MALNUTRITION IN ELDERLY—RECENT ADVANCES AND CHALLENGES

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Abstract

Background: Malnutrition in older adults has been recognized as a challenging health concern associated with not only increased mortality and morbidity, but also with physical decline, which has wide ranging acute implications for activities of daily living and quality of life in general. Malnutrition is common and may also contribute to the development of the geriatric syndromes in older adults. This review summarizes the current state of evidence on the complex aetiology of malnutrition in old adults, considering both effects of ageing processes and disease-related factors. Also remaining challenges in the identification and treatment of malnutrition in the old are outlined. **Summary**: As age is one main risk factor for the development of chronic disease, older persons are particularly susceptible to disease-related weight loss, loss of muscle mass and strength (i.e., sarcopenia) and ultimately, the frailty syndrome, all of which can fundamentally impact recovery from disease and clinical outcome in general The treatment of malnutrition requires early identification and multimodal intervention, in hospitalized patients as well as community dwelling older adults. However, treatment modality still poses a challenge for nutritional therapy with yet open questions. **Keywords: malnutrition, ageing, inflammation, sarcopenia, anorexia of aging, micronutrients**

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INTRODUCTION

Malnutrition in the old is reflected by either involuntary weight loss or low body mass index, but hidden deficiencies such as micronutrient deficiencies are more difficult to assess and therefore frequently overlooked in the community-dwelling old. In developed countries, the most cited cause of malnutrition is disease, as both acute and chronic disorders have the potential to result in or aggravate malnutrition. Therefore, as higher age is one risk factor for developing disease, older adults have the highest risk of being at nutritional risk or becoming malnourished. However, the aetiology of malnutrition is complex and multifactorial, and the development of malnutrition in the old is most likely also facilitated by ageing processes (**Norman et al., 2021)**.

Nutritional status deteriorates with aging, leading to several changes in body composition, which may include depletion of body fat stores and muscle wasting and contribute to a loss of muscle strength and symptoms such as fatigue, declining nutritional status with aging is attributable mainly to chewing and swallowing problems, a diminished sense of smell and taste, delayed gastric emptying, certain medical conditions (e.g., cardiovascular diseases, depression, and use of medication), and economic issues **(Tramontano et al., 2016).**

This review summarizes the current state of evidence on the complex aetiology of malnutrition in old adults, considering both effects of ageing processes and disease-related factors.

Geriatric age and its health problems

Aging is a natural process that causes a series of physiological, metabolic, anatomical, social, and psychological changes, manifested in structural and functional changes (**Li et al., 2021).** Aging is a progressive biological process, characterized by specific hall marks summarized in Figure I **(Pellanda et al., 2021).**

The World Health Organization (WHO) determines elderliness as the reduction in the competency to accommodate environmental factors and accepts 65 years of age as the lower elderliness limit, though they accept 60 years in some conditions, but the United Nations (UN) agreed cut off is 60 years and over **(Morgan et al., 2017)**.

The World Health Organization (**WHO**) has declared Healthy Ageing a priority of its work on ageing between 2016 and 2030 and developed a policy framework which emphasizes the need for action across multiple sectors **(Rudnicka et al., 2020).**

Malnutrition problems among elderly

Older people are vulnerable to malnutrition for many reasons including physiological and functional changes that occur with age, lack of financial support and inadequate access to food. The functional status of the elderly is their ability to carry out their day-to-day activities including preparation of food and intake, thereby affecting nutritional status. A significant association was found between the nutritional status and the older age groups, female gender, status of being financially and functionally dependent (**Agarwalla et al., 2015**).

Factors affect Nutrition in the Elderly

Older adults are at risk of compromised nutritional status because of age-related changes, such as cognitive, isolation and limited income (**Mangels, 2018**).

Aging is associated with various physio-psychological changes that make elderly people vulnerable to poor nutrition or malnutrition (**Spirgienė et al., 2018**).

1-Gastrointestinal system changes:

There is a general decline in gastrointestinal function in old age including decreased intestinal motility, sensory signaling, and afferent sensitivity. There is also an increased prevalence of significant constipation in aged populations (**West et al., 2019**).

