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Short communication

Impact of nutrition for rehabilitation of older patients: Report on the 1st EICA-ESPRM-EUGMS Train the Trainers Course

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1. Introduction

Population ageing presents significant challenges for society and the scientific community. Healthy ageing and elderly free-of-disease are the subject of intense research, and "ageing well" has become a global health priority according to the World Health Organization (WHO) (http://www.who.int/ageing/en/) [1]. The increase in life expectancy in the 20th and 21st centuries has created expectations for better quality of life, especially in the elderly. Most longevity research suggests that healthy eating is central to living a long life. There is an increasing interest among the scientific community in nutritional information, to address patients' needs more effectively [2]. The authors of the current article attended the 1st EICA-ESPRM-EUGMS "Train the Trainers" Course, held in San Servolo, Venice, Italy, and after following this course, felt motivated to enrich knowledge on this topic by writing a common report based on the keynote lectures and working group proceedings of the course.

According to epidemiological studies, the prevalence of malnutrition in geriatric patients in European countries ranges from 23 to 39%. Older persons undergoing rehabilitation are at high risk of malnutrition, and one in two patients in this setting are malnourished, while 91% are considered at risk [3]. Patients with malnutrition have a deficit of energy, protein, vitamins, or minerals, and this has measurable adverse effects on the body. Those at risk include patients with poor intake or appetite, dysphagia, or chronic disease, or those with poor functional, social and/or cognitive ability. Malnutrition is characterised in this population by involuntary weight loss and/or an acute or chronic discrepancy between nutritional needs and nutritional intake, as well as loss of function [4]. Malnourished older adults with significant weight loss tend to have a relatively low body mass index (BMI). However, studies have shown that abnormal BMI alone should not be considered as a tool for nutritional screening. Indeed, several specific malnutrition-screening tools have been developed and are widely accepted thanks to their clinical feasibility. ESPEN, the European Society for Clinical Nutrition and Metabolism, recognizes several screenings tools for use in the hospital, elderly care and community settings, namely the Mini-Nutritional Assessment-Short-Form (MNA-SF), which is probably one of the most widely used tools; the Nutritional Risk Screening 2002 (NRS-2002), the Malnutrition Universal Screening Tool (MUST), and the Short Nutritional Assessment Questionnaire (SNAQ) [5,6]. The aim of screening is to identify subjects who require further nutritional assessment with a view to initiating a nutritional intervention plan. It is known that rehabilitation inpatients frequently fail to meet their energy and protein needs [7]. Their intake is often poor, due to a lack of appetite, or difficulty chewing and swallowing (i.e. dysphagia) as a result of numerous different diseases or conditions [8]. Average daily intakes meet only 58% of protein and 88% of calorie requirements. In post-acute care, up to 33% of patients eat less than 50% of the food they are served, with the intake of protein-rich food being especially reduced [9]. Particular attention should be paid to metabolic alterations in the nutritional status of patients in order to optimize

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the medical and neurological effects [10]. Indeed, malnutrition is associated with higher mortality, and higher use of health resources [11,12] and other adverse outcomes [13]. The prognostic value of malnutrition in the rehabilitation setting is also established, and malnutrition has been shown to be related to functional decline, especially protein-energy malnutrition [14], worse functional status [15,16] and poor recovery [16,17]. Some retrospective studies have shown that the risk of death among malnourished patients is three times higher than among those who are not malnourished [18]. Older patients in need of rehabilitation generally present the same characteristics, regardless of the underlying pathology engendering their need for rehabilitation. All such patients are old, mal- or under-nourished, and indeed, may even be sarcopenic and frail. Most are multi- or co-morbid, many are depressed and some are demented. These global characteristics are the main features of orthopaedic, neurological or cardiac or respiratory patients in need of rehabilitation, as pointed out by Prof. Jean-Pierre Michel in the introductory lecture to this course.

