Clinical Nutrition 43 (2024) 1815–1824

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Narrative Review

Nutrition for the older adult – Current concepts. Report from an ESPEN symposium

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ARTICLE INFO

Article history:
Received 10 June 2024
Accepted 18 June 2024

Keywords:
Ageing
Older adults
Report
Nutritional intervention

SUMMARY

Background & aims: In view of the global demographic shift, a scientific symposium was organised by the European Society for Clinical Nutrition and Metabolism (ESPEN) to address nutrition-related challenges of the older population and provide an overview of the current state of knowledge.
Methods: Eighteen nutrition-related issues of the ageing global society were presented by international experts during the symposium and summarised in this report.
Results: Anorexia of ageing, dysphagia, malnutrition, frailty, sarcopenia, sarcopenic obesity, and the metabolic syndrome were highlighted as major nutrition-related geriatric syndromes. Great progress has been made in recent years through standardised definitions of some but not all syndromes. Regarding malnutrition, the GLIM approach has shown to be suitable also in older adults, justifying its continuous implementation. For anorexia of ageing, a consensus definition is still required. Intervention approaches should be integrated and person-centered with the aim of optimizing intrinsic capacity and maintaining

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https://doi.org/10.1016/j.clnu.2024.06.020

functional capacity. Landmark studies like EFFORT and FINGER have impressively documented the potential of individualised and multifactorial interventions for functional and health benefits. Combining nutritional intervention with physical training seems particularly important whereas restrictive diets and drug treatment should generally be used with caution because of undesirable risks. Obesity management in older adults should take into account the risk of promoting sarcopenia.

Conclusions: In the future, even more individualised approaches like precision nutrition may enable better nutritional care. Meanwhile all stakeholders should focus on a better implementation of currently available strategies and work closely together to improve nutritional care for older adults.

The global demographic shift with an ever-expanding older population requires from the scientific community to deepen its understanding and knowledge about the challenges this shift imposes. ESPEN, the Eurpean Society for Clinical Nutrition and Metabolism, organised a scientific meeting on December 3–4, 2023 in Istanbul, Türkiye, to let 18 international speakers address specific nutrition-related issues the ageing global society faces today. Here we report the core content of these lectures in six major sections.

1. Current topics in geriatric nutrition

1.1. Precision nutrition in an ageing society

Precision nutrition or personalised nutrition is a concept that has recently attracted a lot of interest due to the increasing possibilities of adapting treatments to specific personal conditions. The relevance of this topic for the ageing society was discussed by **Marjolein Visser**, the Netherlands.

National dietary recommendations are generally developed for the whole population, with some limited modifications according to age and sex. However, the biological effects of nutrition are known to vary, for example due to differences in genetics, metabolic characteristics, environment and microbiome composition [1]. The diet can be tailored to these factors, and one well-known example is the specific dietary advice for patients with phenylketonuria who should consume a diet restrictive of phenylalanine and use tyrosine supplements in order to prevent serious complications. In tailored or individualised dietary interventions, individuals receive the same parent nutritional intervention which is modified on a case-by-case basis using scientific evidence and clinical judgement. Precision nutrition also tailors the diet to the individual, but this is based on data-driven precision health analytics and stratification [2]. It requires large datasets to develop optimal dietary strategies using machine learning and applying and testing these strategies in intervention studies in order to use that information (by deep learning) to further improve the strategies. While machine learning is already used in geriatrics to predict outcomes, select optimal markers or develop dietary profiles [3], precision nutrition in geriatrics would require large-scale nutrition cohort studies incorporating accurate measurement of food intake, (epi) genetic, transcriptome, microbiome, lipidome and metabolome data, and information on disease status, medication use, and lifestyle, social and economic factors [4], as well as the design and execution of precision nutrition trials in older adults using these characteristics. Moreover, research teams should include experts in data science, statistics and system modelling. Precision nutrition in geriatrics has the potential to contribute to optimal health and physical functioning in the future but would require major research investments similar to the Nutrition for Precision Health project in the United States of America [5]. In the meantime, we should focus on a better dissemination and implementation of currently available, evidence-based dietary strategies known to be effective in geriatric care [2].

1.2. WHO actions during the "Decade for healthy ageing"

The WHO has committed itself to the "Decade for Healthy Ageing", which was proclaimed by the UN for the 2020s [6]. **Kremlin Wickramasinghe**, representing the WHO Regional Office for Europe, gave his perspective on the cooperation between the WHO/Europe and ESPEN against this background.

