

Nutritional Assessment and Associated Factors in the Elderly: An overview

Abstract

The world population is facing a serious transition of ageing. Every single country experiencing growth in the number as well as proportion of elderly population. Globally elderly are the fastest growing age group. Older adults are a heterogeneous population with diverse nutritional requirement. For the elderly group, the most important purpose of nutrition is not only growth, but also to support of the metabolism and repair capacity, thus delaying aging related processes. Functioning of every nutrition stage, such as ingestion, digestion, absorption, transport, assimilation, and excretion, is transformed with aging. That makes some nutritional requirements in the elderly different from younger adults. Aging and nutrition have direct innate relationship with each other. Physical, mental, social and environmental variables which take place with ageing may affect the nutritional status of elderly people. The outlay of biological ageing is not programmed and interestingly some lifestyle interventions can reduce the rate of health decline with age. Research proved that exercise and dietary intervention provide the strong evidence in improving the rate of biological ageing, increased longevity while calorie restriction seen as a consequence. A proper dietary guideline also proved to prevent the risk of chronic diseases and mortality and thereby improved the quality of life with ageing. Thus, the aim of the present review is to showcase all the scientific evidence conducted among elderly population to behold the profundity of ageing and different exposure associated with it. Furthermore, successful community-based management or treatment strategies adapted by other population of the world will be discussed with a focus on how to maintain adequate nutritional status and lower the different disease risk factors by implementing the same.

Keywords: Elderly; Ageing; Nutrient intake; Dementia; Personalized nutrition; Geriatric nutrition

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Introduction

The world's population is facing a serious transition of ageing [1]. Every single country is experiencing growth in the number as well as the proportion of elderly population. Globally elderly are the fastest-growing age group [1]. Older adults are a heterogeneous population with diverse nutritional requirements [2]. For the elderly group, the most important purpose of nutrition is not only growth, but also to support of the metabolism and repair capacity, thus delaying aging related processes. Functioning of every nutrition stage, such as ingestion, digestion, absorption, transport, assimilation, and excretion, is transformed with aging [2]. That makes some nutritional requirements in the elderly

different from younger adults. Aging and nutrition have a direct innate relationship with each other [2]. Physical, mental, social and environmental variables which take place with ageing may affect the nutritional status of elderly people [2]. Evidence-based studies revealed that under nutrition is common among elderly people and may influence the clinical outcomes during disease [3]. Therefore, maximum health problems among elderly are nutrition dependent [3]. According to WHO 2011, the development in public health over the last century combined with advances in medicines for the management of chronic diseases has contributed to elevated global population ageing [4]. Although the number of years in good health has not increased at the same rate [5].

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Demographic information of any population is a useful overview of population age and health, although they mask a significant degree of variability in the health of people at any given age [5]. For example, in an observational study of twins have shown that the rate of biological ageing is not solely determined by genes [6]. Some important lifestyle factors such as excessive exposure to sunlight (UVB), stress and smoking play crucial role in accelerating biological ageing [7]. Poor socioeconomic status, shorter time in education correlates with biological age, also the heredity of longevity 'genes' explains less than 50% of good health in older age [8]. Many such genes mediate ageing in model systems encode the insulin signaling pathways, a very important indication of biological ageing [9].

The outlay of biological ageing is not programmed and interestingly, some lifestyle interventions can reduce the rate of health decline with age [10]. Research proved that exercise and dietary intervention provide the strong evidence in improving the rate of biological ageing, increased longevity while calorie restriction seen as a consequence [11]. A proper dietary guideline also proved to prevent the risk of chronic diseases and mortality [12] and thereby improved the quality of life with ageing [13]. Thus, the aim of the present review is to showcase all the scientific evidence conducted among the elderly population to behold the profundity of ageing and different exposure associated with it. Furthermore, successful community-based management or treatment strategies adapted by other population of the world will be discussed with a focus on how to maintain adequate nutritional status and lower the different disease risk factors by implementing the same.

Data Synthesis

Relevant published articles were summarized by performing computerized literature searches of different authentic databases using key words, Elderly, Ageing, Nutrient intake, Dementia, Personalised nutrition, Geriatric nutrition. Potential studies with original data were selected and incorporated their important findings regarding the current scenario on nutritional status among elderly.