The importance of a nutritional care pathway in the context of a multidomain intervention (including physical exercise and medical therapy) was highlighted during this meeting on the Impact of Nutrition for Rehabilitation of Older Patients, in particular during the keynote lectures and working group proceedings. This report presents an update on important geriatric conditions as a function of nutrition in the setting of rehabilitation.

2. Impact of nutrition for rehabilitation of older patients with sarcopenia

In sarcopenia, which is a geriatric syndrome with progressive loss of mass, quality and function of skeletal muscles associated with ageing, the balance of synthesis and breakdown of skeletal muscle protein is compromised in favour of breakdown. The initial number and size of muscle fibers declines, particularly type II fibers, leading to impaired muscle function [19].

There is ongoing debate regarding the controversial results published in studies of moderate-to-high quality investigating protein supplementation and gain in muscle mass, strength and power. Only a transient increase in power was found in one study that measured muscle function through gait velocity and the chair-rise test [20]. This and other studies of moderate quality failed to show a consistent effect of protein supplementation on muscle mass and strength [20–24]. Compared with placebo subjects, protein intake was increased from 1.0 g/kg/day to 1.3 to 1.4 g/kg/day, and this intervention led to an improvement in physical function as assessed by the Short Physical Performance Battery (SPPB), albeit without any improvement in muscle mass. One explanation for this paradox could lie in the improvement in cognitive function achieved by enhancing protein intake in older adults, in the form of a benefit in reaction time for demanding tasks. Indeed, the SPPB score includes the chair-rise task, which depends on the subject's cognitive ability to react [25,26]. Controversial results could possibly stem from the different measurements tools, rather than the real effect of protein supplementation. Muscle power was evaluated with simple clinical tools, mostly isokinetic devices. Human pathophysiology and molecular cycles mean that supplementation with protein is more complicated than just adding protein to the diet of an elderly subject with inadequate protein intake [19], but evidence is still lacking in this regard.

Essential amino acid (EAA) supplementation has been shown to improve muscle mass [27], walking capacity and isometric muscle strength after 3 months, but only in combination with exercise [28]. Overall, evidence in favour of improvements in function with EAA supplementation is limited [29].

There is clinical evidence that low vitamin D levels cause muscle weakness, while alfacalcidol, a prodrug of D hormone, improves muscle function [30]. Vitamin D supplementation increases proximal muscle strength in the lower extremities in adults with vitamin D deficiency only [25(OH)D $<$ 25 nmol/L] according to a meta-analysis [31]. Studies have also shown that vitamin D supplementation could improve immunity in older adults, and could thereby help prevent disability [31].

The use of a dietary supplement, such as creatine, a nitrogenous organic acid compound found mostly in red meat, pork and fish (e.g. salmon, tuna and herring) to counteract sarcopenia is certainly of interest. Muscle atrophy in sarcopenia stems from a loss of fast-twitch (i.e. type II) muscle fibers, which are recruited during high-intensity movements, such as weight lifting and sprinting, and which are particularly high in creatine content. Creatine supplementation in older adults is thought to increase creatine levels, but studies agree that the nutrient works to build muscle only if the subject is exercising. Without the regular challenge to the muscles, supplemental creatine has no effect [32,33]. There are some concerns about the potential for renal toxicity of creatine supplementation in older individuals. However, few isolated studies on renal health disorders associated with creatine supplementation have been published, and in those studies, either recommended dosages were not followed or a history of renal disease or taking nephrotoxic medication was present. Some studies have concluded that creatine may raise creatinine levels without any negative effect on renal function at the proper dosage [34,35].

At the molecular level, proteins are essential components of muscle metabolism. Cellular-signalling mechanisms responsible for nutrients (primarily leucine and leucine-enriched EAA solutions) stimulate muscle protein synthesis in humans, and the rate is dependent on the extent of removal of non-essential amino acids from the mixture. There is evidence showing that the combination of leucine-enriched nutrients and resistance exercise enhances both mammalian target-of-rapamycin (mTOR) signalling and muscle protein synthesis. However, the authors concluded that long-term studies are needed to determine the effectiveness in sarcopenia [36]. Another promising supplemental intervention in sarcopenia is β-hydroxy β-methylbutyrate (HMB), which is a downstream metabolite of leucine. Studies exploring this option suggest a beneficial effect of providing HMB (2 to 3 g HMB per day) in various formats (capsules, liquids, etc), either alone or combined with other supplements in older adults [37–39].