Aging affects all functions of the gastrointestinal system (GIT):

Motility, enzyme and hormone secretion, digestion, and absorption. The GIT also plays an essential role in medication absorption and metabolism, and it is commonly affected by side effects (**Dumic et al., 2019**).

Gastric motility: normal aging is associated with important age-related changes in motor function of the various parts of the gastrointestinal tract. Also, most studies indicate that the rate of acid secretion decrease as the human stomach changes with aging, this acid facilitates the digestion of protein and absorption of iron, calcium, and vitaminB12 as well as prevents bacterial overgrowth and enteric infection. The effect of aging on gasric motility has gained attention because functional dyspepsia, such as postprandial discomfort syndrome, has been reported to be common in the aged population (**Kwon et al., 2017**).

- **Constipation:**

Constipation is a common symptom that may coexist and affect the quality of life in elderly people. Increased age is associated with increased stiffness and reduced sensation in the colon and rectum, reduced anal resting and to a lesser extent squeeze pressures, and increased perineal laxity (**Deb et al., 2020**).

The prevalence of constipation in older adults was high, especially in women, and was associated with frailty and poor quality of life **(Arco et al., 2022**).

The reason for the sense of constipation and in complete emptying is due to the age-related weakness of the pelvic floor muscles (**Levin, 2019**).

The pathogenesis of constipation varied from genetics, socioeconomic status, low fiber diets, lack of fluid intake, lack of mobility, hormonal imbalance, and side effects of drugs **(Kurniawan et al., 2020).**

Constipation can affect the quality of life and nutritional status of all people in different age groups, especially the elderly. Because it is commonly associated with stomachache or cramps, feeling bloated, nausea, anorexia possibly due to acycle of poor intake, stool retention (**Gürsoy Coşkun et al., 2021**).

Lifestyle modifications and increased intake of fiber and water are suggested by most health professionals to avoid constipation, food could play a key role in the pathophysiology and treatment of constipation. Its beneficial effect is due not only to the fiber content but also to the presence of other substances" i.e., polyphenols, sorbitol, etc." (**Bellini et al., 2021**).

2-Oral changes:

Oral function deterioration is related to avariety of factors, including aging, the decline in activities of daily living, malnutrition, and cognitive decline, tongue motor function and tongue pressure decrease with aging (**Iyota& Mizutani 2022**).

The most-reported disturbance among the elderly includes oral sensorial complaints, particularly dry mouth (xerostomia), taste disturbances (dysgeusia or ageusia), and burning mouth syndrome.

Poor oral health, a major concern in geriatrics, is a condition that is prevalent in the elderly and has adverse effects related to mastication and nutritional problems, poor oral health is also strongly associated with malnutrition in the elderly (**Nagamine et al., 2021).**

Dentition and tooth loss can give rise to various problems associated with eating, speaking, and appearance. The number of teeth or wearing of dentures is also related to swallowing function. Therefore, oral, or dental health problems could affect general health and quality of life both directly and indirectly (**Ide et al., 2018).**

The number of teeth, either natural or artificial, was one of the contributing factors for deciding supplied food consistency among the elderly. Mastication is an important physical function for nutrition intake, Mastic]' atory efficiency affected by the presence of teeth, the number of functional teeth, prostheses, and functional decline can result in impaired nutritional status **(Nomura et al., 2019).**

Saliva is essential for oral processing of food and consequently is also related to the sensory and textural experience. It is often assumed that the secretion and properties of saliva change with age, which can result in dry mouth conditions and taste aberrations (**xu et al., 2019**).

3-Dehydration

Water is critical for survival: it is the largest single component of the human body and is necessary for numerous essential physiological processes (**Lacey et al., 2020**).

Age related impairment can cause a higher risk of dehydration in the elderly. Decrease in the sense of thirst is a common reason due to the decline of osmoreceptors and the fall in the angiotensin1 level. The likelihood of the elderly seeking to drink fluids on their own is consequently decreased, and so the risk of dehydration will be increased (**Heung et al., 2021**).

4-Sensory change

A reduction in sensory-specific satiety is noted from 65 years of age such that elders are less inclined to seek novel food and instead choose to eat the same food day after day which may have low nutritional values (**Cichero, 2018**).