There is a growing collaboration between WHO/Europe and ESPEN, focusing on enhancing healthy nutrition for older people and recognizing the need for more clinical nutrition work. The current emphasis of work is on addressing risk factors for non-communicable diseases (NCDs), which are responsible for the majority of deaths and disabilities in the region. The overall aim is to shift the policy focus from lifespan to healthspan, thereby enhancing the quality of life for older people and those living with NCDs. During the decade of healthy ageing, efforts are being aligned between healthy ageing, nutrition, and physical activity teams. Additionally, the importance of considering determinants of healthy ageing and collaborating with older people must be emphasised. To date, WHO/Europe has developed various relevant frameworks, including a report on promoting physical activity and healthy diets for healthy ageing [7]. Success stories from Finland and Germany illustrate effective national policies and multisectoral actions to improve nutrition and physical activity among older adults. These examples can encourage other countries to follow their lead. Finally, future collaborative steps can be outlined, including policy briefs, advocacy, and innovative tools, with WHO/Europe and ESPEN continuing to work together to improve nutritional care for older adults in the WHO European Region.

1.3. Microbiota, food and ageing

Recent developments pinpoint the great importance of the gut microbiota for health, also in older adults. **Nathalie Delzenne**, Belgium, described that the gut microbiota is composed of hundreds of billions of micro-organisms that play a crucial role in human physiology from birth to death [8]. Although the gut microbiome is generally considered as quite resilient in healthy adults, there are intrinsic and environmental factors that drive changes in the gut microbiome composition and activity with age [9]. Among these, changes in gut transit, changes in social behavior and physical activity, changes in eating pattern and digestive functions, and increased medication intake, contribute to changes in the gut microbiome composition. In general, bacteria with anti-inflammatory or butyrate-producing properties are reduced in older people (e.g. Bifidobacteria, *Faecalibacterium prausnitzii* and Prevotella). In addition, new bacterial consortia can emerge during ageing: on the one hand, a set of bacteria that keeps the interesting functions of short-chain fatty acid production and immunomodulation (e.g. *Akkermansia* and *butyricimonas*) which ensures the maintenance of key gut functions, and on the other hand, a variety of bacteria (i.e. *Bilophila*, *Escherichia*, or *Desulfovibrio*) which can be potentially harmful for health through the production of

metabolites like phenols, hydrogen sulfide, secondary bile acids, or trimethylamine [9]. This gut microbial dysbiosis can be associated with an increased gut permeability. Thereby, it may contribute to the so-called "inflammageing", involved in cognitive decline, cardio-metabolic alterations, and carcinogenesis [10]. Few but interesting intervention studies have attempted to evaluate existing tools to modulate the gut microbiome in older people. Some placebo-controlled intervention studies with prebiotics, probiotics or synbiotics have been performed in older patients, demonstrating the potential interest in these approaches to modulate the gut microbiome, as well as related functional (i.e. constipation) or metabolic alterations [9,11,12]. In conclusion, appropriate nutritional advice (intake of dietary fibre and micronutrients) should take into account the contribution of the microbiome to physiology in the particular context of healthy ageing.

2. Screening, diagnosis and assessment of malnutrition in older adults

The second major section of the symposium focussed on recent developments of screening and diagnostic procedures for malnutrition.

2.1. What future for malnutrition screening tools?

Marian de van der Schueren, the Netherlands, has worked for decades on the issue of screening for malnutrition. At the beginning of the 21st century, screening for malnutrition started to be introduced in health care on a large scale. ESPEN published its guidelines for nutritional screening in 2003 [13], based on the evidence at that time. Since then, the landscape has changed. The population – in general, and also in hospitals – has become more obese, ageing places a substantial burden on the healthcare system, the length of stay in hospitals has decreased and care is shifting to the community [14]. These developments ask for re-evaluation of the concept and operationalization of malnutrition screening. Are screening tools that rely heavily on BMI and body weight loss still appropriate for the more obese population? In the light of the ageing society, pressure on health care resources and care shifting to the community: Shouldn't we focus more on the prevention of malnutrition by screening for risk factors that predispose to developing malnutrition than on screening for first signs of depletion? And, finally, what is the role of malnutrition screening in the GLIM framework [15]? Recent studies have shown that the choice of the screening tool influences the outcome of the GLIM diagnostic process [16,17]. Based on this changing landscape and the necessary process of re-evaluation, the concept of malnutrition *risk* screening is currently being defined, followed by its operationalization [14]. The results of this process are expected by the end of 2024.

2.2. Validity of GLIM in older people and future challenges

In 2019 four major clinical nutrition societies introduced the Global Leadership Initiative on Malnutrition (GLIM) format for the diagnosis of malnutrition [15,18]. **Tommy Cederholm**, Sweden, one of the facilitators of this process, described briefly the 2-step GLIM format that advocates screening for malnutrition followed by the recording of three phenotypic criteria (i.e. weight loss, body mass index and muscle mass), and two etiologic criteria (i.e. reduced food intake and disease burden/degree of inflammation). The diagnosis of malnutrition is confirmed when at least one phenotypic and one etiologic criterion are fulfilled in subjects identified as at risk for malnutrition by the previous screening.