The Association between Nutritional Status, Nutrient Intake, Physical and Emotional Health of Elderly Adults

In every day-to-day life human made hundreds of food choices, influenced by a variety of personal, social, cultural, environmental, and economic aspects. Considering nutritional status, the elderly are the most vulnerable group, because of the interaction of these above mentioned multiple interrelated factors and the developing condition is called "nutritional frailty" [14-16]. For example, poverty causes a financial inability to satisfy their nutritional needs [17], whereas loneliness, social isolation causes a reduction of food preparation and the consequent decrease of food consumption as well, leading to a chronic depression that accelerates the nutritional frailty again [18].

Impaired appetite due to physiological increase of sensory threshold also alternates the dietary choices among elderly [19-21]. This phenomenon also is the principal cause of geriatric anorexia and mainly the basic reason behind preferences for sweet or fatty tastes during elderly stages [22-26].

The elderly also demonstrates changes circadian rhythms with a reduction of sleep quantity and quality and a shift towards early rising, which means that they eat earlier than at a younger age [27]. This alteration of genetic clocks, combined to other physiological changes during ageing; for example, loss of skeletal muscle mass, [15] leads to dysfunction of glucose and lipid metabolism and development of "Sarcopenic Obesity" [28].

Therefore, it is caused by hormonal changes, inflammatory pattern and myocellular mechanism and can exacerbate cognitive dysfunction and consequently worsen the eating behaviors in a vicious cycle [29-31]. The accompanying presence of diseases and resulting multiple drug consumption can exacerbate dysphagia and hyper metabolism and contribute to the decreased energy balance and to change in eating behavior [32,33]. Furthermore, eating disorders in the elderly is very often ignored or unnoticed. Geriatric anorexia could be concealing as a pre-existing subclinical and unrecognized anorexia nervosa among aged or the high prevalence of comorbid psychological conditions. Therefore late-life depression or anxiety may increase the risk of developing concomitant eating disorders, like binge eating disorders or bulimia nervosa [34-36]. The in-depth screening to differentiate between impairments in eating behavior during aging is very much essential.

Nutritional status

Nutrition is an important determinant of health in elderly patients [37]. Over the past decade, the importance of nutritional status has been increasingly recognized in a variety of morbid conditions including cancer, heart disease, and dementia in persons over the age of 65 [38-43]. Although there is no uniformly accepted definition of malnutrition among the elderly, some common indicators include involuntary weight loss, abnormal Body Mass Index (BMI), specific vitamin deficiencies, and decreased dietary intake [44]. Malnutrition in older patients is regularly under-diagnosed [45], and many physicians have expressed their need for more education regarding nutritional status in older patients [46]. For example, health practitioners may not readily recognize weight loss in the elderly as a morbid symptom of malnutrition because some weight loss may be associated with age-related reductions in muscle mass [47]. Similarly, elderly patients with concurrent obesity often have protein under nutrition that may be overlooked. Many elderly patients have an increased risk for malnutrition compared with other adult populations. It is estimated that between 2%-16% of community-dwelling elderly are nutritionally deficient in protein and calories [48]. If mineral and vitamin deficiencies are included in this estimate, malnutrition in persons over the age of 65 may be as high as 35% [49].

The situation for hospitalized seniors is also disturbing. Studies of hospitalized older patients suggest that between 20%-65% of these patients suffer from nutritional deficiencies [50-52], and the prevalence of malnutrition in long-term care facilities is estimated to be between 30%-60% [53]. The elderly also often has multiple comorbidities that contribute to overall nutritional compromise. Given these complex contributing factors, a careful nutritional assessment is necessary for both the successful diagnosis of malnutrition in the elderly and the development of appropriate and comprehensive treatment plans [37].

Nutrient intake

Despite of high prevalence of obesity, most of the evidence reports a decline in energy intake with age [54]. In every age group men consumed more than women, but this difference is reduced with aging, while energy intake decreases faster in men than in women [55]. When total energy intake decreases with age, the absolute amount of all macronutrients i.e., proteins, lipid and carbohydrates decline accordingly [56]. Despite high requirements of proteins to respond to anabolic stimuli of ageing, elderly tend to avoid animal proteins probably because of difficulties in chewing and swallowing or concerns about unhealthy content of cholesterol and saturated fats [56].

