

Review

Eating disturbances in the elderly: A geriatric-psychiatric perspective

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Abstract. The prevalence of malnutrition among older adults is increasing, leading to poor health outcomes and increased mortality. This review sheds light on the different etiologies of eating disturbances in the elderly and discusses assessment tools and treatment strategies. Older adults are found to be more prone to nutritional deficiencies and weight loss due to age related physiological and psychosocial changes, in addition to pathological medical and psychiatric disorders. The short form of the Mini Nutritional Assessment is considered the most commonly used screening tool in older persons. Individuals identified as malnourished or at high risk of malnutrition would benefit from comprehensive treatment plans according to the underlying etiology. Those involve environmental changes, oral nutritional supplements and ultimately pharmacotherapy.

Keywords: Malnutrition, anorexia, cachexia, appetite, involuntary weight loss, older population

1. Introduction

Nutrition is one of the most important determinants of physical and mental health, and plays a key role in successful aging. Given the increase in life expectancy, older adults have become a rapidly growing portion of the world's population. In the United States, the prevalence of adults aged 65 years and above increased from 36.6 million in 2005 to 47.8 million in 2015 (a 30% increase) and is predicted to more than double by 2060, reaching around 98 million [1]. With population aging, eating disturbances and malnutrition have increasingly become an important health issue to address. Malnutrition can

be defined as “a state resulting from lack of intake or uptake of nutrition that leads to altered body composition (decreased fat free mass) and body cell mass, leading to diminished physical and mental function and impaired clinical outcome from disease” [2].

Although there have been no uniformly established diagnostic criteria for malnutrition, clinicians and researchers have relied on anthropometric measures, biochemical markers and specific screening tools to identify patients suffering from malnutrition [3]. Its prevalence is reported to range between 5–10% among community-dwelling older adults, compared to 30–61% among hospitalized elderly patients, and 12–85% among residents of long-term and subacute care facilities [4–6]. Despite the availability of various nutrition assessment tools, less than 40% of malnutrition cases are identified upon hospital admission [7]. The etiology of malnutrition appears to be complex and multifactorial. It involves physiological, psychological, social and economic factors, often summarized using the acronym the “nine d’s” comprising dementia, dysgeusia, dysphagia, diarrhea,

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depression, disease (acute, chronic), poor dentition, dysfunction (functional disability), and drugs [8]. Large longitudinal studies such as the National Health and Nutrition Examination Surveys (NHANES) [9] and the Baltimore Longitudinal Study [10] have shown a critical decline of weight and energy intake with aging, leading to “anorexia of aging” as the most common eating disturbance in the elderly. Anorexia of aging can thus be physiological, due to age-related modifications in the digestive system, appetite, body composition and energy requirement/expenditure. However, it can become pathological, when comorbid medical and psychiatric diseases co-occur along with those physiological changes. Furthermore, social, economic and cultural factors may affect older adults’ eating patterns [11].

Regardless of the causes, malnutrition in the elderly has significant medical and socio-economic impact on patients and families: unintentional weight loss, a major manifestation of malnutrition, has been shown to be related to frailty, sarcopenia, dementia, recurrent falls and worse health outcomes [12]. Older hospitalized patients with malnutrition are reported to have longer lengths of stays, higher healthcare costs, and increased mortality [13]. Adequate nutritional support is found to be essential to regulate the older adult’s immune system, prevent infections, and improve the musculo-skeletal system, functional status and neurocognitive functions [14].

A careful nutritional evaluation is hence one of the main components of a comprehensive geriatric assessment to implement necessary treatment plans to achieve successful aging in the elderly.

The aim of this paper is to review the multiple etiologies of eating disturbances in the elderly and discuss the most up-to-date assessment tools and management strategies for this under-recognized geriatric syndrome. For this purpose, we reviewed the PUBMED database for relevant articles published up to July 2018 using the following keywords: ‘malnutrition’, ‘eating disorders’, ‘appetite’, ‘body weight and composition’, ‘nutrition’, “elderly”, “older adult”, “geriatric” and “anorexia”.