The GLIM format is constructed to be feasible in all settings and in the whole adult population. Since 2019, around 400 scientific papers have been published with the aim of testing validity and clinical feasibility. Criterion validity (i.e. does the new format really identify malnutrition?) is mainly examined by comparison with previously validated tools like the Subjective Global Assessment or Mini Nutritional Assessment. Also, predictive validity (i.e. does the new format identify cases with worse clinical outcome?), has been extensively tested.

Two narrative reviews on the validity of the GLIM format in older subjects showed that one year after the GLIM introduction fourteen studies were available, mainly of retrospective character performed in existing datasets with limited access to the five requested criteria [19]. Later around 100 studies of GLIM in older adults are published with increasing data quality. A compilation of 40 of these studies clearly indicates good criterion and predictive validity of the GLIM format [20], evidently justifying its continuous implementation also in the older population. A high sensitivity of the screening procedure before GLIM application is identified as crucial for avoiding underestimation of malnutrition [21].

2.3. Assessment of the inflammation criterion in the GLIM construct

Cristina Cuerda, Spain, targeted the uncertainties on how to implement the GLIM etiologic criterion of inflammation into clinical practice. During the course of a disease with inflammatory response there is a catabolic state driven by a neuro-hormonal milieu, in which cytokines (i.e. soluble extracellular proteins secreted by immune cells that are key intercellular regulators and mobilisers) play an important role. The degree of the inflammatory response depends on the type and degree of injury, and varies in patients with acute or chronic conditions. Inflammation is key in the etiology of disease-related malnutrition as it can induce anorexia, muscle catabolism and increases resting energy expenditure [22]. Besides, inflammation induces a redistribution of many micronutrients resulting in decreased blood levels of zinc, iron, selenium, vitamin A, C and D, especially with C-reactive protein (CRP) levels >20 mg/L [23]. Moreover, inflammation can blunt the response to nutritional treatment.

Inflammation can be assessed by clinical and laboratory data [20,24]. To help in the evaluation of inflammation in the GLIM construct, a multidisciplinary working group has produced a consensus-based guidance paper through a modified Delphi approach with 7 final statements [25]. In summary, the occurrence of an acute or chronic disease, infection or injury that is often associated with inflammatory activity may fulfill the GLIM disease/inflammation criterion, so that confirmation by laboratory markers is not always necessary. Thus, clinical judgement is enough to evaluate the presence of inflammation in patients with acute and chronic conditions. In cases of uncertainty, laboratory markers indicating inflammation, especially CRP in serum, may be used to confirm the disease/inflammation criterion. In acute conditions, CRP levels >50 mg/L and between 10 and 50 mg/L indicate severe and moderate inflammation, respectively. In chronic conditions CRP levels between 10 and 50 mg/L are indicative of moderate inflammation and between 3 and 9.9 mg/L of mild inflammation [25,26].

3. Sarcopenia and nutrition

Muscle function and strength are of paramount importance for the ability to live an independent, self-determined life at old age. Various aspects of sarcopenia were discussed during the third section of the symposium.

3.1. Global Leadership Initiative of Sarcopenia (GLIS)

Loss of muscle mass and ensuing decline of muscle strength and function was named sarcopenia in 1989 [27]. Reduced muscle mass was the initial focus for the definition, whereas during the last 15 years the importance of muscle strength and function was increasingly recognised. **Tommy Cederholm**, Sweden, described the global endeavors to reach consensus how to diagnose sarcopenia. Currently there are three major models from three international expert groups, i.e. the European Working Group on Sarcopenia in Older People (EWGSOP) [28], the Asian Working Group on Sarcopenia (AWGS) [29] and the Sarcopenia Definition and Outcome Consortium (SDOC) [30]. In 2019–2021 the sarcopenia clinical and research community, convened the Global Leadership Initiative in Sarcopenia (GLIS) with representatives from the major consensus groups, and endorsement from 15 relevant international organizations to establish a universally accepted definition.

The first step by the GLIS Steering Committee (n = 21) was to publish a glossary paper defining crucial sarcopenia terms and concepts [31]. The second step was to perform a modified Delphi process among >100 international sarcopenia experts to produce a conceptual definition, assuming there are feasible methods to measure muscle mass, strength and function [32].

The GLIS agreement is that sarcopenia is a generalised disease of skeletal muscle. Its prevalence increases with age. Defining components are muscle mass, muscle strength and muscle specific strength (i.e. strength/muscle size). Following the recent publication of the conceptual definition [32], the final challenge is its operationalization. For this purpose three working groups are brought together, each focusing on one of the defining components. The results of these efforts are expected to be published within 1–2 years.

