Review:

Medical Nutrition in Geriatric Health Care
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Medical Nutrition in Geriatric Health Care

Introduction

Globally, the geriatric population is increasing at a rate of 1.9% which is way ahead of the total population growth of 1.2%, and is expected to increase further. Life expectancy has increased by 30 years in the twentieth century. Over past decades, the oldest group (aged over 80) has been the most rapidly growing population segment, and would reach 10% in developed countries by 2050. (Relph 2016). Elderly adults are living longer, healthier, and more functional lives than ever before. (Krause’s 2008)

As per the World Health Organization individuals of 60 years and above constitute the elderly or geriatric population. In 2008, the geriatric population in India was 90 million which was the second largest in the world, next to China. The elderly population has increased from 5.3% in 1973 to the current level of 8%, which can be attributed to improved literacy and public health that acted as leverage in the decline of fertility rate but increase in life expectancy. The proportion of elderly citizens remains more or less similar in rural and urban areas with 8.1% and 7.9%, respectively. Among the states, it is 7% to 10%, except in Kerala 12.6%.

Growing evidence highlights the role of nutrition in the prevention and postponement of disability in elderly people. Malnutrition is a major factor responsible for morbidity and mortality in older adults. Unfortunately prevalence of malnutrition among the elderly in India is under-reported. The magnitude of malnutrition observed in the aged people is unacceptably high. Different studies in India have shown that more than 50% of elderly Indians are malnourished; underweight while more than 90% have less than recommended energy intake. (Mathew, Das et al. 2016)

Western data shows that 15% of outpatient seniors and half of hospitalized older adults are malnourished. Frail, older people who are malnourished visit their doctors twice as often as well-nourished equivalents and are three times more likely to be admitted to hospital where, on average, their stay is three days longer. Changes associated with normal aging increase nutritional risk for the seniors (older adults). Aging is characterized by diminished organ reserves, weakened homeostatic controls and increased heterogeneity among individuals. Although medical nutrition therapy is commonly being practiced in hospitals, its knowledge and practice should be disseminated to homes and communities where the focus should on health promotion, risk reduction, and disease prevention. This article outlines a role of medical nutrition in geriatric health care to improve the general health and outcomes in elderly population. (Paul and Asirvatum 2016), (Mathew, Das et al. 2016)

Nutrition in Health Promotion and Disease Prevention

The health of elderly population can be affected by physiological alteration due to aging or the pathological disorders which may arise with age. Both these situations can be influenced by the nutritional status of the individual. The health of an individual affects the quality of life. Therefore it is imperative to understand the nutritional needs of elderly and its role in preventive gerontology

The emphasis is on effective nutritional interventions in older people. In geriatrics, nutrition care is not confined to medical nutrition therapy; it has broadened with a stronger focus on healthy lifestyles and disease prevention. Better diets and more physical activity at all ages will reduce the health care expenditures as the population ages. Therefore it is critical to emphasize nutrition for health promotion and disease prevention.

Nutrition Care may include three types of preventive services:

a. Primary prevention: the focus is on nutrition in health promotion and disease prevention. Combining healthy eating with physical activity is a critical factor.

b. Secondary prevention: emphasis on risk reduction and slowing the progression of chronic nutrition-related diseases to maintain functionality and quality of life.
c. Tertiary prevention: disease management and discharge nutrition plan addressing chewing and appetite problems, diets, and functional limitations. This may required the help of dietitians.

**Theories on aging**

Though several theories have been put forth by gerontologists about why the body ages; no single theory can fully explain the complex processes of aging. Principally, the theories are of two categories: predetermined; most organ systems lose approximately 1% of their functioning each referred to as the one percent rule and accumulated damage; initiating at age 30, loss of function due to wear and tear, cells die or are not replaced. As per one another theory; malfunctioning telomeres are responsible for age-related decline in health. (Krause’s 2008) These several theories explain the heterogeneity in older populations.

**Physiologic alteration**

Aging is a normal biologic development affecting every living being. It involves certain decline in physiologic function. With age organs change and the rates of change vary among individuals and within organ systems. It is crucial to distinguish between normal changes of physiological aging and those caused by disease. Senescence is the organic process of growing older and displaying the effects of increased age. Disease and impaired function are not inevitable parts of aging. Nevertheless, there are certain systemic changes that occur as part of growing older. These changes result in varying degrees of losses of efficiency and function. Several factors such as genetics, illnesses, socioeconomics, and lifestyle determine aging progress in an individual. Moreover there may be certain degree of mismatch in some individual’s outward expression of age and chronological age. (Krause’s 2008)

**Body Composition**

With aging body composition changes; fat mass increases (especially visceral fat) and lean muscle mass decreases. Generally; sarcopenia, which constitutes the loss of muscle mass, strength, and function, can be age-related. It accelerates with a decrease in physical activity, but weight-bearing exercise can slow its pace. Sedentary lifestyle is more common in older people than younger people; women often report no leisure-time activity. Sarcopenia can significantly affect the quality of life by decreasing mobility, increasing risk for falls, and altering metabolic rates in elderly individuals. Although inactive persons have faster and greater degree of sarcopenia, it also found in active older individuals. (Taaffe and Marcus 2000)

Sarcopenic obesity is decrease in lean muscle mass coupled with increase in adipose tissue. Decrease in physical activity, in turn accelerates sarcopenia. Sedentary lifestyle is defined as a level of activity below the threshold to impart beneficial health effects of regular physical activity or, burning less than 200 calories in physical activity per day. Sedentary lifestyle poses greater risk for cardiovascular disease (CVD), hypertension, diabetes, dyslipidemia, obesity, overweight, and even death.