The anabolic effects of omega-3 fatty acids include increased activation of the mTOR signalling pathway, but an anabolic response was observed only when supplementation was associated with the anabolic stimulus from amino acid administration [40]. Currently, there is no established dietary reference intake for these nutrients and there is a lack of interventional studies showing associations with sarcopenia [19].

Older adults tend to consume fewer calories in general, and if they do so, this may lead to pronounced protein deficiency. In order to improve nutritional rehabilitation and to overcome anabolic resistance in elderly people, higher protein intake is necessary [41]. It has been suggested that consumption of high quality protein foods (25 to 30 g) at each meal could prove to be beneficial in terms of increasing protein synthesis and conserving muscle mass in older adults [42].

The Society for Sarcopenia, Cachexia, and Wasting Disease developed nutritional recommendations for the prevention and management of sarcopenia. Balanced protein supplementation in the range of 1 to 1.5 g/kg/day slows loss of muscle mass, but only when combined with exercise may it be useful in preventing and reversing sarcopenia, as a part of a multimodal therapeutic approach. Leucine-enriched balanced amino acids and creatine enhance muscle strength, and vitamin D supplementation in doses sufficient to raise levels above 100 nmol/L should be given as

adjunctive therapy [43]. A comprehensive report of the International Sarcopenia Initiative (EWGSOP and IWGS) concluded that some nutritional interventions, like essential amino acids including 2.5 g of leucine, HMB and increasing protein intake to 1.2 g/kg/day, may improve muscle parameters. Nevertheless, current evidence of nutritional support to treat or prevent sarcopenia in the setting of rehabilitation in elderly persons with impairments is limited [29].

3. Impact of nutrition for rehabilitation of frail older patients

Frailty is an age-related clinical syndrome [44] associated with reduced functional reserve, multi-systemic paraphysiological changes (musculoskeletal, neurological, cardiovascular, audio and visual, deglutition apparatus) [45], which are responsible for a reduced ability to maintain physiological homeostasis to stressors, putting older subjects at risk of adverse outcomes, including hospitalization, disability and death [46,47].

The clinical components of physical frailty as described by Fried include unintentional weight loss, exhaustion, weakness, slow walking speed, and low physical activity [44], of which unintentional weight loss is very specifically linked to nutrition, while most of the other components are linked to sarcopenia as well as nutrition. Unintentional weight loss may be mainly due to inadequate energy and protein intake. Prof. F. Landi explained the pathophysiology of frailty in relation to nutrition: as age advances, older adults may experience various biological and hormonal changes (mainly in ghrelin, obestatin, leptin and cholecystokinin), neuromuscular changes and various other geriatric conditions, such as gastrointestinal dysfunction, sedentary lifestyle, polypharmacy, other chronic geriatric diseases, or environmental changes to leading to anorexia of ageing (loss of appetite and reduced food intake). This in turn can lead to conditions, such as sarcopenia or cachexia, micronutrient deficiency, reduced physical performance, decreased mobility and exhaustion (due to oxidative stress), which are the components of physical frailty.

Some studies have shown low BMI to be a risk factor for frailty, while others have identified obesity to be a risk factor, and yet others show that some excess body weight in later life may beneficial, reducing the rate of functional limitations and disability [48]. Instead of the BMI, the Mini-Nutritional Assessment® Short-Form (MNA®-SF) could serve as an effective tool to predict frailty in the setting of rehabilitation, as it includes domains for nutrition, physical frailty and cognitive decline, as pointed out by Prof. C. Sieber during the course.

