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THE SIGNIFICANCE OF SOCIOECONOMIC AND DIETARY FACTORS ON THE PREVALENCE AND ONSET OF FRAILITY AMONGST THE ELDERLY

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ABSTRACT

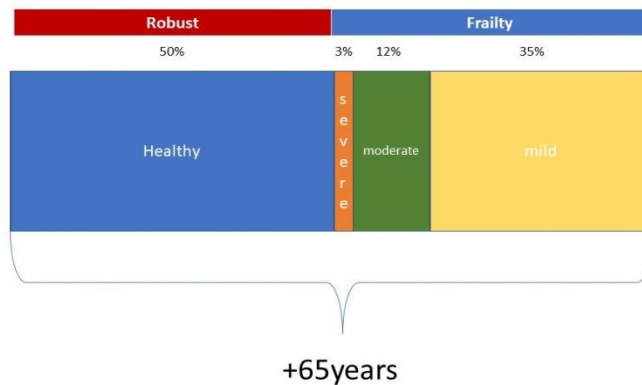
Frailty is the physiological decline of aging characterized by vulnerability to poor homeostatic functioning. Different models have been proposed by which frailty can occur and various screening tools have been developed to assess frailty. Various risk factors have equally been studied if there are significant relationship with these and frailty. This review article focuses on the relevance of socioeconomic and dietary factors to the development of frailty amongst the elderly.

Keywords: *Dietary, Elderly, Frailty, Significance, Socio-economic*

INTRODUCTION

There are many approaches to defining frailty. It can be defined as a state of escalated vulnerability to poor resolution of homeostasis after a stressful event, which raises the risk of adverse outcomes including falls, delirium, and disability.¹ It can also be seen as a decline in an individual's mental and physical resilience, or capability to bounce back and recuperate from events like illness and injuries.² On the other hand, pre-frailty may be described as a multi-faceted concept, an early and reversible risk-state before frailty that can lead to adverse healthcare outcomes, which is interpreted operationally by subsistent frailty screening and assessment tools. This study documented the prevalence of pre-frailty and frailty to be 58.7% and 23.8%, respectively with pre-frailty being associated with gender, age group and Body

Mass Index (BMI), and frailty with gender, age group, hospitalization, functional capacity, and self-perceived health.³ In general, the prevalence of frailty increases with age independently of the assessment instrument and ranges between 4 and 59% in community-dwelling elderly populations and is higher in women than in men.⁴ A longitudinal study of ageing among the English population showed an overall weighted prevalence of 14% with regards to frailty; however, the number of people living with frailty was higher with increasing age, while it was 6.5% in those 60-69 of age, it increases to 65% in those 90+, and it was discovered to be more frequent in women (16%) than in men (12%).⁵ Another UK study noted that approximately 50% of 65 years and over live with frailty. It was noted that 3% of the population aged 65+ in England live with severe frailty, 12% with moderate frailty and 35% with mild frailty.⁶



BMJ. (2018) 'The challenge of ageing populations and patient frailty: can primary care adapt?' Available at: <https://www.bmj.com/content/392/bmj.k3349/rr> (Accessed 12-11-21)

Figure 1: Percentage of robust versus frail individuals (BMJ, 2018)

Models for Assessing Frailty

There are two broad models of frailty: the Phenotype model and the Cumulative Deficit

(CD) model. There are several other tools to assess frailty such as the Timed up and Go test (TUG), PRISMA 7 Questionnaire, The Edmonton Frailty Scale, Gait speed, Self-

reported health questionnaire, Rockwood Clinical Frailty Scale.⁷ Gérontopôle Frailty Screening Tool (GFST) is another valuable one used for persons aged ≥ 65 years with no physical disability and acute clinical disease.⁸ The simple frail test and the GFST have a higher sensitivity compared to the Fried Phenotype and they are appropriate to use in the community. However, Rockwood's tool has the highest specificity and it is appropriate to use in diagnosis.⁹ The Phenotype model identifies a group of characteristics; unintentional weight loss, reduced muscle strength, reduced gait speed, self-reported exhaustion and low energy expenditure. People with three or more of these characteristics are said to be 'frail', the model can also highlight whether someone is 'prefrail'. The Phenotype model defines one of the central characteristics of frailty as sarcopenia. It is a brief tool that does not require large quantities of information. However, it does not provide any indication about preventive or therapeutic interventions