2. Etiologies of eating disturbances in the elderly

2.1. Age-related physiological changes

1. Gastrointestinal

Aging gives rise to a disruption in gustatory and olfactory sensations leading to impairment of the

cephalic phase of digestion (phase I) that regulates appetite and food ingestion via sensory outputs such as sight and smell, before or while the food is being eaten [15]. Additionally, poor dentition/tooth loss, commonly seen in the elderly with dry mouth, may also result in chewing and swallowing difficulties and impaired digestion [16]. Older adults tend to have consequently longer duration gastro-esophageal reflux due to reduced peristalsis and impaired lower esophageal sphincter contraction [17]. Moreover, changes of the myenteric plexus with aging leads to impaired gastric emptying which causes distention and earlier satiety [18]. Also, older adults may have reduced gastric acid and pepsin secretion, commonly related to *Helicobacter pylori* infection. Higher prevalence of hypochlorhydria and achlorhydria are seen which may compromise oral drug bioavailability and absorption of food, vitamins (vitamin B12, vitamin D), and minerals (calcium, iron) [19]. Furthermore, decrease in pancreatic enzymes, bile acids and liver enzymes’ activity notably the cytochrome P450 system, contribute to impairment of absorption, digestion and enhance drug-drug interaction and the risk of adverse events [20].

2. Neuroendocrine

Central and peripheral hormones play a role in the regulation of appetite. Central hormones include opioids, neuropeptide Y (NPY), galanin and orexins; and peripheral hormones are cholecystokinin (CCK), ghrelin, glucagon like peptide-1 (GLP-1), peptide YY (PYY), leptin, adiponectin, insulin, glucagon, amylin, corticotrophin-releasing factor (CRF), and serotonin [21]. Satiety seems to be modulated by a reduction of neurotransmitters that induce appetite also known as orexigenic (e.g. ghrelin, NPY, opioids) and an increase in those that decrease appetite (anorexics) such as CCK, GLP-1, leptin and CRF. CCK, released from the intestine after food ingestion, is reported to be elevated in older adults, causing greater satiety [22]. In a similar pattern, GLP-1 another potent anorexic, involved in stimulating insulin secretion and delaying gastric emptying, was shown to have increased physiological levels in elderly [23]. Leptin is produced mainly in adipose cells and regulates energy intake according to fat stores. Older adults tend to have high levels of leptin because of increased adiposity, increasing satiety [24]. On the other hand, ghrelin is an orexigenic peptide produced in the gastric fundus that activates nitric oxide (NO) in the hypothalamus and stimulates growth hormone (GH) secretion. NO and GH

are also anabolic hormones that induce food intake. Studies have shown a small decrease in ghrelin levels in older adults compared to younger persons, which may contribute to their anorexia [25].

Appetite is further regulated in the central nervous system via the hypothalamus, particularly through the ventromedial hypothalamic nucleus (satiety center), the lateral hypothalamic area (hunger center) and the arcuate nucleus [22]. These 3 areas are connected to the amygdala and the nucleus tractus solitarius where the integration of peripheral satiety signals with hypothalamic and supra-hypothalamic information takes place. Aging has been shown to affect neurotransmitter levels in these centers, notably the endogenous opioids β -endorphin, enkephalin, and dynorphin involved in stimulating food ingestion through kappa receptors [26]. Decreased dynorphin stimulation with age causes a decline in opioid receptor function and reduced NPY responsiveness contributing to anorexia in the older population [27, 28].

3. Body composition

Changes in body composition, energy expenditure and functional status of organs that occur with aging influence the energy homeostasis and nutritional status of older adults. Physiological changes in body composition may begin after the fourth decade and involve muscle loss and increased fat: skeletal muscle loss rate is reported to be 8% per decade between the age of 50 and 70 years, and 10–15% per decade after 70 years [29, 30]. Predominant visceral rather than subcutaneous fat distribution may lead to insulin resistance [31], which increases muscle catabolism even further [32]. In addition, sex steroid levels tend to decline with aging. Increased sex hormone binding globulin also leads to lower bioavailable testosterone, which is an anabolic hormone that plays a key role in muscle mass and strength [33]. All these changes contribute to sarcopenia, which is characterized by loss

of muscle strength, mass and functionality. In addition to sarcopenia, decreased fat free mass and high metabolic organ activity (heart, brain, kidney) result in reduced resting energy expenditure (REE) [34]. Furthermore, physical inactivity often seen with old age is closely related to sarcopenia and reduced REE. Decreased appetite may thus be one of the adaptive mechanisms to regulate reduced REE in the elderly.

