

## EDITORIAL

### NUTRITION AND FRAILTY

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#### Introduction

Older people are more prone to undernutrition or malnutrition, as a result of age related physiological changes affecting appetite, food intake and metabolism, chronic diseases and functional impairment, social and psychological factors (1). The increased prevalence of frailty with ageing is also well known (2). Weight loss may be considered a hall mark of the frailty syndrome, where low energy and protein intake together with various vitamins contribute to the components of the frailty syndrome such as fatigue, decline in strength and aerobic function, and multi-morbidity (3). The important contribution of nutrition to frailty is highlighted in a recent article supporting the use of the Mini Nutritional Assessment as a screening tool for the identification of frail older people (4). The inflammatory process contributes to the underlying pathophysiology of many chronic diseases of ageing, as well as the frailty syndrome, giving rise to the term ‘inflammageing’ (5-9). The concept of a diet that counters inflammageing has also been proposed, as an approach to prevention and treatment (5). This article reviews the current strategies in nutrition research to examine the relationship between nutrition and frailty, existing evidence of studies using frailty as an end point, recommendations in prevention and treatment, and the gaps between research findings and translation into clinical practice and health policies in health promotion and clinical management.

#### Methodological considerations

In the study of the role of nutrition in chronic disease aetiology, as well as other health outcomes, many methodological limitations have been pointed out (10). Epidemiological studies are largely based on self-reported intake (24h Diet recall or food frequency questionnaire); blood tests tend to be for individual nutrients (such as vitamin D, C, B12). Historically the main approach consists of examination of macro and micro nutrients. In recent years, dietary patterns have been examined, as being a more holistic approach to overall nutrient consumption and more useful for dissemination of health promotion messages (11). The strength of evidence is related to the methodology used: observational cross sectional or prospective studies, and randomized controlled trials. Methods used to examine the role of nutrition with frailty as an outcome should be the same as that for chronic diseases.

#### Role of nutrition with frailty as outcome

As early as 1998, the importance of adequate energy intake  $\geq 6.3$  MJ together with adequate intake of minerals and water soluble vitamins in the prevention of frailty had been pointed out (12). The majority of subsequent studies examined the relationship between dietary patterns and frailty as a specific outcome adopted the dietary pattern approach, with the majority of studies examining the Mediterranean Dietary pattern in community-dwelling adults. In a cross sectional study of 192 community-dwelling adults >75 years, good dietary quality as presented by the Mediterranean diet score was inversely associated with the frail state (13). A prospective study of 5925 men aged 65 and over in the US followed up for a mean of 4.6 years showed that higher Dietary Quality Index was inversely associated with incident frailty (14). In a prospective study over 3.5 years of 1872 non-institutionalized people aged 65 years and over, a ‘prudent’ pattern characterized by high vegetable and olive oil intake was protective of incident frailty compared with a ‘Westernized’ pattern with high consumption of refined bread, dairy and meat products and low fruits and vegetable consumption (15). A prospective study over 2.5 years of three cohorts in Europe with 2926 people showed that fruits and vegetables consumption reduced incident frailty in a dose dependent manner (16). In a prospective study of dietary patterns and frailty in 2724 Chinese community-dwelling people aged 65 years and over assessing adherence to a priori dietary patterns (Dietary Quality Index-International DQI-I, Mediterranean Diet) and three post priori dietary patterns derived from local data, every 10 unit increase in DQI-I was associated with 41% reduced risk of frailty adjusted for age and gender (17). Similar findings were observed among the Chinese population in Taiwan in a cross sectional study, where a dietary with more phytonutrient – rich plant foods, tea, omega-3-rich deep sea fish and other protein-rich foods was associated with a lower prevalence of frailty (18). A recent systematic review and meta-analysis showed that adherence to Mediterranean Diet reduces incident frailty risk (19).