**Taste and Smell**

Sensory losses affect people to varying degrees, at varying rates, and at different ages. Genetics, environment, and lifestyle all play part in decline of sensory competence. Commonly experienced taste disorders in elders may have serious consequences on their health status. Poor appetite, inappropriate food choices, and lower nutrient intake may result from age-related altered sense of taste, smell and touch. Although some dysgeusia (altered taste), loss of taste, or hyposmia (decreased sense of smell) are attributable to aging, many changes are due to medications. Each of the five main flavors (salty, sweet, sour, bitter and umami) has a specific function. Taste disorders often go unrecognized or are underestimated as there is little medical literature on this issue. Their most common causes are drug use (21.7%), zinc deficiency (14.5%) and oral and systemic diseases (such as liver, kidney diseases and various neurological conditions). (Mahan LK, 2008) Untreated mouth sores, tooth decay, poor dental or nasal hygiene, and cigarette smoking are other contributing conditions. All these factors can have a negative effect on gustatory system. It is noteworthy that the most useful drugs for treating chronic diseases have a potential to cause taste disorders. So periodical review of pharmacological therapies is not just a matter of good clinical practice, but also helps to prevent or restrain taste disorders.
Immunosenescence
With aging changes occur at all levels of the immune system. Aging affects innate and adaptive immunity. There is immune dysregulation leading to chronic low grade pro inflammatory changes. There is decline in the number of T and B cells. There is decrease in the number of T regulatory cells which maintain immune homeostasis. The ability of T and B cells to interact and respond to vaccinations and infections reduces. The clinical consequences of immunosenescence is increased infection, autoimmune diseases, and cancer prevalence. The progressive decline in T-lymphocyte function and cell mediated immunity contributes to increased infection and cancer prevalence. It is likely that environmental factors and lifestyle choices affects overall immune function. Maintaining good nutritional status promotes good immune function. (Mahan LK, 2008)

Oral
Thirty percent of today’s adults 65 years and older no longer have any natural teeth, though tooth loss is no longer considered part of normal aging. But tooth loss, use of dentures, and xerostomia (dry mouth) can lead to difficulties in chewing and swallowing. Fifty percent of older adults have xerostomia. Reduced taste sensation and saliva production make eating less pleasurable and more difficult. Missing, loose, or rotten teeth or poor-fitting, painful dentures make it difficult to eat some foods. (Fulop, Larbi et al. 2007) People with these mouth problems often prefer soft, easily chewed foods. They avoid some nutritionally dense options such as whole grains, fresh fruits and vegetables, and meats. More than 400 commonly used medications can cause dry mouth. Preparing foods that are moisture-rich such as hearty soups and stews, adding sauces, and pureeing and chopping foods can all make meals easier to eat. In addition, those with poor oral health may benefit from fortified foods with increased nutrient density.

Gastrointestinal
The anorexia of aging is defined as age-related reduction in appetite and food intake, which occurs even in illness-free adults and with availability of adequate food supply. It is prevalent in about 20 % of this population (Donini, Poggiogalle et al. 2013) Anorexia may lead to protein-energy malnutrition, weight loss, numerous associated poor health outcomes, including increased mortality. Weight loss is associated with impaired muscle function, falls, decreased bone mass, immune dysfunctions, anemia, pressure ulcers, reduced cognitive functions, poor wound healing, delayed recovery from surgery, functional decline, and increased morbidity and mortality.

Gastric changes involve decreased gastric mucosal function as a consequence there is inability to resist damage such as ulcers, cancer, and infections. Reduction in the lower esophageal sphincter tone with aging results in increased gastro esophageal reflux. More than 50 % of older persons are infected with H pylori bacteria, prevalence of which increases with advanced age. There is increased incidence of gastritis and increased sensitivity to gastric irritants such as NSAIDs and bisphosphonates. In the long run chronic gastritis may affect the bioavailability of nutrients such as calcium and vitamin B12, increasing the risk of developing a chronic deficiency disease.

Achlorhydria is decreased production of hydrochloric acid in stomach. Approximately 30% of those in their 50’s have achlorhydria. (Mahan LK, 2008) Adequate hydrochloric acid and intrinsic factor are essential for the absorption of vitamin B 12. Although substantial amounts are stored in the liver, B 12 deficiency does occur. Generally the condition is misdiagnosed because the symptoms mimic Alzheimer’s disease or other chronic conditions, which includes extreme fatigue, dementia, confusion, and tingling and weakness in the arms and legs.

Colonic motility changes with aging resulting in increased frequency of constipation and diverticulosis

Renal
Generally after 30 to 35 years of age the average glomerular filtration rate, measured in creatinine clearance rates, declines by approximately 8 to 10 mL/min/1.73m²/decade. Features of the aging kidney include macroscopic and microscopic changes and important functional adaptations, none of them pathognomonic
of aging. About half of adults more than 70 years of age have a measured eGFR less than 60 mL/min/1.73m², a threshold used to diagnose chronic kidney disease (CKD). Much of the increased rate of CKD diagnosed in the elderly results from the normal structural and functional changes that occur with aging the in the kidney. Loss of renal reserves with aging has the following significance:

- More advanced disease if a new specific nephropathy develops
- Increased susceptibility to acute kidney injury (AKI)
- Toxic accumulation of renally cleared medications
- Requires medications dose adjustment based on eGFR

The progressive decline in renal function can lead to inability to excrete concentrated or dilute urine, a delayed response to sodium deprivation or sodium load, and delayed response to acid load. (Muhlberg and Platt 1999, Ng and Anpalahan 2011)

The assessment of renal function in the framework of aging is challenging. The question whether renal aging should be considered physiological or pathological process remains a much debated issue. Appropriate lifestyle modifications, as those applicable to the general population, currently represent the most plausible approach to maintain kidney health. (Bolignano, Mattace-Raso et al 2014) There are no known therapies that can reverse age related decline in GFR

**Neurologic**

It appears that some brain changes seen with age may be compensatory. (Grady and Craik 2000) There can be significant age-related declines in neurologic processes. Cognition, steadiness, reactions, coordination, gait, sensations, and daily living tasks can decline as much as 90% or as little as 10%. It is important to make the distinction between normal, age-related decline and impairment from conditions such as dementia, a disease process. (Grady 2000)

On average, the brain loses 5% to 10% of its weight between the ages of 20 and 90. But most if not all neurons are functional until death unless a specific pathologic condition is present. It now is an acceptable fact that in there is loss of memory with age. Different memories are affected to different extent. Recollection difficulties may not always indicate dementia, Alzheimer’s disease, Parkinson’s disease, or any mental disorder. (Droogsma, van Asselt et al. 2015) Many changes in memory can be attributed to environmental factors, including stress, chemical exposure, and poor diet rather than to physiologic processes. However, even mild cognitive impairment that affects approximately 20% of those older than age 70 may affect eating, chewing, and swallowing, thus increasing the risk of malnutrition.