Limited amount of vegetable intake is also another common concern thus vegetable protein also scarce as well, because of declining efficiency of gastrointestinal functions [57,58]. Reports are also there indicating that carbohydrate intake does not alter over time, however fibers intake increases, especially in women [55]. Considering macronutrient intake poor lipid consumption is the principal cause of the reduced energy intake, even if there is a strong gap between their consumption during the whole week, probably because of some major social stimuli in the weekends than weekdays that push to prepare and choose more fatty and palatable foods [56]. Another concern among elderly is reduction of caloric amount and the decline of sensitivity of taste and smell lead to less variety in food choices and related reduction in micronutrient intake [59].

High risk of vitamin B₁₂ deficiency is one of the most common concerns due to reduced animal foods and fat- soluble vitamin D due to less physical activity and less sun exposure [60,61]. These two important micronutrient deficiencies are involved in the development of neurocognitive decline and dementia [61]. Also, the better acceptance of cooked food over raw foods, including vegetable foods, leads to various minerals deficiencies, especially iron and calcium, leading to stable weakness and strong bone fragility, which shows significant relationship with cognitive performance [56].

Impact of socio-demographic factors, lifestyle and health status

Socio-demographic characteristics such as age >70 years, gender, uneducated level, unmarried status and low income were

positively associated with under nutrition in older adults. Lifestyle factors, including smoking, alcohol drinking, daily sleep duration of 6-8 hours and vegetarian diet, also correlated with increased risk of under nutrition, when compared to the corresponding reference group. Several factors such as age, gender, occupation, education, marital status, family income, smoking, alcohol drinking, sleep duration; dietary habit, medication, morbidity and dysphagia are significantly associated with the nutritional status of older adults. Early screening and nutritional assessment are necessary for the effective diagnosis of malnutrition.

Markers of Nutritional Assessment in Elderly Adults

Nutrition is the most important element of health among the elderly [62]. High prevalence of malnutrition is existing in this population, which is associated with decline in functional status, impaired muscle function, decreased bone mass, immune dysfunction, anemia, reduced cognitive function, poor wound healing, delayed recovery from surgery, higher hospital readmission rate, and mortality [62].

Currently 16% of those >65 years and 2% of those >85 year classed as malnourished and this predicted figure are on dramatically rise in the next 30 years [63]. Reports are also there that almost two-thirds of general and acute hospital beds are used by people aged >65 years [62,64]. Reports from developed countries reveals that up to 15% of community-dwelling and home-bound elderly, 23%-62% of hospitalized patients and up to 85% of nursing home residents suffer from malnutrition [65]. Thus, nutritional status assessment is important to specify and treat patients who are at risk.

Dietary assessment

Quantification of nutritional intake is best observing tool for a dietician. In this regard various well recognized methods are there; twenty-four-hour recall is commonly used and is based on an interview during which the patient used to recall all food consumed in the previous 24 hours [66]. Yet the disadvantage is that it represents only food intake for 1 day and may not represent a patient's typical intake. The collected information may sometimes wrong if the respondent is having dementia [67]. 7 days recall methods are also used and other than that a food frequency multiple questionnaires is used to explore dietary intake over certain period [68].

Clinical assessment

Clinical assessment is another important tool to identify nutritional deficiencies. Some general impressions are individual with poor wound healing, dry scaly skin, thin hair, the nails are spooned and depigmented, bone and joint pain complain, edema etc. **Table 1** [62].

Table 1: Clinical Signs and Nutritional Deficiencies [62].

System	Signs or symptoms	Nutrient deficiency
Skin	Dry scaly skin	Zinc/essential fatty acids
	Follicular hyperkeratosis	Vitamin A, Vitamin C
	Petechiae	Vitamin C, Vitamin K
	Photosensitive	Niacin
	Dermatitis	
	Poor wound healing	Zinc, Vitamin C
	Scrotal dermatosis	Riboflavin
Hair	Thin/Depigmented	Protein
	Easy pluck ability	Protein, Zinc
Nail	Transverse depigmentation	Albumin
	Spooned	Iron
Eyes	Night blindness	
	Conjunctival	
	Inflammation	
	Keratomalacia	
Mouth	Bleeding gums	Vitamin C, riboflavin
	Glossitis	Niacin, pyridoxine, riboflavin
	Atrophic papillae	Iron
	Hypogeusia	Zinc, Vitamin A
Neck	Thyroid enlargement	Iodine
	Parotid enlargement	Protein
Abdomen	Diarrhea	Niacin, folate, Vitamin B ₁₂
	Hepatomegaly	Protein
Extremities	Bone tenderness	Vitamin D
	Joint pain	Vitamin C
	Muscle tenderness	Thiamine
	Muscle wasting	Protein, selenium, Vitamin D
	Edema	Protein
Neurological	Ataxia	Vitamin B ₁₂
	Tetany	Calcium, Magnesium
	Paresthesia	Thiamine and Vitamin B ₁₂
	Dementia	Vitamin B ₁₂ , Niacin
	Hyporeflexia	Thiamine