Disturbance in the ability to smell and taste is common in older people. Such disturbances can significantly influence nutrition, safety, and quality of life, as well as both psychological and physical health, age related decrements in the ability to smell are evident for all types of olfactory tests, including nominal odor identification, detection, discrimination, and memory (**Doty, 2018**).

Changes in taste, smell and appetite generally decline with age, making it more difficult to enjoy eating and keep regular eating habits. Appetite loss in older people, the Anorexia of Aging (AA), is commonly associated with undernutrition (**Cox et al., 2019).**

Despite the high prevalence, anorexia of aging is commonly accepted as inevitable and apart of normal aging, anorexia of aging includes a loss of appetite and /or reduced food intake which can be noticed with older age. It is associated with the development of undernutrition and other adverse health outcomes, such as poor quality of life, morbidity and mortality **(Jadczak and Visvanathan, 2019**).

Many studies reported the importance of the role of vision and visual cues when eating, visually impaired always or frequently, need support to prepare meals, eat and drink more slowly (**Jones and Bartlett, 2018**).

Diseases of elderly related to nutrition:

- **Malnutrition**

A recently published study on community-dwelling older adults participating in long-term osteoporosis. Trial in Hongkong demonstrated that the GLIM criteria were associated with a higher risk for sarcopenia, frailty, and mortality during a 14-year follow-up period **(Yeung et al.,2020).** While the GLIM criteria are not age-specific, they include age as a risk factor among the components. For geriatric patients, the guidelines on Enteral Nutrition in Geriatrics by the European Society of Clinical Nutrition and Metabolism (ESPEN), have defined clinical malnutrition as the presence of either weight loss which reflects a catabolic state (>5% in six months) and/or low BMI (i.e., BMI below 20 kg/m²) which represents depleted physiological stores **(Cederholm et al.,2017).**

Nutritional risk is less well defined but commonly understood to be a condition in which the present nutritional status is at risk of impairment due to a range of factors such as medical history, comorbidities or drugs which might increase dietary requirements or interfere with nutrient absorption or metabolism. Further factors may include physical, mental, or cognitive status which might prevent the older person to properly care for themselves as well as socio-economic factors which hinder access to a varied high-quality diet **(Cederholm et al.,2017).**

Despite the body of evidence describing the personal and clinical consequences of malnutrition and its economic impact on the health care system, malnutrition among elderly remains a considerable problem with reported high frequencies, especially in situations of dependency **(Sánchez-Rodríguez et al.,2018**).

This has been attributed to poor awareness and lack of time or education in medical as well as nursing staff, but recognition and treatment of malnutrition in older adults is undeniably a challenge even when identified early. All in all, it is estimated that roughly a quarter of European adults over the age of 65 are at high risk of malnutrition across various settings **(Leij-Halfwerk et al.,2019).**

Egyptian elderly had unsatisfactory nutritional status, prevalence of malnutrition among Egyptian elderly: nursing home had significantly higher percentage of malnourished participants compared to community participants (43.4% vs 30.9%). (**Sabbour et al., 2018**).

In industrial countries, disease is one of the most common reasons for developing malnutrition and the onset of malnutrition can be both acute and slow. Age is an established non-modifiable risk factor for malnutrition. Higher age is associated with physiological changes which can potentially lead to malnutrition such as impaired taste and smell, decreased gastric flexibility, reduced appetite, etc. **(Norman et al.,2021).**

Malnutrition among the elderly is one of the most growing concerns in this demographic shift. During the change into older years, often nutrition priorities change towards meeting and minimizing increased nutrient needs with fewer energy requirements and preventing lean muscle loss (**Amarya et al.,2015**).

Malnutrition in the elderly leads to protein-energy malnutrition, sarcopenia, and cachexia. Protein-energy malnutrition increases with age and the number of comorbidities (**Agarwal et al., 2013).**

Because of the impact on the elderly, malnutrition entered the arena of the "geriatric giants" and is standing side by side with traditional geriatric

syndromes like immobility, instability, incontinence, and intellectual impairment (**Lewandowicz et al.,2018).**

Malnutrition plays an important role in the development of certain geriatric syndromes. Geriatric syndromes are complex multifactorial conditions occurring in higher age with serious effect on health **(nouye et al.,2007).** and have been described as "phonotypical presentations of accumulated and underlying ageing-related dysfunctions spanning over different organ systems" **(Rausch et al.,2021).**

They include (not only) dementia and delirium, depression, incontinence, fall risk, visual as well as hearing impairment, wound healing disorders, frailty, and sarcopenia **(Won et al.,2013)**.