**Nutritional status of senior citizens is adversely affected by their frailty and declining cognitive functioning**

**Pathological disorders**

**Eye disease**

Age-related macular degeneration (AMD) is the leading cause of blindness in those above 65. AMD occurs when the macula, center part of the retina, degrades resulting in loss of central vision. The macular pigment is composed of two chemicals, lutein and zeaxanthin. A diet rich in fruits and vegetables may help delay or prevent development of AMD. Zinc has also been shown to achieve similar results. As a final point, obesity and smoking are modifiable factors that can reduce progression of AMD. (Mahan LK, 2008)

Glaucoma damages optic nerve resulting from high pressure in the eye. Hypertension, diabetes, and CVD all increase the risk of glaucoma. Cataract is clouding of lens of the eye. A diet high in antioxidants such as beta-carotene, selenium, resveratrol, vitamins C and E may delay cataract development. Studies show that a high sodium intake may increase risk of cataract development. Diabetic retinopathy, a complication of diabetes is common cause of blindness. Those with moderate-to-severe vision loss may have difficulty shopping for, identifying, and preparing foods and self-feeding. All forms of vision loss can negatively affect nutritional status.
**Psychological changes**

Depression in older people is frequently undiagnosed or misdiagnosed because symptoms present atypically. Often, it is secondary to other morbid conditions like heart disease, stroke, diabetes, cancer, grief, or stress. Untreated depression can have serious outcomes for older adults. This is associated with decreased appetite, weight loss, and fatigue. Nutritional care plays an important role in addressing this condition. Providing nutrient- and calorie-dense foods, additional beverages, texture-modified foods, and favorite foods at times when people are most likely to eat the greatest quantity can be very effective. Sometimes comorbidities lead to polypharmacy and concern regarding drug-drug interactions by physician may lead to omission of antidepressants, which leaves the depression untreated.

**Pressure Ulcers**

Pressure ulcers, formerly called bedsores or decubitus ulcers, develop from continuous pressure that impedes capillary blood flow to skin and underlying tissue. Several elements contribute, but impaired mobility and urinary incontinence are key factors. The goal of therapy is to heal the ulcer by optimizing regional blood flow (by use of a stent or vascular bypass surgery), managing underlying illnesses (such as diabetes, hypothyroidism or congestive heart failure) and providing adequate caloric and protein intake (whether through use of dietary supplements by mouth or by use of tube feeding). ([Jaul 2010](#)) Notably malnutrition (inadequate protein) and undernutrition (inadequate energy intake) set the stage for its development and can delay wound healing. The wound nutrition equals whole-body nutrition, and coordinated efforts of a multidisciplinary treatment team are important. If oral intake is not adequate, enteral or parenteral nutrition is recommended. Nutrition recommendations for the treatment of pressure ulcers are as follows:

1. Adequate protein intake with a goal of 1.25 to 1.5 g/kg/day.
2. Optimal calorie requirements at 30-40 kcal/kg/day.
3. Assess the effect of medications and recommend frequent position changes

**Frailty and Failure to Thrive**

Frailty is the most problematic expression of population ageing. It is a state of vulnerability to poor resolution of homoeostasis after a stressor event and is a consequence of cumulative decline in many physiological systems during a lifetime. This cumulative decline depletes homoeostatic reserves and as a consequence minor stressor events trigger disproportionate changes in health status.

The four syndromes known to be predictive of adverse outcomes in older adults that are prevalent in patients with frailty or “geriatric failure to thrive” include impaired physical functioning, malnutrition, depression, and cognitive impairment. Symptoms include weight loss, decreased appetite, poor nutrition, dehydration, inactivity, and impaired immune function. Interventions should be directed at easily remediable contributors in the hope of improving overall functional status. The decrease in food intake associated with anorexia leads to the frailty syndrome and is a modifiable risk factor. ([Martone, Onder et al. 2013](#)) Nutrition interventions, especially that rectifying protein-energy malnutrition (PEM), are essential. ([Clegg, Young et al 2013](#))

**Quality of life**

Food and nutrition contribute to one’s physiologic, psychological, and social quality of life. Quality of life is a general sense of happiness and satisfaction with one’s life and environment. Health-related quality of life is the personal sense of physical and mental health and the ability to react to factors in the physical and social environments. To assess health-related quality of life, common measures and scales, either general or disease-specific, can be used. Because older age is often associated with health problems and decrease in functionality, quality-of-life issues become relevant.

Although the effects of malnutrition on morbidity and mortality of older people is well established, there has been little work done to investigate its relationship with quality of life (QoL) in this population. Systematic review and meta-analysis results suggest likeliness of malnourished individuals to experience poor QoL. Consistent with this, interventions designed to improve nutritional status can also lead to significant improvements in QoL, both physical and mental aspects. However, the results should be interpreted with
caution in view of the poor quality of the included studies and the heterogeneity of methods employed in the assessment of both nutritional status and QoL. (Rasheed and Woods 2013)

**Functionality**

Functionality describes physical abilities and limitations of an individual to remain ambulatory. It is the ability to achieve self-care, self-maintenance, and physical activities, correlates with independence and quality of life. Such individual self-performance skills needed in everyday life, Activities of daily living (ADLs), and instrumental activities of daily living (IADLs) are used to monitor physical function. Many nutrition-related diseases affect functionality of elderly individuals. Inadequate nutrient intake may hasten loss of muscle mass and strength, which can have a negative effect on performing ADLs.

**Weight Maintenance**

**Obesity**

The prevalence of obesity has increased among older adults. It is now well known that obesity is linked to increased mortality and contributes to many chronic diseases: type 2 diabetes, heart disease, hypertension, arthritis, dyslipidemia, and cancer. Though the mortality risk of obesity may lessen with age there are still metabolic and functional benefits to weight loss in the obese older adult. Obesity leads to progressive decline in physical and function IADLs which may result in enhanced frailty.