4. Cytokines

Although cytokines are generally produced in response to a significant stress like a malignancy, aging itself may be a form of stress that may alter cytokine production [22]. Aging individuals usually have increased cortisol and catecholamine levels inducing the release of pro-inflammatory cytokines such as interleukin (IL)-6 and tumor necrosis factor (TNF)- α , the levels of which have been shown to inversely correlate with the degree of functional ability in the elderly. Increased TNF- α levels have been shown to correlate with increasing levels of the anorexic circulating leptin, and to induce muscle breakdown and reduce the sensitivity of skeletal muscle cells to anabolic stimuli [35]. Increased IL-6 levels contribute to anorexia through an activation of the hepatic acute phase response, and the hypothalamic-pituitary-adrenal axis, leading to bone and muscle loss [36]. Pro-inflammatory cytokines create an anorexigenic, catabolic, hypermetabolic state [35]. Table 1 summarizes the anorexigenic effects of major cytokines including IL-1 β and 6, TNF- α , INF- γ and leptin [36].

2.2. Social, economic and cultural factors

From a social perspective, adhering to a healthy and balanced pattern of eating may be affected by several factors that may be physical (food availability), economical (affordability), socio-cultural

Table 1
Role of major cytokines in anorexia

Cytokines	Effects
Interleukin-1 β	Pro-inflammatory, induces fever, acute phase response and activates Nuclear Factor kappa (NF-K), regulates serotonin and central melanocortin system
Tumor necrosis factor (TNF)- α	Pro-inflammatory, increases leptin, causes oxidative stress and muscle breakdown, blocks β endorphin
Interleukin-6	Both pro and anti-inflammatory, activates NF-K, increases leptin
Interferon- γ	Pro-inflammatory, amplifies the effect of TNF α and IL-1
Leptin	Suppresses appetite, causes anorexia

Adapted from Morley JE, et al. Cytokine-related aging process. The journals of gerontology Series A [36].

(norms and values) and/or political (rules and laws) [37]. Community-dwelling older adults are at higher risk of malnourishment because of difficulty relative to accessing food/ transportation to grocery stores, or in paying for food due to limited incomes, much of which may be spent on healthcare expenses. Food attitudes, cultural preferences and religious beliefs are also determinants of food choices [38]. In addition, low levels of education and common incorrect beliefs regarding the need for dietary restrictions may lead to poor food choices [39]. Furthermore, older adults who live alone, especially males, are reported to have a significantly increased risk of poor nutrition, highlighting the importance of social isolation as a risk factor for malnourishment [40]. Moreover, older adults are more prone to being victims of psychological and/or physical abuse, financial exploitation, and caregiver neglect putting them at additional risk of malnutrition [41].

Although nursing home residents are the most cognitively impaired and frail patients, which puts them theoretically at a higher risk of malnourishment, being in an institutionalized setting, rather than being socially isolated, may enhance their chances of getting better nutrition via regularly scheduled meals during the day [42].

2.3. *Pathological medical conditions and polypharmacy*

Anorexia in the elderly can result from systemic diseases such as chronic heart failure, chronic kidney disease, chronic obstructive pulmonary disease, rheumatologic diseases, cancer, and acute illnesses. The common denominator for these conditions is systemic inflammation and a hypercatabolic state, ultimately leading to cachexia [35]. Pro-inflammatory cytokines (IL-6, IL-1, TNF- α) induce serotonergic neurons and the melanocortin system in the hypothalamus leading to reduced appetite. Additionally, they inhibit transcription of the myosin heavy chain and induce its proteolysis via the ubiquitin-proteasome mechanism leading to cachexia. Furthermore, stress and chronic inflammation activate the adrenocortical system and catecholamines secretion, enhancing basal metabolic rate and production of reactive oxygen species, leading to protein degradation. Therefore, cachexia is a serious “wasting” disorder that is not a consequence of starvation or age-related muscle loss and does not typically respond to increased caloric

intake [43]. Moreover, other diseases such as malabsorption syndromes, hypermetabolic states such as hyperthyroidism may also lead to anorexia in older adults [39].

In a prospective observational study involving 1419 older adults aged 65 years and above, Bosch et al. found 2/3 of unintentional weight loss cases were attributed to malignant and non-malignant organic disorders. 50 % of non-malignant organic disorders were digestive disorders such as gastric and duodenal ulcer, colitis, in addition to swallowing and dental problems [44]. Patients with malignancies were predominantly older men, with more pronounced weight loss. Therefore, it is important to differentiate malignant disorders in patients with red flag signs [44].