Screening tools

Malnutrition Universal Screening Tool (MUST) is the most recommended screening tool, a five-step tool to identify adults who are malnourished or at risk of malnutrition [69]. This includes one guideline to develop a care plan, widely used in both hospitals and in the community [70]. BMI, history of unexplained weight loss and acute illness effect are the three major components in it. It is recommended by National Institute of Clinical Excellence (NICE), the British Dietitian Association (BDA) [62, 69, 70].

The Mini Nutritional Assessment (MNA) and Malnutrition Risk Scale (SCALES) are specially designed for assessment of elderly [71]. Use of MNA for nutritional status assessment is mostly used screening tool, consists of 18 items and it takes less than 15 minutes to perform. Basically, the subjective global assessment relies on physical signs of under nutrition, patient history, and does not use laboratory findings which are ideal for elderly outpatients mostly [72].

Anthropometric markers

Assessment of Body Mass Index among elderly is one of important anthropometric measurements as it predicts disease risks in those termed underweight and in those who are obese [62]. Furthermore, a patient moves outside the normal reference range the more the association with morbidity and mortality increases [73]. There is certain limitation during measurement of BMI, which include loss of height caused by vertebral collapse, change in posture and loss of muscle tone [59]. In presence of ascites, edema etc., BMI can be unreliable [74]. Additionally, BMI does not identify unintentional weight loss as a single assessment [62].

Skin fold measurement is another important anthropometric tool for understanding lean mass [75]. Mid-upper arm circumference is another independent predictor of mortality in older people in long-term institution stay [76]. One formula named Haboubi-Kennedy has been devised using both BMI and Mid-arm circumference to evaluate nutritional status altogether [77].

Biometric impedance analysis is another simple tool to estimate total body water, extracellular water, fat-free mass and body cell mass. Several reports are there indicating that low body cell mass has a prognostic value in malnourished patients [78].

Biochemical markers

The serum proteins which are synthesized by the liver have been used as markers of nutrition albumin, transferrin, retinol-binding proteins and thyroxin-binding prealbumin [79]. The most commonly used marker is serum albumin, since it can predict mortality among elderly [80]. However other than nutritional factors, albumin can be affected by inflammation, infections as well [80].

Transferrin is another sensitive biochemical marker of early protein-energy malnutrition but is affected by several conditions including hypoxia, iron deficiency, hepatic diseases and chronic infections [81].

Low serum total level is significantly associated with an increased risk of malnutrition [82]. Vitamins and trace element assessment is also important since deficiencies can lead to medical complications [82]. To date there is no single biochemical marker of malnutrition as a screening test. Thus, detailed assessment and monitoring is crucial [62].

Changes, assessment and management of eating behavior in ageing and dementia patients

Eating habits or nutrition behavior are formed during childhood (e.g., through cultural behavior, nutrition education etc.) and are often retained for a lifetime [83]. Thus, these deep-rooted behaviors that has once been implemented are very hard to change in older age [83]. Although report shows that elderly subjects reported a higher consumption of Mediterranean foods, tending to avoid non-Mediterranean foods [84]. This type of dietary habits led to the older groups having a higher adherence to the recognized protective Mediterranean diet than

younger one [84]. The prevalence rate ranged from nearly 0% for the younger subjects to around 30%-40% for the elderly [85]. One critical observation is that the elderly simply maintained traditional dietary habits acquired in infancy, thus remaining less affected by the process of diet-westernization [85]. Nevertheless, elderly seems to be more adherent to the healthy eating patterns than younger people characterized by more consumption of fruits and vegetables, even if always less than recommended [56]. This tendency is probably due to their higher awareness of food health concerns for the prevention and management of suggested diseases by specialist, considering the recent findings on the protective role of some dietary components as whole grains, berries, nuts and green leafy vegetables on proper brain functioning [86].