Weight-loss interventions improve physical performance, quality of life for many obese seniors. Lifestyle modifications that include diet, physical activity, and behavior modification techniques are the most effective. Weight loss therapies should be targeted to maintain muscle and bone mass in obese older adults. Weight loss of 10% of total body weight over 6 months should be the initial goal. Cautious weight loss is pursued in the context of regular exercise and appropriate calcium and Vitamin D supplementation.

**Underweight and Malnutrition**

There are several elements leading to general malnutrition in the elderly that result in depletion of muscle including (protein-energy malnutrition (PEM), sarcopenia and cachexia. (Agarwal, Miller et al. 2013)

The following criteria for the diagnosis of malnutrition have been recommended in a consensus statement from the Academy of Nutrition and Dietetics (Academy) and the American Society for Parenteral and Enteral Nutrition (ASPEN) (White JV, 2012):

**Two or more of the following six characteristics:**

- Insufficient energy intake
- Weight loss
- Loss of muscle mass
- Loss of subcutaneous fat
- Localized or generalized fluid accumulation that may mask weight loss
- Diminished functional status as measured by handgrip strength

Weight - Serial measurements of body weight offer the simplest screen for nutritional adequacy and change in nutritional status in older adults.

Obtaining periodic body weights may be challenging, particularly in frail patients

Weight loss is considered to be clinically significant with the following parameters (Zawada ET, 1996):

- ≥2 percent decrease of baseline body weight in one month
- ≥5 percent decrease in three months

Weight loss leads to not only loss of fat but also loss of muscle and bone. This increases the propensity to fall, fracture a hip or develop frailty. Loss of fat increases the potential toxicity of fat-soluble drugs and a decrease
in albumin has a similar effect on protein-bound drugs. Finally, weight loss is often a harbinger of occult disease, which, if detected early, may be treatable.

Nutrition screening and assessment

There is no gold standard for estimating malnutrition among the elderly. Body mass index (BMI) predicts disease risk both in those termed underweight and in those who are obese. The WHO categorizes underweight as BMI < 18.5, normal 18.5-24.9, overweight 25-29.9, obese 30-39.99, and extreme obesity > 40. However, BMI may be unreliable in the presence of confounding factors such as edema or ascites, and may not identify significant unintentional weight loss if used as a single assessment.

Nutritional screening tools

Malnutrition risk increases with age and despite significant medical advances. It remains a significant and highly prevalent public health problem. Early identification and appropriate nutrition support may help to reverse or halt the malnutrition and its negative outcomes. A nutrition screening process is recommended to help detect people with protein-energy malnutrition (PEM) or at malnutrition risk.

A number of screening tools have been developed for identifying older adults at risk for poor nutrition:

- The Malnutrition Universal Screening Tool (MUST) incorporates BMI, weight loss in three to six months, and anorexia for five days due to disease. When neither height nor weight is available, the midarm circumference and subjective assessment of physical characteristics, such as very thin, can be used instead. It is commonly used in the United Kingdom and is particularly sensitive for recognition of protein energy undernutrition in hospitalized patients.

- The Malnutrition Screening Tool (MST) was developed for use in acutely hospitalized patients and also validated for use in cancer patients (average age 57 to 60 years, range 15 to 89). It asks two simple questions: "Have you been eating poorly because of a decreased appetite?" and "Have you lost weight recently without trying?" The sensitivity of the MST in hospitalized patients ranges from 74 to 100 percent with a specificity of 76 to 93 percent when compared with the Subjective Global Assessment.

- The Mini Nutritional Assessment (MNA) consists of a global assessment and subjective perception of health, as well as questions specific to diet, and a series of anthropomorphic measurements. It has been widely validated and is predictive of poor outcomes. The Mini Nutritional Assessment-Short Form (MNA-SF) uses six questions from the full MNA and can substitute calf circumference if BMI is not available. A validation study demonstrated good sensitivity compared with the full MNA.

The two screening tools in the highest quartile for sensitivity (>83 percent) and specificity (>90 percent) were the MNA (SF) and the MST.

Compared with younger adults, undernutrition in older individuals is both more common and may have greater impact on outcomes, including physical function and health care utilization. Inadequate energy intake is common in hospitalized older adults, with increased risk associated with poor appetite, diagnosis of infection or cancer, delirium, and need for assistance with feeding.

Involuntary weight loss may be driven by variety of factors, including:

- Inadequate dietary intake
- Appetite loss (anorexia)
- Disuse or muscle atrophy (sarcopenia)
- Inflammatory effects of disease (cachexia)

or a combination of these factors.

Inadequate dietary intake — There are multiple causes of weight loss due to inadequate nutrient intake. These include social (eg, poverty, isolation), psychological (eg, depression, dementia), medical (eg, edentulism, dysphagia), and pharmacologic issues.
Social factors - Social factors contributing to weight loss include:

● Increased likelihood of isolation at mealtimes.

Several studies have demonstrated that older adults who eat in the presence of others consume more than those who eat alone.

● Financial limitations affecting food acquisition.

Individuals with fixed incomes may use money previously spent on food for medications and other needed items.

Medical and psychiatric factors - The most important medical and psychiatric causes of weight loss in older adults are malignancy and depression.

● Malignancy was identified as the cause for weight loss in 9 percent of older patients in a study of medical outpatients, and was second to depression as the most frequent identifiable cause of undernutrition.

● Depression and dysphoria are common in older adults and often remain unrecognized and undertreated. Depression is an important cause of weight loss in older patients in the community.

● Dysphagia has a negative effect on energy intake.

Dysphagia occurs in approximately one-half of patients with acute first-ever stroke or with Parkinson disease. Oropharyngeal dysphagia may occur due to stroke, Parkinson disease, amyotrophic lateral sclerosis, Zenker’s diverticula, and other motility or structural disorders.

● Other important medical etiologies to consider include:

● Endocrine disorders (hyperthyroidism, new onset diabetes mellitus).