Nutrition and frailty are highly correlated. Indeed, older adults are known to have inadequate caloric intake, which could lead to reduced physical function, weight loss, or disability [49].

Weight loss is a major component of frailty, and can be counteracted with protein supplementation. Protein supplementation has been shown to improve physical performance in frail subjects, improve grip strength, and increase muscle mass and strength [50]. Some studies have shown that the distribution of protein intake was associated with frailty, but not the amount of protein consumed [51]. Therefore, careful attention should be paid to maintain an appropriate amount of protein intake, with an adequate distribution as part of nutritional rehabilitation in older patients, since excessive amino acids could result in increased oxidation, and increase the load on the kidneys. Very low levels of vitamin D [25(OH)D] have been reported to be associated with risk of frailty, decreased physical performance, incidence of disability and an increased risk of all-cause mortality [52]. The role of other low micronutrients was also reviewed during this course. Several cross-sectional and longitudinal studies describe the existence of an association between low levels or low intake of several micronutrients (such as vitamin E, vitamins B6 and B12, carotenoids or selenium) and disability. It is known that there is a high risk of vitamin B deficiencies in elderly rehabilitation patients [9]. Low levels of vitamin D are associated with worse physical performance, muscle strength, gait or balance. Moreover, high levels of advanced glycation end products (AGE) are associated with low performance in strength or functional measures, such as grip strength, sarcopenia, or walking speed [53].

Therefore, the first step in preventing frailty is to maintain a suitable caloric intake. A minimum requirement of 25 kcal/kg/day has been shown to maintain the daily energy level for older adults, and if this level if not met, loss of weight and muscle mass may ensue [54]. Adequate protein intake is another essential component for the ageing population to maintain their muscle mass and strength, and as such, it plays a major role in preventing frailty. Micronutrients, in combination with other nutritional supplementation, should always be taken into consideration when implementing nutritional interventions in frail older adults. Implementation of special dietary patterns such as the Mediterranean diet, rather than single nutrient interventions, could also be more beneficial for frail older adults. The Mediterranean diet is rich in fruit, nuts, cereals and fish, and could supply natural vitamins, minerals and *n*–3 fatty acids, which play a major role in preventing malnutrition. *n*–3 long-chain polyunsaturated fatty acids (PUFA) or fish oil supplementation could help to increase strength. Indeed, a regular Mediterranean diet is known to maintain a good SPPB score, thus preventing frailty, as explained by Prof. Maria-Gabriela Ceravolo. Deficiency in vitamin D or other micronutrients, such as vitamins A, C, E, B6, B12, folate, minerals, such as zinc and selenium, and carotenoids in older adults are reportedly related to physical performance and frailty, but very few randomized trials have shown promising results from interventions on these elements [55].

According to Prof. Bruno Vellas, multidomain interventions, including nutritional supplements, physical and cognitive exercises, pharmacological supplementation as well as public awareness education programmes, could be more efficient than a single intervention technique for treating physical and cognitive frailty. This latter shares the same pathogenetic pathways as physical frailty, and therefore, similar interventions could be beneficial.

4. Impact of nutrition for rehabilitation in older patients with dementia

Both eating problems and malnutrition are under-recognized in aged patients with cognitive impairments. It has been reported that up to 45% of community-dwelling demented patients had significant weight loss in the previous year, and even half of those living in nursing homes have insufficient oral intake [56,57]. Different deficits and problems will be of major concern to doctors and caregivers, depending on the severity of the dementia. During the early stages of dementia, reduced nutritional intake may be the result of decreased appetite, with loss of olfactory sensitivity and taste. The most important factors influencing nutritional habits, in addition to the cognitive deterioration, include attention deficit, limitations on executive function, agnosia and apraxia, loss of independence and capacity for self-are, as well as aversive feeding behaviours. At the advanced stages of dementia, oral and pharyngeal dysphagia may develop, with eating difficulties and refusal to eat [56–58]. The nutritional care pathway in demented patients should always start with routine screening for malnutrition. Several screening tools are available that have been designed to assess nutritional status. The MNA-SF is the most widely used and broadly recommended tool for these patients. It is also recommended to regularly re-assess the state of nutrition and nutrition-related behaviours in demented patients [58]. ESPEN

experts suggest checking body weight at least once every three months, and at least once a month in case of nutritional problems [56]. In patients with advanced dementia, regular screening and formal assessment are no longer recommended. In these patients, the focus should be shifted from formal assessment with regular weighing, to determining patients' individual needs and demands, in order to elucidate the problems and accordingly, provide comfort with optimal palliative care [59].