Involuntary weight loss, a hallmark of malnutrition, is inevitably associated with loss of skeletal muscle mass, which appears to occur to a greater extent in higher age. This increases the risk of developing sarcopenia, a phenomenon which is characterized by the loss of both muscle mass as well as muscle strength and function. As these two entities frequently occur together, this has led to the new term "sarcopenia malnutrition syndrome". And a need for new screening tools which reliably identify both conditions has been voiced **(Juby et al.,2019).**

Malnutrition has also been linked to cognitive impairment**.** although the relationship is complex and difficult to extract and more studies are needed on this subject **(Yu et al.,2021).** Similarly, there is a close interaction between malnutrition and depression, but causality is difficult to establish, as the relation is most likely mutual **(Yoshimura et al., 2013).**

- **Under nutrition**

Malnutrition is the state of being poorly nourished which can be caused by excess (over nutrition) or lack of nutrients (under nutrition). In the aging population under nutrition is an important problem that has been seen in hospitals, residential care and in the community.

Elderly people are more likely to suffer from undernutrition, as age increases the functions of the vital body organs decreases. Socio-demographic factor also affects body function, The consequences of malnutrition are sever and along lasting situation among the elderly, It increases the risk for infection, pressure sores, and delayed wound healing and reduces rates of drug metabolism, physical performance such as less physical activity or working capacity (**Uddin et al., 2020)**

- **Overweight and obesity**

Being overweight is a leading risk factor for global deaths; about 3.4 million adults die each year because of obesity. In addition, 44 % of the diabetes burden, 23% of the ischemic heart disease burden, and between7%and41% of certain cancer burdens and attributable to obesity**.** Obesity among the elderly is of great concern as it can be associated with functional limitations due to decreased muscle mass and strength, increased joint dysfunction, disabilities in activities of daily living, frailty, chronic pain and impaired quality of life **(Ariaratnam et al., 2020).**

Obesity can increase CVD morbidity and mortality directly and indirectly:

Direct effects are mediated by obesity-induced structural and functional adaptations of the cardiovascular system to accommodate excess body weight; indirect effect are mediated by co-exiting CVD risk factors such as insulin resistance, hyperglycemia, hypertension and dyslipidemia. Through local and systemic consequences of maladaptive AT 'Adipose tissue' expansion of obesity **(Koliaki et al., 2019).**

- **Anemia**

Anemia is a common condition, especially in the elderly, and its prevalence increases with age in the geriatric population, the most common anemia is related to nutrient deficiencies, especially iron, vitaminB9 'Folic acid ', and vitaminB12 ' Cobalamin' (**Andres et al., 2019).**

Anemia among the elderly population has adverse health consequences such as fatigue, weakness, and shortness of breath leading to lowered functional ability and mobility, lower bone density and skeletal muscle mass, diminished cognitive function, increased frailty, increased risk of recurrent falls, increased risk of co-morbid conditions and mortality **(Gupta et al., 2020).**

Iron deficiency anemia in the elderly is the most common cause of anemia among the elderly, about two-thirds of nutritional anemia is associated with iron deficiency results from chronic gastrointestinal (GI) blood loss mainly caused by esophagitis, gastritis, ulcer, related or not related to non-steroidal anti-inflammatory drug intake, and \or chronic infections, avarices (portal hypertension), pre malignant polyps, colorectal cancer, or angiodysplasia (**André., 2018**).

- **Osteomalacia**

Vitamin D deficiency is the most common nutritional deficient worldwide. In adults, sever vitamin D deficiency leads to osteomalacia. Osteomalacia causes weak bones, bone pain and muscle weakness (**Emini-Sadiku and Morina-Kuqi, 2019**).