● End-organ disease (congestive heart failure, end-stage renal disease, chronic obstructive pulmonary disease, hepatic failure).

● Gastrointestinal disorders (ischemic bowel, inflammatory bowel disease, pancreatic insufficiency, peptic ulcer disease).

● Infections (tuberculosis).

● Rheumatologic disorders (polymyalgia rheumatica, rheumatoid arthritis).

● Neurologic conditions (Parkinson disease, chronic pain).

● Alzheimer disease (especially among those with behavioral and psychological symptoms).

● Drug or alcohol dependence.

● Medication side effects (digoxin, opioids, serotonin-reuptake inhibitors, diuretics).

Additionally, medical or dental conditions in older adults may impair the ability to eat. Paralysis from stroke, severe arthritis, hand tremors, and dementia may lead to routine need for feeding assistance from others.

Chewing difficulty puts older adults at risk for poor intake. In a study of noninstitutionalized older adults, being edentulous doubled the risk for significant weight loss over a one-year period, after adjusting for gender, income, age, and baseline weight.

Physiologic factors - Physiologic factors associated with weight loss include age-related decrease in taste and smell sensitivity, delayed gastric emptying, early satiety, and impairment in the regulation of food intake.

● Age raises the threshold for odor detection and lowers perceived odor intensity. The number of taste buds remains constant, but thresholds for recognition of salt and other specific tastes increase. Impaired taste and smell likely alter the cephalic phase of digestion, affecting learned associations between the taste and smell of food with signals involved in meal initiation, volume of food intake, and meal termination.

● Decrease in the rate of gastric emptying in older adults may result in prolonged antral distension with reduced hunger and increased satiety.
Aging may influence production of, and/or central nervous system sensitivity to, several digestive hormones thought to be involved in satiety. Glucagon, glucagon-like peptide-1 (GLP-1), cholecystokinin (CCK), leptin, and ghrelin are peripheral satiety signals and appear to be less well-detected by the brain with increased age.

**Nutrition needs in different health conditions and their management**

Many older adults have special nutrient requirements because aging affects absorption, use, and excretion of nutrients.

**Sarcopenia**

Sarcopenia is a syndrome characterized by the loss of muscle mass, strength, and performance

Unlike cachexia, sarcopenia does not require the presence of an underlying illness. Also, whereas most people with cachexia are sarcopenic, most sarcopenic individuals are not considered cachectic. Sarcopenia is associated with increased rates of functional impairment, disability, falls, and mortality.

Loss of muscle mass, accompanied by decreased muscle strength, can occur in overweight individuals (sarcopenic-obese), as well as in normal and underweight individuals.

The causes of sarcopenia are multifactorial and can include disuse, changing endocrine function, chronic diseases, inflammation, insulin resistance, and nutritional deficiencies

Causes of sarcopenia include endocrine changes, activation of proinflammatory cytokines, reduced alpha motor units in the spinal cord, decreased physical activity, and suboptimal protein intake.

Reductions in testosterone and estrogen that accompany aging appear to accelerate the development of sarcopenia. Relative deficiencies of estrogen and testosterone contribute to muscle catabolism.

Testosterone replacement may increase muscle mass, but studies have not demonstrated similar benefit for estrogen replacement. Selective androgen receptor modulators (SARM), such as enobosarm, are a promising potential treatment for sarcopenia. Insulin resistance increases with age. Insulin inhibits muscle breakdown and the reduction of insulin action on muscle may contribute to muscle catabolism.

Insulin resistance increases with age. Insulin inhibits muscle breakdown and the reduction of insulin action on muscle may contribute to muscle catabolism

Physical activity declines with age. In the United States, 28 to 34 percent of adults aged 65 to 74 and 35 to 44 percent of adults ages 75 or older are inactive. Inactivity exacerbates ongoing muscle loss and increases proportion of body fat mass.

Inadequate protein intake can also contribute to sarcopenia. In a small randomized study of postmenopausal women, consumption of inadequate dietary protein (0.45 g/kg/d) compared with adequate intake (0.92 g/kg/d) for six weeks led to deterioration in strength and lean body mass.

MUAC measures the circumference of the left upper arm at the mid-point between the tip of the shoulder and the tip of the elbow (olecranon process and the acromion). MUAC of less than 22 cm for women and 23 cm for men are suggestive of chronic energy deficiency. Although suggestive of malnutrition, it is unclear whether MUAC predicts mortality and morbidity. The MUST screening tool uses mid-arm circumference measures.

Protein needs do not appear to change significantly with age, although studies evaluating protein intake in older adults have shown wide variation in optimal protein requirements. A meta-analysis of data from 19 studies of nitrogen balance in older adults found no significant effect of age on the amount of protein required per kilogram of body weight. (Rand WM, 2003)

The Institute of Medicine has determined that the Recommended Dietary Allowance (RDA) for protein for men and women 51 years of age and older is 0.80 g/kg body weight/day.

Lift dietary restrictions whenever possible. In one study, undernutrition (average weight loss >1 pound per month, serum albumin <3.5 g/dL) was associated with dietary restrictions. (Buckler DA, 1994) Fifty-nine percent of the patients with weight loss and 75.2 percent of those with hypoalbuminemia were on some type...
of dietary restriction. In older, nutritionally high-risk adults with diabetes, regular monitoring of blood glucose and adjustment of medication is preferable to dietary restriction or even a "no concentrated sweets" prescription. The short-term substitution of a regular diet for a diabetic diet increased calorie consumption and did not cause gross deterioration of glycemic control in a study of chronic care patients with type 2 diabetes.

Consider ways to supplement the patient’s diet. Increase the nutrient density of food. For example, increase protein content by adding milk powder, whey protein (found in many health food stores), egg whites, or tofu. Increase fat content by adding olive oil (or other "good fat") in preparation of sauces, fresh or cooked vegetables, and grains or pasta. If weight does not improve, offer daytime snacks between meals.

- Give a daily multivitamin and mineral supplement until the cause of inadequate intake is determined.