to be put in place and it does not identify what the underlying cause might be. The subsequent Comprehensive Geriatric Assessment (CGA) will provide the supporting specific actions. The CD model describes an accumulation of characteristics which sometimes occur with ageing and thus increase the risk of adverse outcomes for the person. It requires substantially more information than the Phenotype model, both medically and functionally. Characteristics include loss of hearing, low mood, tremor, loss of memory which combined, form the frailty index. Frailty index is calculated by dividing the number of deficits present by total number of deficits in the questionnaire. The higher the score is, the greater the degree of frailty. In a global longitudinal study by Li et al findings were that both tools predicted risks of adverse health outcomes; however, the CD model predicted the risk of future falls, fractures and death more precisely than the Phenotype model.¹⁰

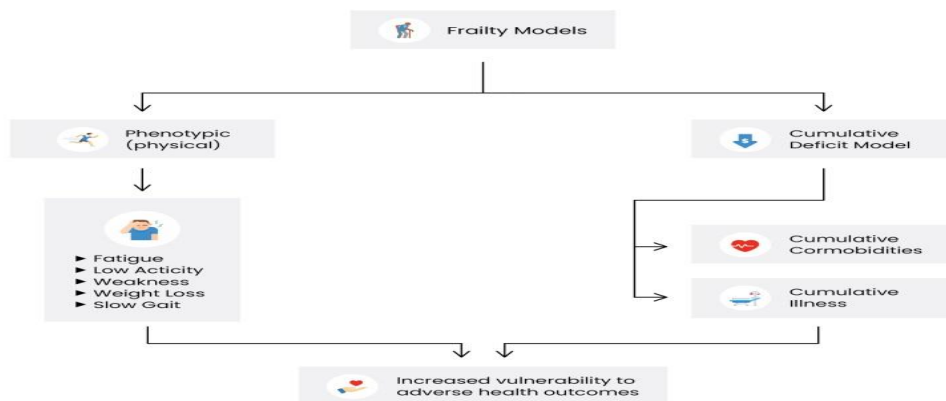


Figure 2-Frailty Models (Courtesy Tony Tom)

Nutritional assessment in the elderly, clinical and anthropometric assessments

Multiple changes occur when aging, metabolism decreases, body composition changes, muscle mass decreases and adipose tissue increases; with many intrinsic and extrinsic nutritional contributors involved for these outcomes. Assessing the nutritional status of elderly patients is an integral component of CGA with the purpose, after a clinical anthropometric, biochemical and dietary evaluation of each individual, to determinate clinical reasons for unexplained weight loss, asthenia, adynamia and changes of the pattern of oral intake and frailty therefore helping to identify problems and intervene according. Clinical evaluation and collateral history will help to determinate causes of physical conditions like loss of appetite, impaired taste perception, poor dentures- loss of teeth, gastrointestinal diseases as dysphagia and gastroesophageal reflux disease(GORD); mental health and cognition impairment like depression and dementias; neurological conditions, medication-induced anorexia; functional disability affecting shopping and meal preparation; also, in many occasions and very important to take in consideration the poor nutrition as result of socioeconomic factors affecting the adequate oral intake in quantity and quality of nutrition, therefore impacting directly in the physical and mental health of the aging population. Anthropometric evaluation will help to determine and evaluate malnutrition, overweight, obesity, muscular mass loss, fat

mass gain and adipose tissue redistribution, using the measurements of body composition like Body Mass Index (BMI), hand grip strength, dynamometer, body fat percentage determined by bioelectrical impedance analysis and abdo-brachial and thigh perimeter and questionnaires to evaluate nutritional status such as the Mini Nutritional Assessment(MNA), along with biochemical markers (levels of albumin, total proteins, cholesterol, lymphocytes, and haemoglobin) to evaluate the nutritional status of the patient that will help to determinate a plan to follow.¹¹