Study proves that elderly use more supplements than younger people for the same reason [87]. Considering food choices, the elderly tends to reduce intake of meat, eggs, fish, fruits and vegetables, whereas the frequency of consumption of milk and cereals remains almost unchanged, especially as substitutes of dinner meal [88]. Older people tend to have more structured eating pattern than the younger one, concentrating most of the caloric intake in the first part of the day with three main meals and rarely small snacks [56]. These alterations of food choices are mainly due to the necessity of resting disturbed circadian rhythms to improve metabolic health [89]. Study proves that the meal timing strongly contributes to the regulation of metabolic state and body weight [90,91]. One recent research on food habits recommended that, the mealtime-based strategies, associated to a restricted feeding can be employed to prevent obesity and associated metabolic diseases in both older and younger adults [92].

Changes in eating behavior in dementia

Dementia is an age-associated syndrome due to several disorders affecting the central nervous system of the elderly. 65 years or more aged person have high risk of neurodegenerative dementia, characterized by progressive cognitive impairment with consequences on multiple aspects of daily living leading to loss in daily functioning and behavior disturbances [93]. Worldwide the most common form of dementia is Alzheimer Disease (AD), while Front Temporal Dementia (FTD) is a common cause of early-onset dementia [93]. Some of the key aspects for diagnosis of dementia are non-cognitive, behavioral and psychiatric disturbances like apathy, disinhibition, agitation, depression, psychosis, appetite changes and sleep disturbances etc. [93,94].

Especially in the initial and intermediate stages of the disease, the patient can present a peculiar dietary change and eating disorders whereas in the final stages of the disease, with a marked impairment of functional and cognitive ability and a complete dependency on others [95]. It can be observed that there is an overlap of the symptoms with main difficulties related to feeding themselves and swallowing [96]. The main tool used in Neuropsychiatric Inventory (NPI) condition, is to assess behavior disturbances in dementia, dietary changes or other eating behaviors, due to their important clinical role in the course of the

disease [97]. Yet there is often insufficient information regarding the complexity and diversity of eating disorders in dementia [56].

Alzheimer's Disease

60% of all cases of dementia are Alzheimer's disease, the most common form out of all [98,99]. Clinically it is characterized by the presence in the brain of senile plaques and neurofibrillary tangles that lead to irreversible loss of neurons in the cerebral cortex and hippocampus [100]. At the initial stage the basic clinical symptom is memory impairment which is progressively followed by a deterioration of other cognitive functions and difficulties in everyday life activities and behavioral disorders [101]. Due to the slower progression of the disease, the eating habits and nutritional behaviors are affected gradually [102]. Considering early stage of the disease, due to initial memory or cognitive impairment and the disorientation among the patient, it may cause greater difficulty on selecting food or purchasing products in a supermarket or in preparing food recipe properly, are the leading cause of poor dietary outcome among elderly [102,103]. Another common consequence observed is forgetfulness, sometimes patient can also forget to eat or drink, especially because they can experience decreased in appetite or conversely, even if it is less frequent, others can forget they have already eaten multiple times a day [104,105]. Another concern from the physical point of view was that the decline in the sense of smell occurs in healthy elderly but even more occurs in patients with AD, who are already in the prodromal stages of the disease, worsen during the progression of the disease; ultimately alter the dietary choices and leads to poor nutrition [106,107]. Nevertheless the behavioral, cognitive and functional deficits can significantly affect social capability, increased depression, isolation, loneliness and ultimately leads to malnutrition [108,109]. Sleep disturbance, disruption of circadian rhythms are frequently reported in Alzheimer's Disease [110], again leads to the consequence of changes in eating patterns [111,112]. One common eating disturbance during Alzheimer's Disease progression is "swallowing difficulty", tend to worsen with worsening of the disease, others such as food preference, appetite change and eating habits also altered accordingly [111,112].

