.²⁷ Nutritional screening or assessment tools are described as tools which use a questionnaire-type format containing more than one risk factor for malnutrition, ranging from objective measurements to subjective assessment and give a quantitative or categorical assessment of risk. Nutritional assessment and screening tools can be useful to highlight those in need of a nutritional care plan. More than 20 tools are available for older population, however many of them have not been subjected to validity and/or reliability testing but are still used clinically. The decision to use a particular tool should therefore be considered carefully.²⁷⁻²⁸

Four screening tests for nutritional assessment have been widely used-

1. The Nutritional Screening Initiative (NSI)²⁹
2. The Mini nutritional assessment (MNA)³⁰
3. SCALES²²
4. Subjective Global Assessment.

1. The Nutritional Screening Initiative (NSI)

The Nutrition Screening Initiative (NSI) is a

collaborative effort between the American Dietetic Association, the American Academy of Family Practitioners, and the National Council on the Aging, Inc. A consensus approach was used by the NSI to develop three interdisciplinary nutrition risk-screening tools to aid in the evaluation of the nutritional status of older persons.

A checklist was created to raise public awareness regarding nutritional concerns of older persons. This self-report questionnaire is composed of 10 items and is intended to help identify potential risks, but not to provide a detailed assessment of diagnosis.³¹

Checklist

Illness affects diet, Eats <2meals/day, Lost or gained weight, 3 or >3 alcohol drinks/day, Tooth/mouth problems, Not enough money for food, Eats alone most of the times, 3 or >3 drugs/day, Eats few fruits - vegetables and/or milk products, Unable to shop- cook or feed himself.

The Level I screen is a comprehensive tool intended for use by health care professionals and incorporates measures of height and weight as well as additional assessment items regarding weight change, dietary habits, functional status, and living environment.

The Level II screen encompasses all the items from Level I with additional biochemical and anthropometric measures as well as a more detailed evaluation of depression and mental status, if indicated. The Level II screen must be administered by medical and nutrition professionals who are more highly trained than those who administer the Level I screen and is suggested for use in the diagnosis of malnutrition.³¹

2. Mini Nutritional Assessment

Prof. Vellas from Toulouse and Yves Guigoz from Nestle, Switzerland developed the MNA. It was designed as a 30-point scale.³⁰ The Mini Nutritional Assessment (MNA) originally was developed to evaluate the risk for malnutrition among frail older persons and to identify persons who may benefit from early intervention. The MNA must be administered by a trained professional and consists of 18 items, including BMI, midarm and midcalf circumferences, weight loss, living environment, medication use, dietary habits, clinical global assessment, and self-perception of health and nutritional status. A shortened screening version of the MNA that contains only six items has been made available and

is subject to ongoing evaluation.³²

3. SCALES

SCALES was developed at St. Louis University based on clinical experience and the recognition that depression is the most common cause of PEM.

S (Sadness),

C (Cholesterol <160 mg/dl),

A (Albumin <4 gm/dl),

L (loss of weight),

E (Eating problems - cognitive or physical),

S (Shopping problems or inability to prepare meals).

Presence of any two is associated with high nutritional risk.²²

4. Subjective Global Assessment

The five guidelines obtained from the history and physical examination for SGA include (1) weight loss, (2) dietary intake, (3) gastrointestinal symptoms that may influence nutritional status, (4) functional capacity, (5) physical signs.

SGA is a subjective screening tool and has various categories that can be interpreted as follows:

Class A indicates less than 5% weight loss or more than 5% weight loss but recent evidence of weight gain and improved appetite (well-nourished).

Class B indicates 5% to 10% weight loss without recent weight gain, poor dietary intake, and mild (1+) loss of subcutaneous fat (moderately malnourished).

Class C indicates weight loss of more than 10% with severe loss of subcutaneous fat and muscle wasting, often with edema (severely malnourished).

The effectiveness and usefulness of SGA in a clinical setting have yet to be established.³³

While good clinical judgement often is sufficient to diagnose malnutrition ("When you see it, you know it"), the fact that it is so often overlooked strongly supports the need for the regular use of nutritional screening tools.