Screening tools and biochemical markers

Several screening tools can be used to diagnose frailty as earlier mentioned. A screening tool is a simple way of determining a disorder in a large population.¹² Nutritional status has been noted to play a vital role in development of frailty particularly in the elderly. A biomarker or signature molecule is a biological molecule found in the body to indicate the presence of a disease condition.¹³ Traditionally pre-albumin and albumin have been used as the nutritional biomarkers and have also been used in different nutritional assessment screening tools such as MNA and Prognostic Inflammatory and Nutritional Index, while others such as Birmingham Nutrition Risk Score, Subjective Global Assessment and Nutrition Risk Classification do not make use of any biomarkers.¹⁴ The MNA has been proven as a useful screening tool in predicting pre frailty and frailty amongst several others.¹⁵ As frailty involves a set a biological processes namely inflammation, oxidative stress, mitochondrial

dysfunction, cellular senescence and genomic instability, many different markers have been used as a set of investigations. A Full Blood Count (FBC) in the case of frailty will show low haemoglobin not attributable to iron deficiency or any myelosuppression, high neutrophil count and high monocyte count. Serum lipids will give low cholesterol levels and C-reactive protein (CRP) will be raised. Low levels of insulin growth factor due to a reduced response to hormones because of oxidative stress. High interleukin-6 and tumour necrosis alpha-factor are among the pro-inflammatory cytokines which indicates inflammation. Low serum albumin, low levels of vitamin D and low alanine transaminase are also consistent in frailty.¹⁶

Effect of dietary factors on frailty

The effect of nutrition and dietary factors on developing frailty in older age is significant because a poor nutritional state (including both malnutrition and obesity) impacts on pathophysiological processes involved with ageing and frailty including oxidative stress and immune response.^{17,18} Nutrition can impact on all the phenotype model of frailty criteria, including weight loss, exhaustion, low physical activity, slow gait speed and weak grip strength.¹⁸ Poor diet can also lead to increased risk of osteoporotic fracture, peripheral arterial disease, multi-morbidities and frailty.^{17,18} Low intake of certain micronutrients has been found to increase the risk of frailty, including vitamin D, vitamin B12, Vitamin E, vitamin C, folate and betacarotene.¹⁷ The main macronutrient involved in reducing risk of frailty is found to be protein.^{17,19} A diet high in antioxidant-rich

foods is also associated with lower frailty risk; however Leon-Munoz et al highlights that people do not eat micro-nutrients rather food which are a combination of micronutrients, so it is complex to pinpoint which nutrient is affecting frailty.¹⁷ Overall dietary quality has been found to be most effective in providing protection against frailty, with the Mediterranean-style diet (high in olive oil and fruit and vegetables and low in processed foods) found to be high quality.¹⁸ Leon-Munoz et al noted Mediterranean diet is also associated with lower risk of metabolic syndromes. A Western diet high in refined cereals, whole dairy and red and processed meats is associated with increased risk of frailty, slow walking speed and weight loss, as well as increased risk of heart disease, diabetes, metabolic syndromes, insulin resistance and an increase in inflammatory biomarkers.¹⁹ Dietary restriction is another pattern that has been found to improve health and life span, likely due to reduction in oxidative stress and preservation of mitochondrial function, however it is recognised this approach is unlikely to be sustainable in everyday life.¹⁹ Lochlainn et al finds there is limited research into dietary interventions alone as treatment for frailty, however in studies where diet and exercise are looked at together the combined intervention was found to be more beneficial than exercise alone.^{18,21}

Metabolic Syndrome and Frailty

Metabolic syndrome is defined as a combination of diabetes, hypertension and obesity which puts people at greater risk of vascular complications including coronary

heart disease and stroke. It is estimated to affect 1 in 3 adults over 50 in the UK.²² This syndrome is closely associated with frailty because of the overlap of key characteristics, such as inflammation, obesity and insulin resistance, which can cause increased risk of functional decline and dependency where both metabolic syndrome and frailty co-exist.²³ Development of metabolic syndrome is associated with lower socio-economic status when considering educational level and household income; this is found to affect women more than men.^{24,25} Those from lower socio-economic background are more likely to smoke and drink, while those with a higher educational background tend to have better lifestyle behaviours, psychosocial attitudes and have greater access to health services.²⁶ Prevention or reversal of metabolic syndrome is suggested to be through making lifestyle changes such as reducing obesity, increasing exercise levels, a healthy and balanced diet, and reducing smoking and alcohol intake.²²