➢ **Causes of Osteomalacia may be**:

1-Extrinsic (extraneous to the individual such as environmental, secular, or behavioral)

Inadequate dietary intake of vitamin D, Decreased exposure or avoidance of sunlight, Use of sunscreens (especially >8 SPF), Fully covered garbs (veil, hijab, burqa, Indian Saree etc., Dark skin pigmentation (**Emini-Sadiku and Morina-Kuqi, 2019**)

2-Intrinsic (within the individual)

Advancing age with decreased cutaneous production of vitamin D, Morbid Obesity,

Malabsorption due to various gastrointestinal disorders. Gastrectomy (partial, total, or gastric-bypass procedures), Small intestinal disease, resection or bypass, Gluten enteropathy (Celiac sprue), Primary Biliary Cholangitis (uncommon), Pancreatic insufficiency including cystic fibrosis (uncommon) (**Minisola et al., 2021).**

Assessment of nutritional status among elderly:

Screening tools which are suitable for the use in older adults need to focus on the most important risk factors for malnutrition in high age, in order not only to diagnose manifest malnutrition but also to capture the risk to develop malnutrition as described above **(De van et al.,2020)**.

Several instruments were created to evaluate the nutritional status of the elderly, including the Mini Nutritional Assessment, which assesses nutritional risk and identifies those who may benefit from early intervention (**Neumann et al**., **2014)**.

The Mini nutritional assessment (MNA) tool is a non-invasive perfect practical, and validated instrument utilized for assessing malnutrition in the elderly. when it was compared with a clinical evaluation by two nutrition expert physicians; the tool`s accuracy was revealed to be 92% and raised to 98% when it was compared with a comprehensive nutritional assessment, including anthropometric measurements, dietetic evaluation, in addition to biochemical testing (**Xu et al**., **2020**).

Background Information Demographic, socioeconomic information, and data on self-reported morbidity were collected during the interview. The demographic indicators used here included age and sex of the respondent. Education was noted up to the completed class and was later classified into illiterate, primary (I–IV), middle school (V–VIII), and high school and above. Socioeconomic status (SES) of the respondents was assessed by modified BG Prasad Scale (**Lahiri et al.,2015)**

Remaining Challenges

Despite the overwhelming evidence regarding the negative outcome of malnourished older adults, there are still many remaining challenges in the understanding, identification and treatment of malnutrition in older adults. They concern both the prevention of slow onset age-associated malnutrition as well as the treatment of disease-related malnutrition (**Maggini et al., 2018)**.

One particular concern regarding the prevention of malnutrition is that some nutritional requirements are not well established in higher age. Micronutrient and trace element concentrations have been shown to change with age and have even been implicated to play a role in the ageing processes (**Höhn et al., 2016)**.

Moreover, although recent research on determinants of malnutrition has added considerable new evidence, the impact of ageing-related changes on the long-term development of malnutrition, still needs further elucidation. One example is the ageing gut and its altered microbiome, which have gained attention in the last years. Emerging technologies, such as e.g., high-throughput culturing, will further the research on ageing microbiome, so its role in the development of malnutrition might soon be elucidated. Novel dietary approaches which modulate the ageing microbiome such as the Mediterranean diet (**Ghosh et al., 2020)** are of interest in the prevention of malnutrition, and more studies are warranted. Considering the importance of muscle mass maintenance (**Deutz et al., 2019)**, nutritional intervention needs to focus on muscle mass and also, needs to be combined with exercise. Therefore, more studies on nutritional therapy together with different kinds of exercise regimen are clearly needed.

Lastly, not only the prevention of malnutrition, but also the topic of treatment of malnutrition needs more research, in terms of well-designed and adequately powered clinical trials in order to ensure sufficient statistical power to identify true treatment effects. Moreover, relevant outcome parameters need to be included, and a careful selection of target populations with well-defined malnutrition is necessary (**Van der Pols-Vijlbrief et al., 2017)**.

Also, more research is needed for treatment approaches which specifically target the underlying causes of malnutrition themselves i.e., causative treatment. This, however, not only requires a longer time frame and a broader inter-disciplinary approach, but more research regarding the most relevant causes and their common pathophysiology which would allow a "causation-oriented" multimodal treatment (**Norman et al., 2020).**

CONCLUSIONS

Taken together, more research is needed to understand which ageing-related changes are early predictors/precursors of malnutrition that in turn can be addressed in order to prevent the development of nutritional deficiencies. For clinically manifest malnutrition, more studies need to be performed in older adults in order to identify the suitable treatment for the various settings.

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