Dysphagia is nowadays considered a new geriatric syndrome leading to malnutrition, that needs to be screened for in older adults with neurological/neurodegenerative diseases such as cerebrovascular accidents, Parkinson’s disease and major neurocognitive disorders or dementias [45, 46]. Parkinson’s disease gives rise to alterations in the dopaminergic, serotonergic, noradrenergic and cholinergic neurotransmitter systems. Not only dysphagia, but also delayed gastric emptying, constipation, disturbed hand-mouth coordination and comorbid mood disorders may have a serious impact on nutritional status in these patients [47]. Medications such as NSAIDs, bisphosphonates and potassium supplements may also cause dysphagia [48].

Additionally, obesity, poor salivation and concomitant use of medications that affect esophageal motility such as anticholinergics, calcium antagonists, benzodiazepines and theophylline, autonomic neuropathy which is common in neurodegenerative diseases and diabetes mellitus are risk factors for developing gastroesophageal reflux (GERD). GERD should be especially considered in patients who present with loss of appetite and weight due to dyspepsia [49]. Atrophic changes in the gastrum (atrophic gastritis) may also result in micronutrient deficiency and malabsorption [50]. Data relative to gastric motility changes with aging is conflicting, but delayed gastric emptying is commonly seen, causing early satiety and reduced appetite [51, 52].

Moreover, reduction of myenteric neurons, neuropathy, metabolic derangements (e.g. hypothyroidism, hypercalcemia), drugs (e.g. anticholinergics, antihypertensives, opioids, antacids), decreased rectal compliance and sensation, decreased fluid intake and physical activity, all contribute to chronic

Table 2
Commonly prescribed medications affecting taste and appetite

Medication Class	Side Effects
Antibiotics (macrolides, metronidazole, fluoroquinolones)	Dysgeusia
Anti-epileptics (carbamazepine, phenytoin)	Dysgeusia, nausea, vomiting
Mood stabilizer (lithium)	Dysgeusia
Antihypertensive medications (captopril, ramipril)	Dysgeusia
Anti-neoplastic drugs (5-fluorouracil, cisplatin)	Dysgeusia, nausea, vomiting
Anti-parkinsonian drugs (levodopa, amantadine)	Dysgeusia, nausea, vomiting
Anticholinergics (antispasmodics, antimuscarinics, tricyclic anti-depressants)	Dysgeusia, dysphagia
Statins (atorvastatin, simvastatin)	Dysgeusia
Muscle relaxants (baclofen)	Dysgeusia
Digoxin, hormone replacement therapy and phenytoin	Nausea, vomiting
Cholinesterase inhibitors (donepezil, rivastigmine)	Nausea, vomiting

Adapted from Syed Q, et al. The Impact of Aging and Medical Status on Dysgeusia, and Viswambaran V, et al. Orexigenic agents in geriatric clinical practice [54, 55].

constipation [52]. Elderly patients are also susceptible to fecal impaction and overflow diarrhea because of constipation.

Prescription of inappropriate medications is associated with adverse drug reactions such as altered taste, dry mouth, constipation and nausea, leading to reduced food intake [53]. Polypharmacy has also been shown to be a main risk factor for malnutrition in the elderly [53]. Several classes of medications (shown in Table 2) can adversely affect appetite and taste or may be associated with gastro-intestinal side-effects such as nausea, vomiting and diarrhea [54, 55].

A recent meta-analysis has shown a 2-fold increased risk of weight loss in vulnerable patients diagnosed with dementia and taking cholinesterase inhibitors [56]. However, the rivastigmine patch formulation has been shown to be associated with less gastrointestinal side effects [57, 58]. Sedatives and opiates may also affect the ability to eat independently without assistance in patients who develop severe sedation and impaired motor coordination [48].

2.4. Psychiatric disorders

1. Eating Disorders (EDs)

EDs are serious psychiatric disorders that are often overlooked in the elderly, as they typically occur in adolescents and young adults. Body-image related concerns are often neglected in older individuals, although they may constitute a core feature of pathological eating behaviors in this population [59]. Research has shown that the drive for thinness and

body dissatisfaction may persist in the elderly, and they closely correlate with the fear of aging [60].