Standard nutritional recommendations regarding protein and calorie intake are applicable in patients with dementia, although personalization of the diet is generally recommended, based on the results of the patient's nutritional evaluation, their individual risk of malnutrition, and their comorbidities. Nutrition with dietary restrictions is generally no longer advised, and a more liberal diet is suggested. Unfortunately, no specific dietary supplements are available that may improve cognition. A non-pharmacological approach promoting eating as a social activity, with enjoyment of food, is important for adequate food intake. If feasible, it is advised that patients eat meals at the table with family or other patients in an enjoyable, friendly atmosphere. Together with the nutritional requirements, the patients' preferences (i.e. type, variety of food, cooking method) should be taken into consideration. In severely demented patients with dysphagia, modification in food texture and consistency should be introduced. In demented patients who are no longer able to eat independently, careful hand feeding is encouraged. Moreover, it has been shown that being fed by the same caregiver, as opposed to being fed by different carers, may be beneficial for these patients, and the positive effect of nutrition education provided for carers and medical staff has also been demonstrated [56,57].

Enteral tube feeding in dementia remains a controversial issue. [60]. Both nasogastric tube and percutaneous endoscopic gastrostomy (PEG) placement are widely perceived as non-high-risk procedures. However, tube insertion may be followed by aspiration pneumonia, enteral and thoracic complications, fluid and electrolyte imbalance, or local complications, such as tissue trauma with pain and bleeding. In addition, an increased risk of fecal and urine incontinence, pressure ulcers and patient discomfort with a growing demand for physical restraint and pharmacological sedation has been shown [56,57,60]. Furthermore, there was neither a survival benefit, nor a beneficial effect on nutritional and functional status in patients with advanced dementia and enteral tube feeding as compared to those without enteral nutrition [56,60]. According to the expert consensus, tube feeding should be regarded as a medical intervention with individual recommendations for treatment being considered. The decision to insert a feeding tube should be based on careful analysis of the potential benefits and burdens for the patient related to the procedure. Setting attainable nutritional goals with patient-centered care is vital [56,59]. It is justified to use feeding tubes in mildly and moderately demented patients for a limited time period, in the event of a temporary crisis when oral intake remains insufficient despite food fortification and use of oral nutritional supplements (ONS). However, tube feeding should not be initiated in advanced dementia. For severely demented patients at the end of life, alleviation of symptoms and delivery of complex palliative care is crucial. Families and caregivers should be reassured that limited food and water is part of the dying process, and that mouth care with the option of "comfort feeding only" is a method of choice [56,60]. However, the rate of feeding tube insertion in advanced dementia is high, and in some settings, more than one third of institutionalized patients with advanced dementia receive enteral tube feeding [61]. In many cultural and religious settings, enteral tube feeding is regarded as a basic human right to live. To illustrate this experience, at the course in San Servolo, during his lecture entitled "Introduction to the clinical case: Nutrition and dementia", Prof. Cornel Sieber compared the PEG tube to an umbilical cord, which may trigger an instinct of caretaking in the family. In such difficult situations, respectful and tactful counselling of loved-ones is necessary, and it is also advisable to consult an ethics committee if a very ambiguous situation is encountered.

When caring for demented patients, ethical considerations regarding duty of care, principles of non-malfeasance and beneficence, and patient autonomy must be addressed. If feasible, advanced directives should be documented, and wishes expressed early in the course of dementia.