3.2. Sarcopenic obesity and ageing

Besides declining skeletal muscle mass and strength (sarcopenia), ageing is commonly associated with body fat accumulation potentially resulting in sarcopenic obesity (SO) [33,34]. This topic was covered by **Rocco Barazzoni**, Italy. He highlighted that both fat accumulation and muscle loss may be worsened by age-related lifestyle changes, including sedentary behavior. In addition, excess body fat may cause or aggravate muscle loss through metabolic derangements and comorbidities [33,34]. Most importantly, SO has a strong negative clinical impact and leads to frailty and disabilities, cardio-metabolic and infectious complications, and increased mortality risk [33–36]. Although an obesity paradox is described in older adults with potential favorable impact of higher BMI on overall survival, this issue remains under debate and no protection is observed when high BMI is associated with low muscle mass [34–36]. Clinical and scientific SO recognition, patient identification and treatment have been hampered by missing consensus on diagnostic criteria, and by methodological issues regarding muscle assessment [37]. Notably, in a recent international initiative, a consensus diagnostic algorithm was proposed and is currently being validated [34,38]. In general, obesity management in older adults should take into account the risk of causing or aggravating sarcopenia [39,40]. While relevant potential health benefits associated with fat loss, including improved physical function [41] should be considered, muscle-sparing strategies including exercise and adequate dietary protein provision (>1 g/kg adjusted body weight·and day) [39–41] should be part of routine care, with monitoring of body composition and muscle function.

3.3. Nutritional treatment of sarcopenia

To conclude this section, **Gulistan Bahat**, Türkiye, addressed the question how to combat sarcopenia. Resistance training constitutes the first-line treatment modality. Albeit less effective, the evidence base for nutritional treatment modalities are growing [42,43]. Accordingly, international clinical practice guidelines for sarcopenia (ICFSR) [42], recommend resistance-based training, and conditionally recommend protein supplementation and protein-rich diets combined with physical activity interventions [42]. An adequate protein intake is needed to build muscle, especially in cases of sarcopenia. Thus, the protein intake in older persons should be at least 1 g/kg body weight per day and individually adjusted upwards in cases of sarcopenia [39]. To maximise protein utilization, it was proposed that a sufficient amount of protein should be ingested with each meal (25–30 g) [44], and that exercising individuals should consume protein within 1–2 h after physical training [45,46]. Regarding type and quality of protein, the intake of 2.5–2.8 g leucine per meal was suggested [47]. Furthermore, adequate energy intake is crucial because in case of lacking energy, protein is used for energy production and then lacking for structural and functional purposes. Regarding vitamin D, ICFSR stated that there is insufficient evidence to determine whether vitamin D supplementation by itself is effective in the treatment of sarcopenia [42], however, maintaining a physiological vitamin D level is advisable also for persons with sarcopenia. Other nutrients, e.g. antioxidants and omega-3 fatty acids, are important for muscle health as well, and discussed in connection with the management of sarcopenia, but the specific evidence is limited. Overall healthy dietary patterns according to official guidelines are considered increasingly relevant and seem to have high potential also for prevention and treatment of sarcopenia [48]. In clinical practice, comprehensive treatment approaches should be established, combining exercise training, adequate energy, protein and overall nutritional intake with an individualised treatment plan and education and motivation by a multi-professional healthcare team [42].

4. Frailty and nutrition

Ageing, and especially accelerated ageing is the main cause of frailty, observed in around one in five people older than 80 years [49]. Various nutritional aspects of frailty were discussed in the fourth section of the symposium.

4.1. Current concepts of frailty – The role of nutrition

Meltem Halil, Türkiye, defined this geriatric syndrome as deterioration in the functioning of multiple physiological systems accompanied by an increased vulnerability to stressors with significant implications for clinical practice and public health [50]. Frailty is a multidimensional issue with physical, psychosocial, functional and social aspects contributing to its development. It is an extreme consequence of the natural ageing process, so its prevalence increases with age. Adults of any age may become frail, particularly if they suffer from multiple morbidities [51,52]. The manifestations of frailty are many and varied. They include 1) nutritional-medical conditions like anorexia, unintentional weight loss, sarcopenia, incontinence, increased number of re-admissions and hospitalizations, 2) psychological-psychiatric conditions like delirium, cognitive decline/dementia, depression, anxiety and sleep disorders, 3) functional conditions like weakness, exhaustion, immobility, falls, and balance problems, as well as 4) social problems like isolation, and caregiver problems [53]. Since frailty is a dynamic state, every older adult should be evaluated for frailty,

either through physical frailty assessment tests (e.g Fried et al. [54]) or deficit accumulation tests (e.g Rockwood et al. [55]) in order to determine who would benefit from strategies to prevent and slow the progression of frailty.