Socioeconomic factors that affect frailty in the elderly

Brunner et al in a study of 6,233 adults investigated factors affected by socioeconomic status (SES) which contributed to frailty onset. They concluded the influential factors were: physical activity (13%), interleukin -6 levels (13%), body mass index category (11%), CRP (11%) and lung function (10%). They recommended interventions to modify inactivity, obesity; smoking and low grade inflammation in middle age might reduce disparity between socioeconomic groups in terms of frailty experienced.²⁶ Another study by Soler-Vila et

al investigated 1,857 elderly individuals for 4-6 years and found that women with lower education or manual occupation were associated with greater propensity to frailty.²⁷ Analysis elucidated that no alcohol (compared to light /moderate consumption), time spent watching television, less time spent reading, higher frequency of obesity, and severity of chronic disease states in women with lower SES were responsible. By contrast they were unable to find a correlation between frailty in men and education or occupation. A review by Gusseous et al found that low levels of education and income were associated with frailty as was residing in a deprived neighbourhood.²⁸ Information obtained by the Survey of Health, Ageing and Retirement in Europe was used to model frailty index trajectories.²⁹ Data from community dwelling adults over 50 across ten countries was used. They found that the association of frailty with low levels of education, occupation and wealth were focused to continue throughout old age while the effect of income on frailty became negligible. Majid et al stated that people from ethnic minorities living in economically developed countries were more likely to experience frailty than Caucasians.³⁰ Higher levels of frailty were seen in ethnic indigenous minority groups in the USA, Australia and New Zealand when compared to the majority white population.

Significance of socio economic and dietary factors on the onset and prevalence of frailty

Although studies have different designs, sample sizes, and locations, they showed that the principal socioeconomic and dietary

factors positively associated with frailty are: age, female gender, black race/colour, BMI, and smoking. Inversely associated factors are schooling, income and alcohol use.^{18, 23-31} Longitudinal studies showed that prevalence of frailty was higher in the old, women, blacks, and low-income individuals. At more advanced ages there is an increase in pre-frail and frail elderly, suggesting that frailty is a progressive condition.²³⁻³¹ Studies have shown that black race/colour is an important indicator of low SES and is associated with deficient health and high mortality risk contributing indirectly and directly to development of the frailty syndrome.³¹ Additionally some authors believe that race is a marker for genetic polymorphisms that have an influence on the emergence of frailty.³¹ Income and schooling do not act directly in the pathophysiology of frailty, but interfere in the individual's lifestyle and quality of life and thus in factors that vary with SES, including gender and age, which can influence the frailty process.^{28, 31} Underweight elderly and those with a higher proportion of overweight showed a higher prevalence of frailty. The association between frailty and underweight may be related to the common loss of muscle mass in individuals with unintentional weight loss. Meanwhile, the relationship between frailty and overweight and obesity may be due to the fact that excess weight can be associated with activation of inflammatory processes, which trigger systemic alterations, which in turn can influence the onset of frailty. Although studies showed an inverse association between alcohol consumption and frailty and a positive association between smoking and the syndrome the authors do not discuss the possible explanations for such

findings. Woods et al merely mentioned that when stratifying the variable in doses per week, elders with moderate alcohol consumption had 13 to 31% lower odds of presenting frailty syndrome, even after adjusting for chronic diseases that have been associated with moderate alcohol use.³² Although socioeconomic and dietary factors show a relationship to frailty in the elderly, some determinants are not subject to changes and interventions. For example, it is impossible to alter age or gender, but they should be considered anyway, since various health conditions increase with age and occur differently between men and women.^{31, 32}

Interventions and Prevention

The role of dietary interventions on frailty is unclear as most studies around this subject incorporate supplementation and exercise. Dietary interventions that can have an impact on frailty are:

Mediterranean diet – high consumption of fruit, vegetables, plant-based foods (legumes, nuts, seeds), use of olive oil, reduced meat and dairy consumption. This leads to higher intake of micronutrients, antioxidant nutrients, polyphenols, and plant bioactive compounds. It has been linked to several benefits on general health which can lead to positive changes in frailty.^{18, 33}

Protein supplementation – the maintenance of muscle mass appears essential in managing frailty. This can be achieved by forming new muscle mass or by maintaining the current levels. Studies that have incorporated protein supplementation plus exercise have shown more promising outcomes. Appetite loss is

associated with malnutrition, weight loss and subsequently frailty. High protein meals are often satiating and compliance with these meals is poor. Protein supplementation can be an effective strategy in this group of patients while further investigations are conducted to understand the cause of poor appetite.¹⁷

Vitamin D – lower concentrations have been found in frail subjects (circulating 25 (OH) D concentrations). Supplementation has not shown to be effective in changing frailty status and its role remains uncertain.