5. Dysphagia and swallowing disorders in the elderly

Dysphagia, or swallowing difficulty, is a serious health concern in the ageing population. The prevalence of dysphagia among people over the age of 65 ranges from 15% in the community-dwelling elderly, to 68% in nursing home residents. Swallowing problems are largely under-recognized [62]. Age-related changes in the physiology of swallowing are pre-disposing factors to dysphagia, along with age-related diseases [63]. Dysphagia thus appears to be a rather common cause of malnutrition, dehydration and aspiration pneumonia in the elderly. Moreover, swallowing problems increase mortality and morbidity among elderly patients [64]. The natural healthy ageing process affects the anatomy of the head and neck, and impacts on changes in physiological and neural mechanisms leading to alterations in swallowing (presbyphagia), which naturally diminishes the functional reserve, even in healthy older adults [65]. Presbyphagia is strongly associated with sarcopenia and consequent functional decline [66].

In addition, a reduction of muscle mass and connective tissue elasticity results in loss of strength and range of motion. Oral food processing requires more time, and food moves more slowly, also due to diminished lingual pressure [67] and lack of teeth, influencing chewing [62,68]. Persons older than 65 show delayed initiation of laryngeal and pharyngeal phases, including laryngeal vestibule (and airway) closure. Aspiration of the bolus into the airways occurs more often and deeper into the airways than in younger adults. Many commonly used drugs can seriously affect the swallowing ability, especially medication altering alertness or cognitive function, those causing xerostomia or oesophagitis [65]. Finally, a whole array of diseases in the elderly are accompanied by dysphagia, especially diseases of the central nervous system, such as stroke, Parkinson's disease, and dementia (as underlined in the previous chapter). It has been estimated that up to 45% of patients institutionalized for advanced dementia suffer from swallowing difficulties [63]. Impaired attention, memory and visual-perceptual abilities in patients with dementia play a significant role in rehabilitation. These domains are linked to malnutrition in older patients during cognitive rehabilitation, and negatively influence the rehabilitation programme, as emphasised by Prof. Maria-Gabriela Ceravolo. According to some reports, patients with prior stroke develop dysphagia in 30 to 65% of cases, predominantly after stroke affecting the brainstem or both hemispheres [69–71]. Although many patients spontaneously recover functional swallowing ability within the first month after stroke, difficulties may persist beyond 6 months in some patients. Screening for and evaluation of dysphagia varies in different settings and countries. However, better results are achieved when interdisciplinary dysphagia teams are available. Trained nursing staff can screen for any swallowing pathology using special dysphagia screening tools, e.g. the Gugging Swallowing Screen (GUSS), or the 10-item Eating Assessment Tool (EAT-10), to identify patients with dysphagia and risk of aspiration [72]. The speech language pathologist performs non-instrumental bedside examinations that include medical history, oropharyngeal sensorimotor assessment and evaluation of trial swallows. However,

when the screening process increases the suspicion of dysphagia, additional assessment by the speech language pathologist using instrumental methods may be necessary [65]. Among the possible examinations, flexible endoscopic evaluation of swallowing (FEES) can distinguish uni- or bilateral swallowing pathology [73]. The use of videofluoroscopic swallow study (VFSS) provides objective information on bolus transport, safest consistency of the bolus, and optimal head position and manoeuvres that may facilitate and individualize the act of swallowing. VFSS also helps to classify the degree of dysphagia, which in turn determines dietary management [74]. The penetration-aspiration scale (Rosenbek scale) is the most frequently used classification [75]. VFSS is an important tool to identify silent aspirations (i.e. absence of cough or visible signs of choking and distress), because up to 40% of silent aspiration goes undetected at clinical examination [76]. Finally, all persons with dysphagia should receive nutritional assessment to identify those individuals who have, or are at risk of protein-energy malnutrition, or other specific nutrient deficiencies.