Malnutrition, sarcopenia and frailty overlap in multiple domains, namely weight loss, reduced body and muscle mass and physical weakness [56]. Nutrition is associated with muscle mass, strength, and function, and plays a critical role in both the prevention and treatment of frailty [57,58]. Since energy and protein intake is often inadequate in frail persons [59], implementation of effective strategies against malnutrition and sarcopenia should be part of the frailty management process.

4.2. Intrinsic capacity, ICOPE and WHO

In 2019, WHO proposed "Guidance on person-centered assessment and pathways in primary care" called ICOPE (Integrated Care for Older People) [60]. **Yves Rolland,** France, described how this document emphasises that healthy ageing consists of optimizing the intrinsic capacity and maintaining the functional capacity of all individuals. To avoid or delay functional dependence, screening and management of the determinants of intrinsic capacity – defined by six domains: mobility, hearing, vision, mood, cognition, and vitality/nutrition – must be prioritised in primary care. WHO suggests that healthcare professionals practicing in primary care must invest in this simple and inexpensive prevention action by identifying older people with a decline in intrinsic capacity and proposing appropriate interventions. An integrated and person-centered approach is essential because the determinants of the decline in intrinsic capacity are interdependent.

The HealthAge Hospital-University Institute of Toulouse is a WHO collaborating center and participates in the implementation of the ICOPE program in Occitania (France). This work, carried out in a real population, concerns subjects aged 60 and over and living in the community. Participants are screened (step 1) by healthcare professionals or through self-assessments using digital tools (the ICOPE MONITOR app and the ICOPEBOT chatbot). Training on WHO ICOPE has to date involved more than 4000 healthcare professionals. The training is carried out online and the infrastructure is based on digital tools, and a remote ICOPE monitoring platform run by geriatricians and nurses dedicated to this task. The feasibility of implementation was recently reported [61]. Between January 2020 and November 2021, 10,903 older people (76.0 ± 10.5 years; 60.8% women) benefited from ICOPE screening. About 20% of the screened people have lost weight and/or appetite. Subjects with a loss of appetite without other abnormalities in domains of the intrinsic capacity have an increased risk of reduced motor capacity, cognitive decline and reduced morale after around 6 months. 958 participants (9.3%) were assessed by Comprehensive Geriatric Assessment after the screening test in step 2. The personalised care plan (step 3) focuses primarily on maintaining locomotion, vitality/nutrition and cognition [61].

To date, more than 40,000 people are being monitored in the ICOPE program in France, which benefits from funding support from the Ministry of Health. The implementation of ICOPE in France demonstrates its feasibility on a large scale. The high prevalence of positive screenings for an impairment domain of the intrinsic capacity demonstrates the importance of investing in the field of prevention in older people. Monitoring intrinsic capacity, possibly using abacus reference curves, must become a simple means of targeting subjects at risk of disability [62].

4.3. Anorexia of ageing – Where are we?

Although the term anorexia of ageing has been used in a large number of scientific publications since the 1980s, no international consensus definition has been established yet. **Jürgen Bauer**, Germany, discussed how, for this reason, the distinction between anorexia of ageing and malnutrition in older people has often been unsatisfactory. According to the majority of experts, anorexia of ageing should primarily refer to a loss of appetite in older individuals, which may or may not be accompanied by a reduction of food intake. The etiology of anorexia of ageing is multifactorial in most cases and it may be regarded as a geriatric syndrome [63]. Anorexia of ageing is highly prevalent in older individuals beyond age 70 with the highest rates reported in the nursing home population. Anorexia of ageing has been associated with an increased risk of incident malnutrition and with a higher mortality [64]. Several studies have shown that anorexia of ageing may trigger functional decline across several domains. Among a wide range of potential assessment tools, the Simplified Nutritional Appetite Questionnaire (SNAQ) should be highlighted because it has been validated in older persons and as its application is highly feasible from a clinical perspective [65,66]. The evidence on therapeutic interventions in patients with anorexia of ageing is still very limited [63]. It is therefore recommended to initiate an international consensus which should agree on a definition for anorexia of ageing and which should also outline the research agenda in this field. A successful consensus would support the successful design of future trials for innovative pharmaceutical approaches.