References

1. Munro, H. N.: Nutrition and Aging. *Br Med Bull*, 37:83-88,1981.
2. Jensen GL, Rogers JZ: Obesity in older persons. *J Am Diet Assoc* 98:1308, 1998.
3. Evans WJ, Campbell WW: Sarcopenia and age-related changes in body composition and functional capacity. *J Nutr* 123(2 suppl):465, 1993.
4. Stevens J, Cai J, Pamul ER, et al: The effect of age on the association between body mass index and mortality. *N Engl J Med* 338:1, 1998
5. Sullivan DH, Moriarty MS, Chernoff R, et al: Patterns of care: An analysis of the quality of nutritional care routinely provided to elderly hospitalized veterans. *J Parenter Enteral Nutr* 13:249, 1989.
6. Morley JE: Anorexia of aging: Physiologic and pathologic. *Am J Clin Nutr* 66:760, 1997.
7. Shay K, Ship JA: The importance of oral health in the older patient. *J Am Geriatr Soc* 43:1414, 1995.
8. Lovat LB: Age related changes in gut physiology and nutritional status. *Gut* 38:306, 1996.
9. Altman DF: Changes in gastrointestinal, pancreatic, biliary and hepatic function with aging. *Gastroenterol Clin North Am* 19:227, 1990.
10. Russell RM: Changes in gastrointestinal function attributed to aging. *Am J Clin Nutr* 55:1203S, 1992.
11. Lee M, Feldman M: The aging stomach: Implications for NSAID gastropathy. *Gut* 41:425, 1997.
12. Harari MB, Gurwitz JH, Avorn J, et al: Bowel habit in relation to age and gender. *Arch Intern Med* 156:315, 1996.
13. Towers AL, Bugio KL, Locher JL, et al: Constipation in the elderly: Influence of dietary, psychological and physiological factors. *J Am Geriatr Soc* 45:1140, 1997.
14. Russell RM, Rasmussen H, Lichtenstein AH: Modified food guide pyramid for people over seventy years of age. *J Nutr* 129:751, 1999.
15. Campbell WW, Crim MC, Dallal GE, et al: Increased protein requirements in elderly people: New data and retrospective reassessments. *Am J Clin Nutr* 60:501, 1994.
16. Blumberg J: Nutritional needs of seniors. *J Am Coll Nutr* 16:517, 1997.
17. United States Department of Agriculture, Human Nutrition Information Service: Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans. Washington, DC, U.S. Government Printing Office, 1990.
18. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine: Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, Fluoride. Washington, DC, National Academy Press, 1997.

19. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine: Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline. Washington, DC, National Academy Press, 1999.
20. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine. Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids. Washington, DC, National Academy Press, 2000.
21. Phillips PA, Rolls BJ, Ledingham JG, et al: Reduced thirst after water deprivation in healthy elderly men. *N Engl J Med* 311:753, 1984.
24. Launer LJ, Harris T, Rumpel C, et al: Body mass index, weight change, and risk of mobility disability in middle-aged and older women. *JAMA* 271:1093, 1994.
25. Grant A, Dehoog S: Anthropometrics. In Grant A, Dehoog S (eds): Nutritional assessment and Support, 3rd ed. Seattle, self published by Grant and Dehoog, 1985,p.12.
27. Reuben DB, Greendale GA, Harrison GG: Nutrition screening in older persons. *J Am Gerontol Soc* 43:415, 1995.
29. White JV, Dwyer JT, Posner BM, Ham RJ, Lipschitz DA, Wellman NS. Nutrition screening initiative: development and implementation of public awareness checklist and screening tools. *J Am Diet Assoc* 1992;92(2):163-7.
30. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: The Mini-Nutritional Assessment as part of the geriatric evaluation. *Nutr Rev* 1996; 54:S59-65.
22. Morely JE. Why do physicians fail to recognize and treat malnutrition in older persons? *J Am Geriatr Soc* 1991;39L11)1139-40.
31. Nutrition Interventions Manual for Professionals Caring for Older Americans. Washington, DC, Nutrition Screening Initiative, 1992.
32. Vellas B, Garry PJ, Guigoz Y (eds): Mini Nutritional Assessment (MNA). Nestle Nutrition Workshop Series. Basel, Karger, 2000.
26. Salive ME, Coroni-Huntley J, Phillips CL, et al: Serum albumin in older persons: Relationship with age and health status. *J Clin Epidemiol* 45:213, 1992.
23. Tayback M, Kumanyika S, Chee E: Body weight as a risk factor in the elderly. *Arch Intern Med* 150:1065, 1990.
28. Green s.m. & watson r. Nutritional screening and assessment tools for older adults: literature review *Journal of Advanced Nursing*(2006) 54(4), 477-490
33. Barbosa-Silva MC, Barros AJ. Indications and limitations of the use of subjective global assessment in clinical practice: an update. *Curr Opin Clin Nutr Metab Care* 2006 93:263-269.

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