Successful treatment of dysphagia in the elderly requires a combination of compensatory and rehabilitation approaches. The compensatory strategies usually include postural adjustment, slowing the speed of eating, limiting the bolus size, providing adaptive equipment, adapting the environment (i.e. avoiding distractions during feeding) and modification of the diet. The goal of diet modification is to improve the safety and ease of oral feeding, and ensure adequate oral intake of food and liquids. Some patients require a soft diet that is easily chewed; some require liquids with thinned or, alternatively, thickened consistency. However, low acceptability and poor adherence to the texture-modified foods and liquids can contribute to reduced food and liquid intake, thereby increasing the risk of dehydration and malnutrition [63]. Groher and McKaig [77] reported that 91% of nursing home residents on a modified diet received unnecessarily restrictive diets that did not match their swallowing ability. Expanded diet options, and a diet personalized by a dietician can help to prevent malnutrition and negative health outcomes. Patients with severe dysphagia may require artificial nutrition and hydration by nasogastric tube for short-term enteral feeding (less than 30 days) or PEG for medium- and long-term enteral feeding. Adverse PEG events are common, and include local wound complications, leakage around the insertion site, tube occlusion and increased reflux with aspiration, leading to complications, such as aspiration pneumonia [78]. The use of enteral feeding methods occasionally promotes a cascade of negative psychosocial features, including depression and loss of social interaction associated with feeding [79]. For patients with advanced dementia, artificial tube feeding is not recommended, as it does not prolong survival or improve quality of life [80,81]. Rehabilitation approaches have mostly been focused on exercises for controlling oral, pharyngeal and laryngeal range of movement, and re-educative exercises of the swallowing act. Therapy can be done directly with a bolus of a different texture, or indirectly on saliva. There are different approaches, including oral motor exercises, lingual resistance exercise, expiratory muscle strength training (EMST) or the Shaker head lift exercise [82]. The McNeill Dysphagia Therapy Programme (MDTP) is an exercise-based therapy programme addressing the entire swallowing mechanism [83]. Oral sensory awareness techniques, like the use of a sour or cold bolus, can be used with patients who have a swallow apraxia, tactile agnosia for food, reduced oral sensation, or delayed onset of the pharyngeal swallow. Results of recent investigations have revealed that swallowing rehabilitation can represent an efficient way to increase safe oral intake in elderly patients suffering from dysphagia, and it also demonstrated extended benefits related to improved nutritional status and reduced rates of pneumonia [63]. Aspiration, dehydration, pneumonia, malnutrition, sarcopenia, functional decline and institutionalization are often consequences of dysphagia in the elderly. These life-threatening conditions require multiprofessional team diagnostics and therapeutic interventions, accompanied by cooperation with patients, family members or caregivers. Behavioural, dietary and environmental modifications, together with a good rehabilitation programme are non-invasive, yet effective approaches.

6. Research in progress

The Multidomain Alzheimer Preventive Trial (MAPT) study was designed to investigate the efficacy of a multidomain intervention consisting of nutritional counselling, physical exercise and cognitive stimulation, combined with omega-3 fatty acid supplementation, in slowing cognitive decline in frail older adults at risk of cognitive decline [84,85]. The research group of Prof. B. Vellas concluded that a possible effective way to prevent dementia appears to emerge through a synergistic effect of all the tested components in a multidomain, rather than a single intervention. According to the authors, another advantage of the MAPT trial design is that it can easily be implemented in the general population. Rapid screening of older adults at the community level is required to prevent frailty. In his lecture, Prof. B. Vellas presented the Gérontopôle Frailty Clinic, and explained the Gérontopôle Frailty Screening Tool (GFST), which is a suitable example of how to integrate frailty into clinical practice in the general population [86]. The GFST is an 8-item questionnaire that can be used to identify frailty in community-dwelling persons older than 65 years without functional disability or current acute disease. The questionnaire includes 6 questions to evaluate the patient's status (living alone, involuntary weight loss, fatigue, mobility difficulties, memory problems and gait speed), and 2 questions for the physician who is examining the subjects about the frailty status of the individual and their willingness to be referred to a specialized geriatric (frailty) clinic for further evaluation [87].