4.4. Metabolic syndrome and ageing

The underestimated importance of the metabolic syndrome (MS) in older adults and potential interactions with frailty were discussed by **Michela Zanetti**, Italy. The MS is a cluster of factors (abdominal obesity, hypertension, high plasma triglycerides, high fasting glucose and low HDL cholesterol) that predisposes to diabetes and to cardiovascular disease. MS is common in older people, particularly in women, with a prevalence ≥40% in those aged 65 years or older [67]. In older persons, MS is frequently associated with frailty [68] especially in the presence of abdominal obesity and of hyperglycemia [69]. The combination of frailty and MS is associated with poor outcomes, including an increased risk of functional dependence and disability [70]. The established direct risk of premature death observed in younger patients with the MS is less clear in older adults and seems to be partly mediated by the coexistence of frailty [71]. Indeed, frailty and the MS share some common pathogenic mechanisms, including changes in body composition, i.e. adipose tissue redistribution and dysfunction, sarcopenia, low-grade chronic inflammation and insulin-resistance [72,73]. Identifying frailty in older adults with the MS is important to target interventions to reduce the risk of functional decline. Interventions include physical exercise, nutrition treatment and pharmacological therapy. Physical inactivity increases the risk of MS and frailty, while physical exercise counteracts frailty and improves metabolic health [74]. The combination of physical and nutritional intervention providing adequate energy and high-quality proteins has a potentially positive effect on both health and physical performance. In the presence of diabetes, optimizing glycemic control is a crucial step. Selection of the best glucose-lowering therapy should be individualised on the basis of clinical, functional and quality of life-related targets [75].

5. Neurology, cognition and nutrition

Brain health is crucial for ageing well. The fifth section of the symposium focussed on nutritional aspects of Alzheimer's disease, other types of dementia, as well as on dysphagia in older adults.

5.1. Lifestyle changes to prevent cognitive decline: The FINGER study

The number of people affected by dementia increases due to population ageing [76]. **Jenni Lehtisalo**, Finland, discussed risk reduction by targeting modifiable risk factors as a key to halt this global development. Lancet commission [77] identified 12 risk factors which account for 40% of dementia cases, including e.g. obesity, hypertension and physical inactivity. WHO risk reduction guidelines [78] suggest that related interventions, such as nutritional and physical activity interventions, may be beneficial in delaying cognitive decline. However, most interventions targeting only one risk factor have failed [79]. Due to the multifactorial nature of late-onset dementia, multifactorial interventions have the best potential for risk reduction.

The "Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER)" was the first to show that a lifestyle program including dietary counselling based on national recommendations, physical exercise combining strength and aerobic training, computerised cognitive training, and intensive monitoring and treatment of cardiovascular risk factors can delay cognitive decline among older adults [80]. The same intervention was beneficial for many secondary outcomes, e.g. reduced decline in physical performance and activities of daily living [81], less multi-morbidity [82] and improved diet quality [83] over a two-year period. The first long-term results showed lower incidence of cerebrovascular events [84], particularly in secondary prevention.

The FINGER follow-up continues up to 11 years and long-term analyses are ongoing. The intervention concept is being transferred and modified to other countries within the World Wide FINGERS network, including up to now more than 25 countries [85], which will provide further evidence for multi-domain lifestyle interventions for dementia prevention.

5.2. Updated ESPEN guidelines on nutrition in dementia

Nutritional options if dementia has already occurred were discussed by **Dorothee Volkert**, Germany. In fact, dementia syndrome increases the risk of developing malnutrition and dehydration, mainly due to reduced food and fluid intake on the one hand and sometimes to increased requirements on the other. In a vicious cycle, this can worsen cognitive abilities and increase the risk of frailty, morbidity and mortality [86–88].

The question which interventions are effective in preventing and treating malnutrition in the course of the disease was addressed in the ESPEN guideline on nutrition in dementia published in 2015 with 26 evidence-based recommendations on the four main topics screening and assessment, strategies to support oral nutrition, supplementation and (par)enteral nutrition [89]. This guideline was updated by an international multidisciplinary working group of 10 experts from 8 countries according to the standard operating procedure for ESPEN guidelines [90] and recently published [91].

As a result, 40 evidence-based recommendations for nutritional care and support of older persons with dementia were adopted. In a completely new part, seven recommendations are aimed at organisations caring for persons with dementia, for example calling for sufficient qualified staff and provision of attractive food and drinks with choice in a functional and appealing environment. New to the updated guideline is further the inclusion of dehydration in all chapters, which is a common nutritional problem in people with dementia. At the individual level, nutritional screening, assessment and monitoring are recommended as a prerequisite for timely and appropriate interventions. Nine strategies to support oral nutrition and hydration are highlighted, e.g. appropriate use of eating and drinking utensils and routine oral care. Among oral nutrition interventions, ketogenic diets and probiotics have been newly included; both are not recommended to correct cognitive impairment or prevent further cognitive decline. All six recommendations about enteral and parenteral nutrition and hydration remained unchanged but were underpinned by new literature. Finally, a new recommendation is to adopt an individualised, comprehensive and multidisciplinary approach that combines all available strategies in an appropriate way for each person with dementia.

Due to a lack of appropriate studies, most recommendations are "good practice points", based on experts' opinions. Future high-quality studies are needed to better clarify the evidence.