**Alzheimer's dementia**

Weight loss and undernutrition are commonly described in patients with Alzheimer's disease (AD) and have been associated with various adverse outcomes. Therefore, it is important to know what the best approach is to community-dwelling AD patients with a risk of developing a poor nutritional status. However, there is currently no evidence on which to base nutritional recommendations. Expert based recommendations state that the nutritional status should be part of the work-up of all AD patients. If weight loss of 5% or more has occurred in 3-6 months or if the mini-nutritional assessment (MNA) classifies a patient as undernourished, a nutritional intervention should be started. The intervention should be multifactorial and encompass treatment of the underlying proposed causes and risk factors of weight loss and undernutrition as well as improvement of the nutritional status by increasing energy and protein intake combined with daily physical activity. (Droogsma, van Asselt et al. 2015)

Research indicates that the chronic consumption of flavonoids is associated with cognitive benefits in adults with mild cognitive impairment and neurodegenerative disease. Long term consumption of flavanone-rich 100% orange juice over 8 wk was found to be beneficial for cognitive function in healthy older adults. (Kean, Lamport et al. 2015)

**Vitamin D deficiency**

Lack of sun exposure, impaired skin synthesis of vitamin D, and decreased hydroxylation in the kidney with advancing age contribute to the low vitamin D levels in many older adults. Use of vitamin D for fall prevention in senior patients at increased risk is recommended. A large trial VITAL is underway to investigate the efficacy of vitamin D supplementation on the prevention of cancer and cardiovascular diseases.

Inadequate vitamin D has been linked with muscular weakness, depression and increased risk of falls and fractures. Patients with Vitamin D insufficiency may also have relative hypocalcemia and high serum PTH levels.

Monitoring of serum levels of 25-hydroxyvitamin D is recommended for those at high risk, with the goal of achieving levels > 30ng/ml. Testing at 3-4 months following initiation of vitamin D supplements, if needed, should be done to assure that the target has been achieved. The recommended dietary allowance of vitamin D for adults through age 70 years is 600 IU per day with RDA increasing to 800 IU after age 71 years.

**Vitamin B12 deficiency**

Vitamin B-12 deficiency is of common occurrence among older adults all over the world. Low vitamin B-12 concentrations have been associated with neuropsychiatric damage in cases of mild deficiency (Selhub, Troen et al. 2010) and a significant health problem in elderly individuals.

Malabsorption of food-bound vitamin B-12 is the main cause of low circulating vitamin B-12 concentrations among older adults. (Allen 2009) Absorption of food-bound vitamin B-12 is complex and requires several steps, that include:

1. Release vitamin B-12 in stomach acidic environment from its matrix
2. Binding to haptocorrin
3. Digestion of haptocorrin complex by pancreatic proteases and release of vitamin B-12

4. Binding to intrinsic factor

5. Absorption of intrinsic factor B-12 complex in the ileum.

Atrophic gastritis causes impaired release of vitamin B-12 from its carriers in food. It may occur in up to 50% of older adults where some Asian studies have show even higher prevalence. (Weck and Brenner 2006) It has been associated with low circulating vitamin B-12 concentrations and high circulating methylmalonic acid (MMA) concentrations. (Lewerin, Jacobson et al. 2008) Along with the fact that atrophic gastritis is considered to be an important factor contributing to vitamin B-12 deficiency, it is most important to gain better insight in the bioavailability of vitamin B-12 from different food sources. Particularly in cases of modest vitamin B-12 deficiency, targeted dietary recommendations may contribute to reversing low circulating vitamin B-12 concentrations.

In a clinical study the associations between dietary sources of vitamin B-12 (meat, fish and shellfish, eggs, dairy) and serum vitamin B-12, using cross-sectional data 600 adults (≥65 years) was evaluated. It was found that higher intakes of dairy, meat, and fish and shellfish were significantly associated with higher serum vitamin B-12 concentrations, where meat and dairy-predominantly milk were the most potent sources. Egg intake did not significantly contribute to higher serum vitamin B-12 concentrations. Thus, dairy and meat were the most important contributors to serum vitamin B-12, followed by fish and shellfish. (Brouwer-Brolsma, Dhonukshe-Rutten et al. 2015)

**Anorexia**

Anorexia, the decrease in appetite, in older adults is influenced by multiple physiological changes. Food intake gradually diminishes with age. Much of the intake reduction in early old age is an appropriate response to decreased energy needs due to reduced physical activity, decreased resting energy expenditure (REE), and/or loss of lean body mass.

Changes in taste and smell lead to a decreased desire to eat and early satiety develops with age, related to gastrointestinal changes.

Appetite regulation is further affected by illness, drugs, dementia, and mood disorders.

**Cachexia** - Cachexia has been defined as a "complex metabolic syndrome associated with underlying illness, and characterized by loss of muscle with or without loss of fat mass". It is associated with increased morbidity. Anorexia, inflammation, insulin resistance, and increased muscle protein breakdown are frequently associated with cachexia.

Cachexia is distinct from starvation, age-related loss of muscle mass or psychiatric, intestinal, or endocrinologic causes of weight loss. Cachexia involves many dysregulated pathways, leading to an imbalance between catabolism and anabolism. Because of the presence of underlying inflammation and catabolism, cachexia often is resistant to nutritional intervention. Despite the evidence supporting inflammation as an essential mechanism for cachexia, antiinflammatory medications or drugs targeting cytokines have not demonstrated beneficial effects. Potential drugs such as thalidomide, selective cyclooxygenase (COX) inhibitors and anti-tumor necrosis factor (TNF) agents have shown variable efficacy in treating cachexia.