During a keynote lecture of the course, Prof. F. Landi described a more sophisticated study entitled "Sarcopenia and Physical fRailty IN older people: multi-componenT Treatment strategies" (SPRINTT) (www.mysprintt.eu). This currently ongoing study intends to bring multiple sectors together (pharmaceutical companies, leading universities and hospitals, and small- and medium-sized enterprises) for more multi-factorial intervention-techniques, including physical exercise, nutrition and pharmacological interventions as well as the use of modern technologies for the prevention of frailty. The outcomes of the SPRINTT study could shed more light on future intervention techniques for frailty.

7. Nutritional intervention plan

According to the PROT-AGE study [14], protein requirements recommended for older people who are malnourished, or at risk of malnutrition are 1.2 to 1.5 g/kg/day, with even higher needs for individuals with severe illness or injury. This study underlines the aim of achieving equally high protein intakes at early, mid and late time points in the day, in order to offer a continuous supply of fuel to benefit the tissue. For healthy older people, the diet should provide at least 1.0 to 1.2 g of protein per kilogram of body weight per day. Other macronutrients include carbohydrates (50–65% of calories) and fat (25–30% of calories). Water (30 mL/kg/day) and fibre (20–30 g per day) also need to be considered, and micronutrients should also be assessed according to recommendations. Dietary advice plays an important role in the nutrition care pathway. Personal likes and dislikes must mandatory be taken into consideration, and patients should be included as far as possible in diet-related decisions. Diet modifications and fortified foods or

snacks are frequently used. When, despite all efforts, oral intake is insufficient to cover the patient's needs, oral nutritional supplements should be used to achieve nutritional requirements. There is increasing evidence to support the importance of nutritional status on rehabilitation outcomes. According to a systematic review that included 1220 patients, malnutrition in older adults admitted for rehabilitation had a negative effect on functional recovery and quality of life, and was associated with a higher risk of institutionalization, hospitalization and mortality [88]. Moreover, previous studies have shown that malnourished patients with stroke, chronic heart failure, chronic pulmonary disease, hip fracture and hospital-associated deconditioning – all major causes of disability – have poorer clinical and functional prognosis during rehabilitation, as well as poorer rehabilitation outcomes. In elderly people who need rehabilitation, a nutritional intervention plan is essential, since it not only improves health outcomes, but also optimizes their capacity to participate in rehabilitation [89,90]. Past studies have shown that with proper rehabilitation techniques, frailty can be delayed or reversed in some populations [91,92]. Nutritional support is all the more effective when it is implemented early. Patients with severe undernourishment should start nutritional support under close monitoring, and at the same time, diet modifications should be introduced and nutritional factors assessed. The safety of nutrition interventions should be ensured by paying special attention to patients with risk factors for refeeding syndrome. The objectives of the treatment plan should be determined, and periodically evaluated.

8. Conclusion

A proper practical, evidence-based guide is warranted for rehabilitation plans, and should be comprehensive, comprising interdisciplinary assessment with a multidisciplinary group (geriatricians, physiotherapists, dieticians etc), yet it should also be individually tailored, according to Prof. S. Masiero. Aspiration, dehydration, pneumonia, malnutrition, functional decline and institutionalization are often the consequences of dysphagia in the elderly. These life-threatening conditions require multiprofessional team diagnostics and therapeutic interventions, accompanied by cooperation with the patients, their family members and/or caregivers. Behavioural, dietary and environmental modifications together with a rehabilitation programme are non-invasive, yet effective approaches. Providing adequate nutritional care is a priority. This should include a set of tailored interventions delivered by multidisciplinary teams. Finally, the authors strongly support the belief that nutritional rehabilitation is a very interesting topic, and underline that relevant courses should be organized every one or two years, with an update of current knowledge.

Disclosure of interest

The authors declare that they have no competing interest.

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