5.3. Oropharyngeal dysphagia – A hidden geriatric challenge

Oropharyngeal dysphagia (OD) is another common, but still poorly recognised geriatric syndrome, in which nutrition and neurology interact [92]. **Rainer Wirth**, Germany, described how this condition is defined as the perceived or real difficulty in forming or moving a bolus safely from the oral cavity to the esophagus [93]. OD doubles the risk of pneumonia and malnutrition and triples the risk of mortality, while the risk of dehydration has not been systematically studied [94]. Since flexible endoscopic evaluation of swallowing (FEES) is increasingly used for diagnosis, the understanding of dysphagia improved substantially. Age-associated changes of swallowing (presbyphagia) have been identified as a sensory deficit [95] and distinct patterns of dysphagia have been described in different neurological diseases [96]. This is of particular importance, because distinct dysphagia patterns require different treatment approaches, including nutrition. In addition to well established risk factors, subcortical vascular encephalopathy [97], delirium [98] and neuroleptic medication [99] should be considered as a potential cause of dysphagia. The term sarcopenic dysphagia has been coined for OD caused by sarcopenia [100]. While there is no doubt that sarcopenia is clinically relevant for patients with OD, recent studies were not able to identify sarcopenia as a causative factor for presbyphagia [95] or dysphagia [101].

6. Current challenges for nutritional treatment of older adults

The final section of the symposium covered various nutritional intervention strategies.

6.1. When stop dieting?

Stéphane Schneider, France, first highlighted that restrictive diets are the most common therapeutic lifestyle modification in patients with overweight/obesity (calories), type 2 diabetes (sugar), hypertension and congestive heart failure (salt), chronic kidney disease (proteins) and hypercholesterolemia (fat).

Regarding obesity, many cohort studies have shown that the optimal BMI in older adults is between 25 and 30, in terms of survival and function [102], but also to protect against osteoporosis [103]. Yet, 23% of obese community-dwelling adults in the United States follow a restrictive diet, including 16% over the age of 75 [104]. A restrictive diet can worsen age-related sarcopenia and induce further muscle mass loss [105], increasing the risk of sarcopenic obesity, with the double burden of metabolic syndrome and sarcopenia [34]. In 190 octogenarian outpatients following a restrictive diet (low salt, diabetic, low fat) was associated with a 3.6-fold increase of the risk of malnutrition [106].

Although reducing salt intake may be useful for a limited period of time during an acute flare-up of heart failure, the risk-benefit

ratio of short-term and long-term restrictive diets is generally unfavourable, and the ESPEN guidelines on clinical nutrition and hydration in geriatrics [39] consequently recommend avoiding or limiting weight-reducing diets in overweight/obese older adults, carefully weighing the medical benefits and potential risks based on medical, nutritional and geriatric history and assessment [107], and focusing more on physical activity [108]. It is also important to always look for restrictive diets in the medical history of an older patient, as this is a modifiable cause of malnutrition [109].

6.2. Nutrient and drug interactions in older adults

In addition to pharmacokinetic and pharmacodynamic changes with ageing, polypharmacy due to increased comorbidities is important in older persons due to drug-drug and nutrient-drug interactions [110]. This topic was addressed by **Kutay Demirkan**, Türkiye. Nutrient-drug interactions can be classified as effects of nutrients on drugs (i.e. reduced drug-absorption, altered drug-concentrations due to changes in dietary habits, increased drug concentration, decreased drug effect, increased risk of adverse effects, altered drug metabolism) and effects of drugs on nutrients (i.e. altered electrolyte levels, reduced vitamin levels, altered appetite, altered nutrient absorption due to drug effect on gastrointestinal functions, induced metallic taste, dry mouth) [111].

Due to limited evidence, drug administration with thickening agents is another problem in older people with dysphagia or swallowing difficulties. Thickeners can delay the release of the drug in solid dosage form until it reaches the colon, and several factors (i.e. solubility/permeability of drug, type of thickener, targeted viscosity level with thickener and mixing order of preparation technique) can also affect the bioavailability of the drug [112]. A feeding tube is an alternative route for drug administration in this population which may carry the risk of altered drug or nutrient absorption and tube occlusion. The appropriateness of the drug dosage form and the primary site of drug absorption should be considered, and the direct addition of drugs to an enteral feeding formula and the mixing of drugs for administration through an enteral feeding tube should be avoided [113].

6.3. Protein recommendations and chronic kidney disease

Chronic kidney disease (CKD) currently may affect one in ten individuals and an even larger proportion of older people. A recent update counted about 844 million individuals with CKD worldwide in 2017 [114]. **Giorgina Barbara Piccoli,** France, discussed how malnutrition, frailty and chronic kidney disease are strictly correlated: each disease or condition can lead to the other, and each one negatively affects the prognosis of the other [115]. Dialysis treatment, especially in high income countries, is increasing the most in the age group of 80+ years [116]. However, dialysis is not only associated with costs, but also with an increased risk of mortality and morbidity. The IDEAL study has shown that an early start of dialysis is not associated with a gain in lifespan, and it can be associated with a lower quality of life [117]. Hence, new guidelines recommend postponement of dialysis, especially in the absence of clinical signs of uraemia [118]. The concept of "incremental dialysis start" gains recognition; i.e. peritoneal dialysis can be started with only one exchange per day (instead of 4) and haemodialysis with one or two sessions of 2–3 h per week (instead of 3 times per week 4 h) [119,120].