Oral health promotion– Poor oral health can lead to difficulty speaking, swallowing and eating and reduced overall quality of life. This will lead to a decreased nutritional intake and increase risk of frailty. Improved proactive management of oral health in patients at risk of frailty is essential.¹⁸

Malnutrition can be a risk factor for frailty and has been known to be influenced by the socioeconomic level of the older adult.³⁴ While low socioeconomic status has been linked with frailty, high socioeconomic status has been linked with increased mortality secondary to frailty – likely due to very poor underlying condition as this population has access to good living and working environment, healthier lifestyle choices and behaviours.³⁵ Public health multicomponent interventions that incorporate exercise, smoking, obesity, polypharmacy, depression, nutrition, and assessment of home hazards are essential as they have the potential to reduce socioeconomic inequalities in frailty. These should be aimed at those with lower socioeconomic status and started earlier on in life.²⁶

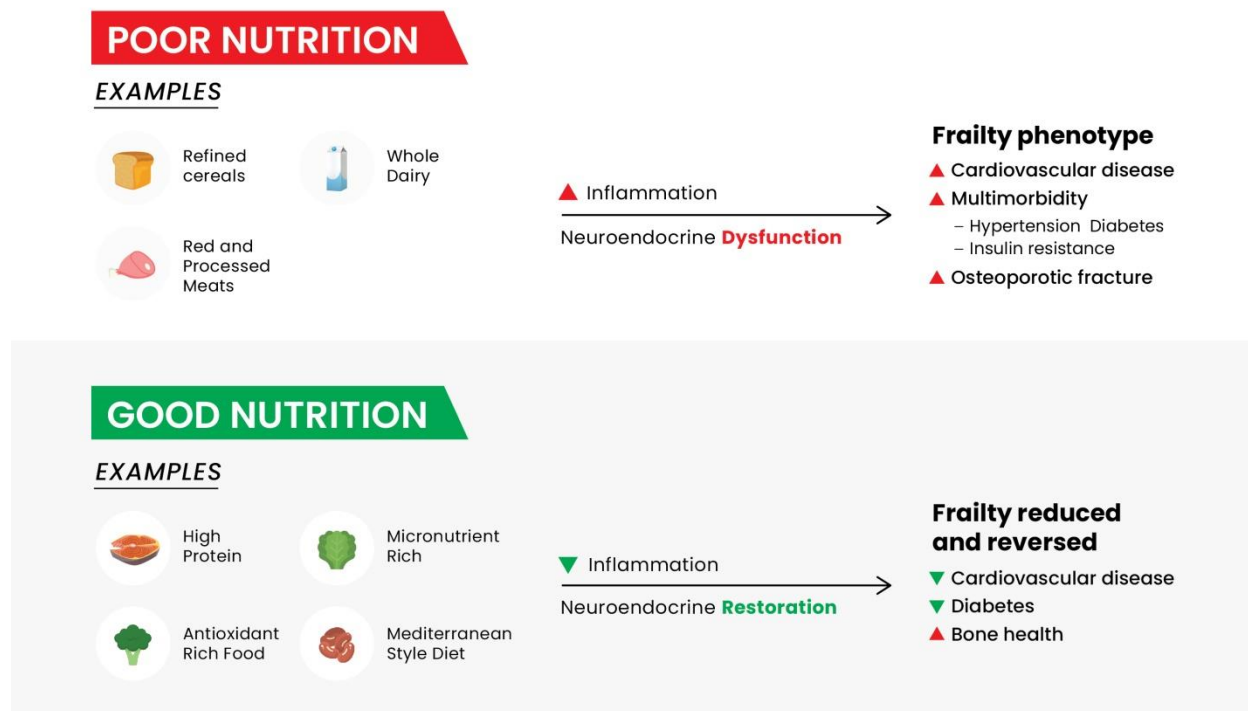


Figure 3- Intervention and Prevention of frailty (Courtesy Tony Tom)

Conclusion

Malnutrition can be a risk factor for frailty and has been known to be influenced by the socioeconomic level of the older adult. The onset and prevalence of frailty can be affected by various dietary and socioeconomic factors although the mechanisms have not been fully understood.

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