In a sample of community-dwelling Austrian women aged 60–70 years, the prevalence of EDs according to the DSM-IV criteria was 3.6% [61]. Per the DSM-5 criteria, a similar prevalence (3.25%) has been found in a sample of 342 Portuguese women aged 65–94 years old [62]. EDs in this population can be divided into young-onset disorders that have recurred or continued in later life and late-onset disorders that have emerged for the first time at an older age. Unfortunately, the definition of late-onset ED is not clear, due to the heterogeneity of studies and the reduced life-expectancy of these patients, but generally an onset after the age of 40 may be considered as late-onset [63].

EDs in the elderly are associated with increased morbidity and mortality: a study looking at published case reports up to 2008 has shown a 21% mortality rate associated with EDs occurring in older adults (mean age = 68.6 years). The most frequent ED in this study's population was anorexia nervosa (AN), and surprisingly, late onset EDs were more common than recurrent early onset [64]. This finding contrasts with large community-based studies that reported binge eating disorder (BED) to be the most common ED in the elderly [59, 62, 65].

Moreover, according to a study that compared prognosis of EDs among various age groups (<18 vs 18–39 vs >39 years), older age was associated with higher likelihood of having a comorbid psychiatric diagnosis, greater psychological and physical constraints on disorder-specific measure of quality of life, and greater interpersonal problems. Older groups also

experienced higher risk of death and poorer prognosis based on body mass index (BMI), eating habits, and number of ED criteria met at 1–11 year follow up [66].

EDs in older males are rare, estimated to be 0.02% in a survey of nearly 500,000 male veterans, mean age of 60.2 (SD = 14.2) years [67]. Despite this drastic difference in epidemiology, a review of 16 cases of EDs in elderly men demonstrated that they share with women similar clinical presentation, precipitating events and degree of functional impairment [68]. Therefore, EDs need to be considered in the differential for unexplained weight changes in the elderly, regardless of the gender.

1a. Anorexia Nervosa (AN)

AN is characterized by restriction of energy intake leading to significant weight loss, fear of gaining weight, and disturbance of body image [69]. With a median age of onset of 18, AN is seen as a disease of adolescents. However, older patients can also be affected by AN due to its chronic and relapsing disease course. A longitudinal study with 21 year follow up after AN-associated hospitalizations showed that 21% of the patients had only partial recovery, and 10% continued to meet all diagnostic criteria [70]. AN may also emerge *de novo* in the elderly, a condition known as late-onset anorexia nervosa or “anorexia tardive”. Anorexia tardive is believed to share important similarities with early-onset AN [71–73].

Body dissatisfaction is a crucial aspect of both the development and presentation of anorexia nervosa [61, 69]. A survey of 106 women with AN showed no statistically significant difference in prevalence or degree of body dissatisfaction across all age groups (20–65 years old) [74]. Similarities between early and late-onset AN extend to the clinical presentation including age of menarche, duration of illness prior to presentation, weight at onset and upon presentation to a healthcare professional, and percentage of women partaking in high levels of physical activity or vomiting to lose weight [75].

Despite these similarities, important differences remain. For instance, depression is more common with anorexia tardive than with classic adolescent AN. Moreover, late-life stressors such as bereavement, domestic problems, and reduced social involvement are common precipitating factors for anorexia tardive [76, 77]. Another observational study showed that patients with anorexia tardive

have greater disease severity, greater suicidality, more common misuse of substances for weight loss, more adequate emotional coping, and less body image distortion [78]. Additionally, prognosis is thought to be worse in anorexia tardive patients, often due to underdiagnosis of the disorder in older adults, leading to inadequate treatment [75, 78].

1b. Bulimia Nervosa (BN)

BN is characterized by binge eating (eating large amount of food with a sense of lack of control over eating) and compensatory behaviors, such as self-induced emesis, laxative or diuretic use, or compulsive exercise to prevent weight gain [69].

Much like AN, BN affects the older population by having late-onset or early onset forms with a chronic disease course. A 20-year follow-up of women with a mean age of 20 ± 2 years showed that 25% continued to suffer from BN [79]. An observational study of 919 BN patients across various age groups (18–25 vs 26–39 vs >40 years) showed that while the older population reported slightly less exercising and fewer binge eating episodes, BN presented very similarly across all age groups; there were no differences regarding demographics (race, gender, and marital status), fasting, self-induced vomiting, and laxative use [65].

1c. Binge Eating Disorder (BED)

BED is characterized by binge eating episodes accompanied by marked distress in the absence of compensatory behaviors to lose weight [69].