There are few randomized controlled trials of nutrition intervention with frailty as an outcome. A study of community-living pre-frail and frail older people in Singapore showed that improvement in frailty score was observed in the nutrition supplement alone arm of the study. That persisted six months after cessation of the 24 weeks intervention (20). It is of interest that the increase in physical activity was greater in the

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nutritional supplement group compared with the exercise group, suggesting that there may be some degree of undernutrition at baseline among the participants.

### Physical frailty

There are many studies examining the relationship between nutrition and sub components of frailty: in particular the physical and cognitive aspects. If sarcopenia is used as an indicator of physical frailty, there is a relationship between nutrients and muscle mass, strength and physical performance, shown in a cross sectional observational study of 227 community-dwelling people aged 65 years and over. Using the European Working Group criteria for the definition of sarcopenia, sarcopenic adults had a lower intake of n-3 fatty acids, vitamin B6, folic acid, vitamin E and magnesium, lower levels of eicosapentanoic acid, linoleic acid, and higher homocysteine level (21). A Mediterranean Diet pattern was associated with greater skeletal muscle mass and power in women in the UK (22), lower risk of sarcopenia in Chinese community older people (23), while a 13 week oral supplementation of a vitamin D and leucine-enriched whey protein improved muscle mass and lower extremity function in sarcopenic adults (24). Higher dietary quality across adulthood is associated with better physical performance in older age (25).

### Cognitive frailty

Physical and cognitive frailty are interrelated, the latter manifesting as varying extent of cognitive impairment, and nutrition is an important underlying factor for both syndromes (26). The importance of various macro and micro nutrients in optimizing cognitive function have been summarized (27, 28). With regard to studies of dietary patterns, the Mediterranean diet appears to have benefits for optimising cognitive function (29, 30), while an inflammatory diet characterized by higher intake of red meat, processed meat, peas and legumes, and fried food was associated with accelerated cognitive decline in the Whitehall II prospective cohort study (31). There is some suggestion that adherence to the Mediterranean Diet may also reduce risk of Alzheimer's Disease (32). A recent review of the role of gut microbiota in the regulation of the gut-brain axis and amyloidogenic properties of gut bacteria suggest a possible impact of nutrients in modulating gut bacteria composition and amyloid formation, and pathogenesis of Alzheimer disease (33). While associations between individual nutrients and cognitive function have been documented, the evidence was not considered strong enough for the recommendation of individual nutrient supplementation, but rather health promotion messages should focus on increasing intakes of certain food groups such as fruits vegetables and oily fish (34, 35).

### Translation into practice

From this brief assessment of current knowledge, it is reasonable to consider assessment of nutritional status in older people with frailty, and to consider that dietary recommendation may have a role both in the prevention and treatment of frailty. The recently published Asia-Pacific Clinical Practice Guidelines for the management of frailty contains two nutritional recommendations, that adults with frailty with unintentional weight loss be screened for reversible causes and considered for protein and caloric supplementation/food fortification, and vitamin D be prescribed for those found to be deficient (36).

Currently there exists a gap between research findings, public dissemination and implementation in clinical management and incorporation into health policies. Researchers, professional societies, policy makers, non-government organizations concerned with the welfare of older persons, should collaborate to promote an optimal dietary pattern to counter frailty, in a way that can be adopted in practice by the lay public, through effective media promotion. Ultimately adoption involves behaviour change, and an understanding of key drivers to motivating older people to change their lifestyle is critical to translating research evidence into prevention and management of frailty. The life course approach and adaption to different cultures would also be important.

### Conclusion

Neither nutrition nor frailty are topics that the majority of doctors in day to day clinical practice and researchers are familiar with, or engage in as fields of research. Yet with population ageing all over the world, much needs to be done to raise awareness of the clinical importance of nutrition and frailty, in addition to chronic disease prevention and management. This approach represents true patient centred care in directing the goal of health promotion and clinical care towards maintenance of physical and cognitive function rather than reducing mortality.

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