Cachexia usually occurs in the setting of underlying illness involving a cytokine-mediated response. Such illnesses include cancer, end-stage renal disease, chronic pulmonary disease, heart failure, rheumatoid arthritis, and acquired immunodeficiency syndrome (AIDS)

Although elevated proinflammatory cytokines (especially IL-1, IL-6 and TNF-a) are commonly seen in older adults, levels are higher in those with cachexia

**Anaemia**

In the elderly, anemia is usually of multifactorial in origin, including chronic inflammation, chronic kidney disease, nutrient deficiencies and iron deficiency (approximately two-thirds of all cases). The remaining cases are unexplained (unknown etiology). In the elderly, the classic diagnosis of anaemia, based on the mean
corpuscular volume associated with a low hemoglobin level, might not be accurate. A predefined standardized diagnostic procedure should be followed. In a common case of frail elderly patients, all investigations should be carefully considered and invasive examinations undertaken where justified (risk-benefit balance). Nevertheless, most cases of anemia require further investigation and the underlying cause should be identified and treated whenever possible. (Andress, Serraj et al. 2013)

**Protein supplementation**

Protein supplementation produces a small but consistent weight gain in older people and its use reduced mortality in older people who were undernourished. (Milne, Potter et al. 2009) Dietary protein supplementation also improved the reaction time but had no significant effect on any of the cognitive domain scores. (van der Zwaluw van der Rest et al. 2014)

**Protein intake and cardiovascular health**

The beneficial effects of high protein intake on cardiovascular health have been well recognized. (Wolfe 2006) An epidemiological study showed that the relative risk of ischemic heart disease among women was highest in those with the lowest protein intake and lowest in those with the highest intake of dietary protein. (Hu, Stampfer et al. 1999) Protein supplementation has been associated with reduction in blood pressure. (Townsend, McFadden et al. 2004) It could be explained by the vasodialatory effect of protein secondary to stimulation of nitric oxide synthesis by the arginine component of dietary protein. (Luiking, Ten Have et al. 2012) Supplementation of the diets of elderly individuals with essential amino acids for 1 month significantly reduced blood and liver triglycerides. (Borsheim, Bui et al. 2009)

**Protein intake and bone health**

Bone strength is directly affected by the torque placed on the bones as a result of muscular contraction. (Pang and Eng 2005) Because higher levels of protein intake increases strength in elderly, increased protein intake may have an indirect effect on bone strength by enabling generation of greater muscular force.

High dietary protein intake, due to its acid-producing load, increases urinary calcium excretion (with potential risk for bone loss and calcium stone formation). Urinary calcium excretion does appear to increase when dietary intake of protein increases and this could pose a long-term risk for nephrolithiasis. However, two small randomized trials that looked at bone metabolism found evidence that increased dietary protein may decrease bone resorption. One of the trials found that increased intestinal absorption of calcium was primarily responsible for the increased urinary excretion of calcium and that the excreted calcium was not coming from bone.

**Protein intake in weight management and metabolic disease**

The benefit of a diet in which protein comprises a relatively high proportion has been well documented in terms of maintaining lean body mass while fat mass is being lost. This could be explained, at least in part, by the fact that total caloric intake is reduced significantly during hypocaloric feeding, so that an increased percentage of dietary protein may be necessary just to achieve the same absolute amount of protein intake normally eaten in a conventional American diet. However, a high level of protein intake also provides beneficial effects on weight management even when caloric demands are equal to or greater than energy expenditure. A thermogenic response to protein intake, which results from the stimulation of protein turnover, (Wolfe 2006) is one mechanism by which protein intake can benefit maintenance of energy balance. There is a metabolic cost of both protein synthesis and breakdown. (Wolfe 2006) The energy cost of protein turnover constitutes a significant proportion of resting energy expenditure, and stimulation of protein turnover by increased protein intake increases energy expenditure via thermogenesis. If caloric intake remains constant, increased thermogenesis favors maintenance of a lower body weight. Increased protein intake may also aid in the maintenance of energy balance and weight management by having a satiating effect. (Paddon-Jones, Westman et al. 2008) Increased protein and/or amino acid intake may benefit the metabolic state by improving insulin sensitivity. (Gannon, Nuttall et al. 2003) Reducing circulating lipid levels. (Borsheim, Bui et al. 2009) Importantly, an increase in protein intake also means a reduction in carbohydrate and/or fat intake to maintain caloric balance. Excess fat and excess carbohydrate, in particular, are linked to a variety of adverse health consequences in elderly. (Swinburn, Boyce et al. 1991) (Wolever Gibbs et al. 2013) Higher-protein diets may improve weight maintenance, as illustrated by the results of a
study of 60 subjects randomly assigned to a low-fat, high-protein versus low-fat, high-carbohydrate diet after completing a four-week very-low-calorie diet. Among the subjects who completed the three-month study (n = 48), the high-protein diet group had significantly better weight maintenance (between group difference of 2.3 kg).

Thus, it may be that benefits of increased protein intake on weight management and metabolic disease are direct results of the increased availability of amino acids, as well as indirectly as a result of decreased intakes of carbohydrate and/or fat.

**Optimal protein intake**

The current Recommended Dietary Allowance (RDA) for protein (0.8 g/kg/day) is a value that was first derived in 1943 in order to define the minimal amount of protein that would enable troops in World War II to avoid protein malnutrition. (Wolfe 2015) Despite the quantity of data that have been generated since then on the topic of optimal protein intake, the value has remained unchanged. The RDA can be viewed as a reasonable minimal level of protein intake. The optimal level of protein intake in the elderly is almost certainly greater than the RDA. There have been numerous studies in which a variety of endpoints have been used to compare the effects of consuming the RDA of protein to consuming greater amounts of protein, particularly in the elderly. (Wolfe, Miller et al. 2008) Although the magnitude of benefit from a higher protein intake varies among studies, depending on the specific experimental design, participants, and endpoint(s) measured, among other factors, there has never been a study in which individuals who consumed the RDA for protein experienced benefits similar to those of individuals who consumed protein in excess of the RDA.

The most practical expression of the recommended protein intake is found in the Dietary Guidelines for Americans (DGA), promulgated by the US Department of Agriculture. (McGuire 2011) These recommendations are intended to translate the most recent nutrition research into dietary guidelines expressed in the context of real foods and daily meal plans. When recommended food intakes from the DGA are broken down into their components, the recommended protein intake is approximately 1.5 g/kg/day. (Fulgoni 2008)

In older individuals, protein intakes greater than the RDA promote better health outcomes by positively affecting a wide range of body systems. Rather than relying entirely on the results of nitrogen-balance studies, recommendations for protein should, therefore, take into account the impact protein has on a variety of endpoints related to health outcomes. The essential amino acids (EAA)-to-calorie ratio for high-protein foods must also be considered when comparing protein-rich foods. High-quality proteins, such as milk proteins, enable EAA requirements to be met with less caloric intake compared with lower-quality proteins. This is reflected by the scoring of their quality by the digestible indispensable amino acid score (DIAAS).

