The Role of Protein in the Management of Malnutrition

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Introduction

Disease related malnutrition remains common; despite slowly increasing awareness through nutrition screening strategies, such as 'MUST' ('Malnutrition Universal Screening Tool'), it remains under identified and undertreated.[1] Where it is identified, treatment plans suggest a focus initially on improving food intake which may increase energy (kcal) intake, but it is vital to ensure increased requirements for protein are also met. This article highlights the types of patient that may have increased protein needs and the evidence to support increased protein requirements above reference nutrient intakes (RNI's).

With more than three million people in the UK thought to be malnourished (1.3 million of these over 65 years of age), and public health expenditure estimated in excess of £13 billion per annum,[2] it is a major clinical and public health issue. It is widespread, particularly in patients admitted to hospital, residents in care homes, and people receiving community care.[1]

Older people may be more vulnerable to malnutrition for a number of reasons (see **Table One**). The BAPEN Nutrition Screening Week surveys consistently demonstrate a higher risk in those over the age of 65 admitted to hospital, care homes or mental health units (39% vs. 28% in those under 65 years $p<0.001$[3]). Given that the population is ageing (the number of older people in Europe aged 65–79 years will increase by + 37.4% by 2030[4]), this means that the costs of malnutrition to healthcare systems will continue to escalate at an extraordinary rate due to adverse clinical consequences.[5, 6] These include increased complication rates, prolonged length of stay in hospital, increased readmission to hospital and need for community care.[7, 8]

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Ageing is associated with a progressive decline in organ and system function, including depletion of lean body mass, dysregulation of the immune system and altered inflammatory response.[9, 10] Depletion of muscle mass, recognised as sarcopenia in the elderly, is often responsible for frailty in this population. It is associated with mobility and functional impairment, increased risks of falls, reduction in independence and also, a reduction in capacity to meet the extra demands of protein synthesis required in disease and injury.[11] Muscle protein is directly affected by protein intake in the diet[12, 13] and it has been demonstrated in the InCHIANTI study[14] that low nutrient intakes, including protein are significantly and independently associated with frailty. Risk factors for sarcopenia in many cases are very similar to those for malnutrition and therefore, can form something of a vicious circle with one directly exacerbating the risk of the other.[9, 11] Many studies have demonstrated that older people residing in care homes or sheltered housing consume inadequate amounts of protein and micronutrients, often despite adequate food provision, predisposing them to rapid decline of muscle mass.[15-17] Ageing and elderly patients are also less responsive to the stimulatory effect of dietary amino acids on muscle protein synthesis, but it has been shown that high protein intakes at levels of up to 25-30g high quality protein per meal can can maximize muscle protein synthesis.[18] This stimulatory effect translates into improvements in lean body mass, strength and functional status.[19]

Depletion in fat free (lean body) mass is also common in patients with chronic obstructive pulmonary disease (COPD), even in the presence of normal body weight in some cases.[20, 21] This loss of lean tissue has a detrimental effect on respiratory function with corresponding fatigue and reduction in exercise tolerance. Until recently, there had been uncertainty as to whether malnutrition in COPD can be successfully reversed with nutritional support or if it is an irreversible consequence of the disease, as individual trials and systematic reviews have shown conflicting results. However, a very recently published systematic review and meta-analysis examining the effects of enteral nutritional support, mainly as oral nutritional supplements (ONS), has demonstrated significant improvements in weight, energy and protein intakes, mid-arm muscle circumference and hand-grip strength.[21]

There is evidence to suggest that bone health may be improved by higher intakes of protein in the elderly, through effects on calcium absorption, and a positive impact on IGF-1 levels which mediate bone growth and muscle mass.[22] It is also known that bone mass and muscle strength tend to change in parallel with each other over time.[22] In hip fracture patients provision of oral nutritional support can reduce unfavourable outcomes (mortality and complications), along with improving nutritional intake, but further trials in the area are needed.[23]

Other patient groups where there is evidence of lower protein intakes and poor outcome include pressure ulcers and wound healing,[24] renal disease,[25] liver disease[26] and post bariatric surgery.[27] A systematic review provides evidence for higher protein requirements in improved wound healing, showing that risks of developing pressure ulcers are reduced by 25 per cent with the provision of enteral nutritional support, particularly high protein ONS.[28] High protein ONS are defined as ONS containing at least 20 per cent energy from protein.[29]