BED has a close association with other psychiatric conditions: about 37% of BED patients have comorbid specific phobias and, 29% were shown to have a comorbid personality disorder with avoidant type being the most common [80, 81]. Type II diabetes is another notable comorbid condition to be aware of in older adults with BED. A long-term study with 171 BED patients revealed a higher lifetime prevalence of diabetes in BED patients compared to the matched control group (34% versus 4%) [82]. Currently, there is no data investigating whether age is a modifier of comorbid conditions in BED patients. However, age appears to impact BED's presentation, by which older individuals (aged >40 years) have higher BMIs and report more medical problems, skip meals less often, exercise less often, and have less frequent binge eating episodes, when compared to their younger counterparts (<25 years old). Interestingly, no significant difference in the degree of body dis-

satisfaction was found between the two groups [65]. Much like other eating disorders, older BED patients have a higher mortality risk and a poorer prognosis compared to the youngest [66].

2. Major Neurocognitive Disorders (MNCDs)

MNCDs, also known as dementias, are defined by a significant decline in one or more domains of cognitive ability that interfere with daily activities in the absence of delirium or other attributable mental disorders [69]. Problematic eating behaviors are common behavioral symptoms in MNCDs, that can be assessed using the Neuropsychiatric Inventory (NPI) questionnaire [83]. They may be due to cognitive decline (forgetting to eat, failing to recognize food) and/or apraxia, in addition to insufficient caregiving (not having someone patiently feed an advanced MNCD patient) [84]. Furthermore, smell and taste dysfunction, dysphagia, chewing problems/poor dentition, functional impairment, and difficulties in social interaction may contribute to worsening of nutritional status [85]. Neurochemical imbalance involving serotonin and noradrenaline also impacts appetite in patients suffering from MNCDs [86]. The nature and frequency of the eating disturbance are dependent on the MNCD type and the underlying neuroanatomical circuits altered. While appetite loss is very common in Alzheimer's Disease (AD), increased appetite and alteration of food preference towards sweets is characteristic of frontotemporal dementia (FTD), thereby leading to significant weight gain [87, 88]. Also, depression and difficulty maintaining attention while eating are major contributors to weight loss in patients suffering from AD [89]. On the other hand, appetite changes seen in patients with the behavioral variant of frontotemporal dementia, have been partly related to hypothalamic degeneration, disruption of the connections between the hypothalamus and orbitofrontal cortex, and an increase in agouti-related peptide, a major hormone promoting food intake [90]. Patients with MNCD vascular type often suffer from dysphagia leading to increased eating difficulties and risk of aspiration pneumonia [91, 92]. Eating disturbances in Lewy body dementia are more prevalent than with AD. They may manifest as swallowing difficulties and decreased appetite sometimes attributed to distraction from visual hallucinations [93]. Moreover, eating disturbances are affected by the severity of the disease: in a prospective cohort study involving 220 AD patients, appetite loss was the most com-

mon feature in the mild stages, compared to changes in food preference and eating habits in the moderate stages, and swallowing disturbances in the more severe stages [89].

3. Depression

Depression in late-life is a common psychiatric disorder affecting up to 35% of community-dwelling older adults [94]. The relationship between depression in older adults and appetite loss as a vegetative symptom is well-established; depression is one of the most common causes of weight loss in the elderly [95, 96]. Diagnosing appetite loss due to a reversible cause such as depression in the elderly is crucial to prevent weight loss and nutritional deficiencies which may lead to increased frailty, failure to thrive, and increased mortality [96–98]. Furthermore, depression-related appetite disturbance may worsen the prognosis of comorbid diseases especially in cancer patients [99, 100]. Appetite disturbance is not only a marker of worse outcomes but also a severity marker of cognitive deficits secondary to late-life depression [101]. Therefore, eating patterns of depressed elderly patients must be carefully assessed, and appetite disturbances promptly addressed.

3. Assessment

Given the serious impact of nutritional impairment on health outcomes in older adults, it is recommended to screen all geriatric patients for malnutrition both in inpatient and outpatient settings [102]. Unintentional weight loss is one of the most important predictors of malnutrition in older adults; a decline in weight of 5% or more over three years is predictive of mortality in older adults [103]. Physicians commonly screen for the most common reversible causes of weight loss in the elderly by using the mnemonic Meals-on-Wheels shown in Table 3 [104].