**Food-based fortification**

Early intervention with nutritional support has been found to stop weight loss in older people malnourished or at risk of malnutrition. Enriched food could be a more attractive alternative to improve meals, than conventional oral nutritional supplements. A meta-analysis of four studies that provided results on caloric and protein intake showed that food-based fortification yielded positive results in the total amount of ingested calories and protein. Simple dietary interventions based on the food-based fortification or densification with protein or energy of the standard diet could be considered in patients at risk of malnutrition as it is simple, cost effective and has positive results in protein and calories intake. (Morilla-Herrera, Martin-Santos et al. 2016)

**Geriatric health policy in India: the need for scaling-up implementation**

With the increase in geriatric population in India, the Central government established the National Policy for Older Persons in 1999 to promote the health and welfare of senior citizens in India. A major strategy of this policy is to encourage families to take care of their older family members. The policy also encourages voluntary organizations to supplement the care provided by the family and provide care and protection to vulnerable elderly people. However the policy lacks measures to address the issue of malnutrition in elderly. Due to breakdown of the joint family system and the migration of the younger generation to the towns and cities, the elderly parents in the villages are left to fend for themselves. Too old to work and with little or no source of income, the elders are struggling even to satisfy their basic needs especially nutritious diet.
As a country we should take cues from other nations who have pioneered in elderly care and have constantly evolved to identify and face the various malnutrition challenges that come up. The Rural Unit for Health and Social Affairs Department of a well-known Medical College in South India has developed a “senior recreation day care” model which proves to be a useful replicable model to improve the quality of life and nutritional status of the elderly in the lower rungs of society. More than a decade since its inception, it is now the right time to assess the implementation of our geriatric health policy and scale-up programs so that the elderly in our country, irrespective of urban and rural, will have a dignified and good quality life. (Paul and Asirvatham 2016)

Diet recommendation of elderly Indians

The elderly population is prone to various nutritional deficiencies. Therefore, the elderly need nutrient-rich foods rich in calcium, micro-nutrients and fiber. Apart from cereals and pulses, they need daily at least 200-300 ml of milk and milk products and 400 g of vegetables and fruits to provide fiber, micro-nutrients and antioxidants. Inclusion of these items improves the quality of the diet and bowel function. Flesh foods and eggs should be included if possible. Food needs to be well cooked, soft and less salty and spicy. Small quantities to be consumed at more frequent intervals and adequate water should be consumed to avoid dehydration, hyponatraemia and constipation.

The recommended daily intake of fat oil should not exceed 20 g in elderly. Use of ghee, butter, vanaspati and coconut oil should be limited. The elderly need foods rich in protein such as pulses, toned milk, egg-white etc.

**Guideline 15**

Include micronutrient rich foods in the diets of elderly people to enable them to be fit and active

Rationale: Senior citizens need more of vitamins and minerals to remain healthy and active

- Body composition changes with advancing age and these changes affect nutritional needs of the elderly.
- Elderly or aged people require reduced amounts of calories, as their lean muscle mass and physical activity decrease with ageing.
- Elderly are more prone to diseases due to lowered food intake, physical activity and resistance to infection.
- Good/healthy food habits and regular comfortable level of physical activity are required to minimise the ill effects of ageing and to improve the quality of life.
- Elderly need adequate amounts of protein, carbohydrates, fat, vitamins, minerals and dietary fibre.
- Elderly need more calcium, iron, zinc, vitamin A and antioxidants to prevent age-related degenerative diseases and for healthy ageing.

Summary and Conclusion

The prevalence of malnutrition observed in the aged people is unacceptably high. The malnutrition in elderly, is a multifactorial condition associated with socio demographic, somatic, and functional status. Hence, it is recommended that the treatment of malnutrition should be multifactorial, and the treatment should be multidisciplinary.

Desirable dietary habits and healthy lifestyle practices have morbidity and mortality benefits. Aging adults are at risk of nutritionally inadequate diets especially in relation to protein, vitamins D, B1, B12, fluid and other food components. Interventions aimed at ensuring dietary adequacy should also consider the social and
cultural aspects of eating and meal availability. The health problems associated with aging such as frailty, depression, incontinence and chronic non-communicable diseases should be identified in both individual and community level before dietary and other health interventions are implemented. In older adults, dietary and health promoting interventions should then focus on maximizing function and quality of life, be acceptable and finally, measurable in terms of effectiveness. (Wahlqvist and Savage 2000)

Further research is needed to develop appropriate guidelines for nutritional screening and interventional programs among geriatric population. (Volkert 2013)

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Dear Doctor,

The geriatric population is increasing at a rate of 1.9% which is much ahead of the general population growth of 1.2%, and is expected to increase even further. Life expectancy has increased by 30 years in the twentieth century. It is now well known that changes associated with normal aging increase nutritional risk for older adults. With age there is diminished organ system reserves, weakened homeostatic controls, and increased heterogeneity among individuals, influenced by genetic and environmental factors.

Nutritional requirements of elderly population are determined by multiple factors, including specific health problems and related organ system compromise; an individual's level of activity, energy expenditure, and caloric requirements; the ability to access, prepare, ingest, and digest food; and personal food preferences.

It gives me immense pleasure to present to you this QMR issue by eminent physician Dr. Preeti Chhabria, Consultant, Geriatrics and Internal Medicine, Sir H. N. Reliance Foundation Hospital and Research Centre, Mumbai. In this issue, she will enlighten us on assessment of nutrition in the older adult, as well as the etiology, evaluation, and treatment of weight loss, overnutrition, and specific common nutrient deficiencies.

With best regards,

Dr. Balaji More
Vice President - Medical

Medical Nutrition in Geriatric Health Care

1. Your comments on this issue of Q.M.R.

2. Please suggest medical topics for our QMR which could be printed in future.

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