Considering food preference, the most common symptom is the preference for sweet foods more than before. Loss of appetite, appetite change is often reported. Reports are also there considering decline in table manner, longer than normal time of eating etc. [113]. In this regard mostly those who are living alone are more at risk of malnutrition than those who are living with others or with caregivers [114]. Weight loss is the foremost common clinical disorder among elderly [115-118], due to multiple unknown pathophysiological alterations during disease progression [119]. Some neuropathological alterations like dysfunction in the limbic system, atrophy of the mesial temporal cortex and reduced glucose metabolism in the anterior cingulate cortex [120,121] are correlated with weight loss of the Alzheimer's disease patient significantly. Summa et al. [122], reported that the weight loss in MCI and Alzheimer's Disease due to the loss of appetite that in turn is related to depression

or cognitive decline or the presence of comorbidities that are common consequences in Alzheimer's Disease [122]. Weight loss also significantly correlated to disease severity [112] and can occur before dementia, suggesting that it is not a consequence of other behavioral disorders [120-128]. Thus, it becomes very important to monitor eating disorders in healthy elderly subjects to predict the risk of dementia.

Assessment of Eating Behavior in Ageing and Dementia

Considering social, physiological, and clinical changes and eating disorders in ageing and dementia, there is one basic need of a comprehensive assessment of eating behavior throughout the entire course of ageing [129]. Considering screening tool for eating behavior in ageing, there are four phenomena, can be examined during screening,

- Eating behavior
- Environmental influences on eating behavior
- Food choices
- Food preferences and hunger [129]

Other than that subject's behavior, in terms of meal duration, food choices, hunger and satiety etc. can be recorded [130]. Natural settings are always preferred for better screening, and self-monitoring tools or caregiver-based questionnaires used [131]. Report says the Mini Nutritional Assessment (MNA) and the Simplified Nutritional Appetite Questionnaire (SNAQ) are the most widely used tool to investigate anorexia [129] among the elderly. Basically, MNA can classify older people according to nutritional status including weight changes, dietary assessment and self-assessment [132] etc. The four important question SNAQ score may be effective in identifying individuals at risk of significant weight loss, can be correlated with MNA as well [129]. For a details understanding of eating behavior, Adult Eating Behavior Questionnaire (AEBQ) and Self -Regulation of Eating Behavior Questionnaire (SREBQ) also recommended [133,134]. Other than that, Eating Disorder Inventory (EDI) [135] and Yale Food Addiction Scale (YFAS) [136] are also recommended.

Considering screening tools for eating behavior in dementia, Eating Behavior Scale is recommended [137]. While considering dementia, it is very important to assess the progress of swallowing function, as well as food preferences, appetite, functional skills, considering the loss of patient ability etc. [137]. Thus, the need for caregiver involvement in the assessment of eating behavior of the patients. EBS is useful at the early stage of dementia [137]. It helps in measuring the ability of people with dementia to feed themselves independently, investigating six specific behavioral aspects observed during meals (able to initiate or maintain eating, use of utensils, able to bite and swallow) [137]. Other than that the Appetite and Eating Habits Questionnaire (APEHQ) and the Cambridge Behavioral Inventory (CBI) are also recommended [138]. The APEHQ comprises total 34 questions, which helps in examining the changes in eating behaviors in some common

domain like: swallowing, appetite, eating habits (stereotypic eating behavior and table manners), food preferences (Sweet preferences or other food fads), and the oral behaviors [137].

Management of Eating Behavior in Ageing and Dementia

Improving dietary quality and behavioral management to enhance the well-being of older adults are the two key aspects when focus is on management of eating behavior in ageing and dementia [139]. For instance, the multi domain intervention that combine healthy diet, physical exercises, cognitive training and social activities have shown promising impact on such management [140-155]. Promoting more dietary educational programs and inclusion of right variety to diet and monitoring frequency of food groups typical of Mediterranean-type diet and Mediterranean-Dash Intervention for Neurodegenerative Delay shows effective results in this regard [142-144]. The more adherence to these dietary patterns has been associated with slower rates of cognitive decline and with a significant depletion in Alzheimer's Disease incidence [145]. This model consists of plant-based dietary approach, characterized by high intake of whole grains, legumes, vegetables, fruits, nuts and olive oil; moderate to high intake of fish; lower intake of meat and eggs and a regular but moderate intake of wines. The mentioned foods are poor in saturated fatty acids, whose intake is negatively correlated with cognitive function [146], but contain multifunctional nutrients in particular Vitamin B and VitaminE, omega-3 fatty acids, oleic acid and polyphenolic compounds-with antioxidant and anti-inflammatory effects [147], promoting the maintenance of lean mass [148] with positive effects on synaptic plasticity and cognition [149]. These phenomena are proactive against chronic diseases (metabolic syndrome, diabetes, prediabetes as well as vascular risk factors) including dementia [150-152]. The traditional interventions are based on cooperation between caregivers who knows well the person's habit, preferences and beliefs and specialized dietician [153-156]. The followings are the recommended strategies to overcome the reduction of caloric amount and the decline of sensitivity of taste and smell [157]:

- Preparation of attractive meals with colorful vegetables, herbs and spices
- Inclusion of unusual food combinations with familiar recipes and preference towards finger foods such as sandwiches, pies, baked dishes
- Elimination of environmental factors and implementation of daily routine that promotes beginning of meal (food within the person eyesight and in clear contrast with the plate or immediate environment)
- Conversation with the patient, giving specific instructions and encouragement during mealtime
- The caregiver should entertain the person with playful activities, so they do not feel bored or lonely
- The portion of food should be divided into two and offer the

second one only if requested

- Fill most of the plate with salad or vegetables etc.

Frequently modifying eating behavior is normal during ageing; therefore, adequate screening of the eating patterns and nutrient intake allows early intervention by health professionals to play a crucial role in patient management [137]. Considering ideal management during the course of neuro degenerative dementia, it must be taking into account that the cognitive impairment affects patients ability to perform basic and instrumental ability of daily livings and that the movement or behavioral disorders can occur [137]. Mounting literature and research are showing strong relation between nutrition, cognition and dementia, yet the evaluation is not common in the clinical management of the elderly patients [137]. Therefore, further studies are needed to develop more comprehensive management.

Geriatric nutrition from personalized nutrition perspective

Improved nutrition is most conventional approach to tackle biological ageing globally [158]. Most countries around the world, the dietary recommendations for adults have been applied irrespective of age [158,159]. Nevertheless, there is a suggested reduction in calorie intake after the age of 50 years. Otherwise, the reference intake for vitamins, in general, does not change with one or two exceptions [160]. Considering niacin requirements, there is a minor reduction in requirements between young and older adults over the age of 50 years. The requirements for iron intake in post-menopausal women are reduced [160].

Ageing is associated with a downswing in health and a rise in age-related disease [158], but such association is not consistent across the population. That is why there is possibility for appropriate nutrition to maintain metabolic health as we age [158].

Nutritional genomics is one precision-based approach to nutrition, depending on an individual's age, lifestyle activities, genotype, epigenome, and microbiome etc. But unfortunately, till date, no such studies observed where basic focus is on older adults

in the community or in care environments [161]. Nevertheless, precision nutrition intervention studies have begun using a straightforward approach, targeted specific and limited genotype for recruitment and then examined the individual's adherences to dietary modification [162].

Study has established that both maternal and paternal diet can imprint epigenetic changes that predispose to metabolic and degenerative diseases in later life [163]. Early indications are there, that same epigenetic changes may be modified by diet. Although there is urged to have big data sets to inform algorithms and diet that should be used to address phenotypic variations in health [162].

Conclusion

In conclusion, a wide range of unresolved issues regarding the management of malnutrition in older persons need to be addressed. Many of these questions cannot easily be answered, and it is an important next step to develop innovative strategies and well-conceived concepts for this purpose. Altogether, high-quality research is urgently required to develop effective strategies for the prevention and treatment of malnutrition in the increasing number of old and very old patients at risk. Nutritional requirements in macro- and micronutrients in the elderly differ from adults because of aging-associated effects on nutrient ingestion; digestion, absorption, and metabolism are well recognized. But aging-related diseases, the effects of aging on nutrients, drug–nutrient interactions, and social problems should be taken into account when analyzing the nutritional status of the older person.

Understanding the association between nutritional status, socioeconomic condition such as level of education, and income is essential for planning and public policies. Many studies demonstrated that lower perceived health status, particularly in rural areas experienced greater feelings of loneliness and depressive affect. A negative association between perceived health status, loneliness, and depressive affect has been frequently reported and need to be addressed.

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