Unfortunately, there is no globally accepted, gold standard tool, for diagnosis of malnutrition in the elderly. In 2012, the Academy of Nutrition and Dietetics and the American Society for Parenteral and Enteral Nutrition (ASPEN) suggested that the presence of 2 or more of the following 6 criteria is diagnostic of malnutrition: insufficient energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, localized or generalized fluid accumulation that may mask weight loss, and diminished functional status as measured by handgrip strength [105].

Screening tools designed to detect malnutrition risk generally focus on the following four determinants: body mass index/mid-arm circumference, recent weight loss, food intake and systemic diseases related to nutritional requirements [102]. In routine clinical settings, clinicians commonly use validated screening instruments such as the Mini Nutritional Assessment (MNA) [106], the Simplified Nutritional Appetite Questionnaire (SNAQ) [107], the Nutritional Risk Screening (NRS 2002) [108], the Seniors in the Community Risk Evaluation for Eating and Nutrition tool (SCREEN) [109], the Subjective Global Assessment (SGA) [110], and the Malnutrition Universal Screening Tool (MUST) [111].

The European Society of Clinical Nutrition and Metabolism (ESPEN) recommends the MNA [112], and the American Society for Parenteral and Enteral Nutrition (ASPEN) recommends the Subjective Global Assessment (SGA) [102]. The MNA is user friendly, easy to perform, applicable for both community dwelling and hospitalized elderly. A recent prospective cohort study in hospitalized elderly has shown that the MNA-Short Form (MNA-SF), NRS 2002, MUST, and SNAQ scales are reliable instruments for malnutrition risk assessment when compared to both the MNA and SGA [113].

The MUST [114] is a 5-step screening tool that estimates malnutrition risk in community-dwellers by assessing BMI, recent unintentional weight loss, and the occurrence of any acute disease affecting oral intake. It also includes management guidelines, whereas the NRS 2002 was developed for malnutrition assessment in hospital settings; it comprises the same nutritional components of the MUST, with an additional severity grading [102].

Table 3

Meals-on-wheels Mnemonic for reversible causes of weight loss

Medications (eg, digoxin, theophylline, cimetidine)
Emotional (eg, depression)
Alcoholism, elder abuse, anorexia tardive
Late life paranoia
Swallowing problems
Oral factors
Nosocomial infections (eg, tuberculosis)
Wandering and other dementia-related factors
Hyperthyroidism, Hypercalcemia, Hypoadrenalism
Enteral problems (eg, gluten enteropathy)
Eating problems
Low salt, low cholesterol, and other therapeutic diets
Stones (cholecystitis)

Morley JE. Weight Loss in the Nursing Home [104].

The MNA-SF was developed for malnutrition screening and assessment particularly in the elderly and is deemed to be valid across different settings including long-term care. It also explores physical and mental aspects affecting nutrition but does not consider severity of illness or current diagnosis. Using an MNA-SF score of ≥ 11 as normal, excellent sensitivity, specificity and diagnostic accuracy for malnutrition were reported (97.9%, 100%, and 98.7% respectively) [115].

The SGA assesses nutritional status by relying on features from the medical history and physical examination, including the presence of cachexia and sarcopenia. However, the requirement of needing to be administered by a qualified professional, length of administration and lack of objective biological data such as laboratory findings and anthropometric measurements constitute limitations of this tool [4].

Despite the availability of numerous screening tools, none are deemed comprehensive. An optimal screening tool is characterized not only by high specificity and sensitivity but needs to be reliably used/validated in different healthcare settings. It should also provide clear information about prognosis and grade/severity of malnutrition [4]. New screening tools incorporating body composition, inflammation, cognitive abilities in addition to sarcopenia and cachexia assessment are hence needed.

In addition to screening tools, physicians often rely on more objective anthropometric measurements such as the body mass index (BMI), the skin fold caliper, and biometric impedance analysis. However, these measures may yield unreliable findings in certain cases of change in posture, loss of muscle tone, ascites, or edema [116]. Specialized laboratory work-up for malnutrition can be also ordered and includes transthyretin (pre-albumin), which has a three-day half-life. Useful labs to identify short term nutritional status may include albumin, ferritin, electrolytes, blood urea nitrogen, fasting glucose, C-reactive protein, and creatinine plasma levels [112].

4. Treatment strategies

Treatment approaches need to be tailored to the underlying etiology of the eating disturbances in older adults (dental problem, malignancy, hyperthyroidism, depression, etc.). However, even in the case of incurable diseases, such as MNCDs, different strategies can be used to improve patients' caloric intake and quality of life.