Since uraemia can be seen as a state of protein intoxication, low protein diets and more recently low-protein plant-based diets have been used for decades to counterbalance many of the metabolic derangements of advanced CKD (i.e. hyperphosphatemia and hyperparathyroidism, acidosis, high urea levels). On the other hand, a low protein intake may contribute to muscle loss and sarcopenia, especially in older adults. The need to find solutions how to deal with these conflicting requirements was recently discussed in detail in a critical review endorsed by ERN-ERA and ESPEN [121]. According to both observational and randomised studies, a well-controlled low-protein diet in patients who reach an adequate energy intake is not associated with malnutrition and may indeed slow the progression of CKD and delay the need for dialysis [122,123]. Of note, not all forms of CKD are rapidly progressive, and identifying those at higher risk of progression may guide clinical management.

Setting individualised goals, considering the severity of CKD, its progression, the presence and risk of malnutrition and individual preferences (including avoidance of dialysis) may allow finding individually adapted solutions [121].

6.4. Individualised nutritional support for older adults: The EFFORT Trial

The symposium was concluded with a presentation by **Carla Wunderle**, Switzerland, who reported on EFFORT ("Effect of early nutritional support on Frailty, Functional Outcomes, and Recovery of malnourished medical inpatients Trial"), which is at present the largest randomised controlled trial examining the effects of individualised nutritional support [124]. In adult patients at risk of malnutrition, an algorithm-guided individualised nutritional intervention to reach protein and caloric goals proved to be effective and cost-efficient [125]. The risk of any adverse clinical outcome could be significantly reduced, in particular the risk of death by 35% [124]. In a subgroup of 881 patients with ageing-related vulnerability (82% 80+ years, 23% frail, 13% with cognitive impairment), an even greater effect was observed with a more than 50% reduction in the risk of 30-day mortality [58].

However, despite these overall beneficial effects of nutritional support, there are subgroups with certain clinical conditions; e.g. advanced cancer [126], severe inflammation [127] or in the very acute phase of a disease [128], where nutritional treatment is less beneficial. There are various parameters to consider when personalizing nutritional support, e.g., screening and assessment tools, GLIM, muscle parameters, metabolic and endocrine conditions of the patient. So far, low handgrip strength [129], a reduced kidney function [130], severe inflammation [127] and a high NRS-2002 total score with low disease severity [131] are potential biomarkers to predict a low or absent response to nutritional support. This raises the question of whether we need to find even more individualised approaches for these patient populations. A better understanding of malnutrition phenotype, reflecting the specific pathophysiology, may allow better characterization of patients and selection of those who would benefit most from nutritional interventions, contributing to a more personalised approach.

7. Conclusion

This symposium report summarises the current state of knowledge on a wide range of topics relevant to the nutrition of older people, presented by internationally renowned experts. The diverse expertise of the speakers from a wide range of fields complements each other and provides a comprehensive picture with numerous suggestions for future research as well as concrete advice for clinical practice in everyday nutritional care of older people.

Funding statement

The symposium on which this report is based was funded by ESPEN, the European Society for Clinical Nutrition and Metabolism,

with unconditional support of Abott, Akern, Baxter, Burset Medical, Erenler MediKal, InBody, Nestle Health Science, Nutricia and Plifarma. No funds were received for the preparation of this report. The supporting companies were in no way involved in the planning and realisation of the symposium or the preparation of the manuscript.

Author contribution

DV, ND, KD, SS, RB, JB, CC, MdvdS, JL, MH, GB, GBP, YR, MV, CW, KW, RW, MZ and TC contributed an abstract of their lecture.

DV and TC harmonised the abstracts and prepared the manuscript, GSA supported manuscript preparation and created the reference list.

OA and MD were part of the faculty and supported the logistics of the meeting.

All authors particpated in the symposium, read and approved the final manuscript.

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The authors alone are responsible for the views expressed here and they do not necessarily represent the views, decisions, or policies of ESPEN, WHO or any other organisation or institution.

Conflict of interest

All authors have declared their individual conflicts of interest according to the rules of the International Committee of Medical Journal Editors (ICMJE). None of the expert panel had to be excluded from the symposium faculty or from coauthorship because of serious conflicts. The conflict of interest forms are stored at the ESPEN office and can be reviewed with legitimate interest upon request to the ESPEN executive.

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