Overall, providing adequate support from caretakers such as supervision during meals, emotional support, encouragement, and domestic help are shown to decrease the risk of low caloric intake [117]. Limiting strict restrictive diets often prescribed to patients suffering from cardiovascular diseases [118], in addition to adding taste enhancers (sauce) to regular food [119] may improve food pleasantness and promote weight gain.

In the case of insufficient caregiving and institutionalization, environmental control among elderly nursing home residents is effective in promoting appetite: changing the dining atmosphere to be more homelike by using tablecloths, napkins, easy-to-use silverware, frequent small meals, improved lighting, and use of relaxing music during meals [120, 121].

Using oral nutritional supplements (ONS) between meals is another way to increase daily caloric intake in the geriatric population, and particularly in patients with MNCs. There is increasing evidence that ONS given in the liquid form do not induce satiety as much as the solid form, so it is unlikely that they would replace the main meal, and are thus effective in ensuring adequate daily caloric intake as well as improving rehabilitation outcomes [122–125]. A systematic review failed to show definitive evidence for or against any specific intervention for improving eating and drinking in cognitively impaired individuals, but based on small, short-term low-quality studies, ONS, food/drink modification (e.g. use of thickened liquids, finger foods, etc.), and providing mealtime assistance with staff/caretakers were shown to be promising interventions in this population [126].

If non-pharmacological approaches fail, appetite-stimulating medication may be tried, and the choice of drug treatment is largely dependent on the patient profile and the etiology of appetite and weight loss [55].

In addition to its FDA approval for weight loss in patients with acquired immunodeficiency syndrome, megestrol acetate has been increasingly investigated for anorexia/cachexia in older adults and cancer patients. In a recent meta-analysis, it has been shown to be safe and well-tolerated and to significantly increase weight, but with no beneficial effect on quality of life or mortality rates [127, 128].

Synthetic tetrahydrocannabinol such as dronabinol and anabolic steroids like oxandrolone are other appetite stimulants that have shown to increase appetite and weight, especially against acquired immunodeficiency wasting syndrome [129, 130].

Mirtazapine is an antidepressant medication that also stimulates appetite. In a retrospective study with AD patients, 82% of patients attained significant weight gain after 6 months of use [131]. Mirtazapine has also shown promising results in a phase II clinical trial for treating cancer-related cachexia [132]. Although there is no data that directly investigates mirtazapine efficacy in depression-induced appetite loss, mirtazapine is the drug of choice in depressed patients with significant appetite and weight loss.

Weight gain is a well-known side effect of atypical antipsychotics: 80% of patients taking olanzapine, 50% of those taking quetiapine, and 58% of those on risperidone had significant weight gain of 7 pounds or more at week 52 [133]. Despite their beneficial effects on appetite and weight, antipsychotics are not typically used in the elderly to promote appetite, due to their increased risk of cerebrovascular events and the black box warning regarding increased mortality risk in patients with dementia [134].

5. Conclusion

Nutrition helps to promote health and quality of life, and nutritional well-being is one of the major determinants of successful aging. Eating disturbances are common in older adults and may lead to malnutrition, sarcopenia, frailty and worse health outcomes. In addition to age-related physiological changes, complex pathological and psychosocial factors may contribute to reduced food intake. Coexistence of systemic diseases, polypharmacy, functional decline, cognitive impairment and depressed mood are major contributors to malnutrition in the elderly. Although malnutrition is a common health problem, there is no universal agreement about its definition, assessment and diagnosis. Weight change is one of the simplest ways to predict nutritional status of individuals. Serial weight measurements can facilitate documentation of weight loss and alert physicians to perform further evaluation. Additionally, a number of screening tools can be used to identify high-risk individuals, among which the MNA-Short Form enables optimized, time saving assessment of nutritional status in the elderly, in various settings. It is thus recommended to screen all older adults for malnutrition and to intervene as early as possible, when necessary. Treatment strategies depend on the etiology underlying weight loss, but usually involve environmental changes and oral nutritional supplementations before

pharmacotherapy. Moreover, patients should be followed over time and re-screened at regular intervals after development of advanced nutritional care plans in order to improve outcomes. Further studies are needed to develop a consensus definition for malnutrition and new comprehensive, reliable and user-friendly screening/diagnostic tools for malnutrition in older adults.

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