Requirements

In healthy individuals with nutritionally balanced diets, protein intakes are generally in excess of demand. Based on nitrogen balance studies, dietary reference values (DRV's)[30] suggest a requirement (RNI) of 0.75g/kg/day for all adults including the elderly, but typical mean intakes in free living individuals show consumption of protein to be significantly higher than this, with 13 per cent of those aged up to 64 obtaining greater than 20 per cent energy from protein.[31] However, as indicated above, several studies have demonstrated that protein intakes in many patients are sub-optimal, particularly those in hospital and other care settings.[32] It has been suggested that the DRV's are insufficient to meet the increased needs of ageing combined with the clinical conditions frequently seen in patients, and higher intakes of up to 1.5g/kg/day, or 15 to 20 per cent of energy intake should be the target for optimal function and health.[12, 18]

Concerns

Many healthcare professionals are concerned about the potential effects of high protein intakes, particularly the impact on renal function, hydration status and bone health in the elderly.[21] Glomerular filtration rate (GFR) will rise with an increase in protein intake and long-term rises have been thought to impact on kidney function. However, in those with normal kidney function, hyperfiltration as a result of increased protein intake is an adaptive mechanism which has not been linked to deterioration in renal function.[21] For those at risk of renal failure, secondary to co-existing diabetes, hypertension or established renal disease, protein intakes above the RNI's are not typically advised.[12, 21] Although, this needs to be balanced with the clinical needs of the malnourished patient, since requirements for those receiving dialysis are in fact recommended at higher intakes of 1.2g/kg/day.[33]

With regard to bone health, the basis for thoughts that high protein diets contribute to bone loss and osteoporosis is in its effects on acid production and calcium excretion.[21] However, it has been suggested it is unlikely that bone acts as a buffer for a protein based metabolic acid load and Roughhead *et al*[34] have demonstrated that high protein intakes have no adverse effect on body calcium retention in healthy post-menopausal women.

The role of high protein intakes on hydration indices, particularly in elderly patients who are

susceptible to dehydration has been raised, due to its effect on renal solute load and water required for its excretion. Although, in those with normal renal function, varying intakes of protein have minimal impact on hydration status.[21]

A recent systematic review, examining the evidence for the use of a high protein ONS in the management of malnutrition, where mean age of patients was 74 years (range 42-86 years), found no significant adverse effects of high protein intakes over the course of the studies included, where duration of supplementation was often six months or longer.[35]

Providing optimal protein

As has been shown, many of those who are or are at risk of becoming malnourished, whether it be through disease related factors or simply age, have an insufficient protein intake to meet their needs for repair and repletion, and to moderate the effects of ageing on muscle mass and function. Many guidelines are available which suggest improving dietary intake with the use of various nutrition support strategies, including dietary counselling and food fortification, ONS, and artificial nutritional support, to improve protein, energy and micronutrient intake.[36] Limited evidence has been demonstrated for the clinical effectiveness of dietary counselling to improve intakes of dietary protein and micronutrients as advice tends to focus on increases in energy (kcal).[37] However, systematic reviews have demonstrated significant improvements with the use of standard and high protein ONS in intakes of both energy and protein (with minimal suppressive effect on food intake), along with clinical benefits such as reduced complications and length of hospital stay; and improvements in weight, muscle mass and corresponding functional outcomes such as hand-grip strength.[7, 27, 35]

Poor compliance with ONS is sometimes highlighted as a concern, particularly in the community.[38] However, a recent systematic review[39] (46 studies n=4328) demonstrated that compliance with ONS is good. Compliance was positively associated with higher energy density ONS (91% compliance with supplements ≥2kcal/ml), which is likely to be due to the lower volume needed to meet prescribed needs. In patients with malnutrition, in particular the frail elderly, volume may be a limiting factor and there are now a range of energy and protein dense ONS available on prescription in the community.

Conclusion

This review demonstrates that malnutrition and deficits in protein intake are present in a number of different patient groups, but are greater in the elderly and in community settings, and directly contribute to poorer clinical outcomes. Concerns regarding potential adverse effects of increased protein intake on renal function and bone health are not as previously thought and there is a case to consider higher protein requirements above the RNI's to improve clinical outcomes. This may be provided effectively via the use of high protein oral nutritional supplementation.

Table One: Summary of Factors Affecting the Nutritional Status of Older People[40]

	Effects
Oral	• Swallowing problems following stroke, Parkinson's disease or other neurological disorder • Worsening dentition and periodontal disease
Manual Dexterity	• Peripheral vascular disease • Osteo- and rheumatoid arthritis • Loss of hand use following stroke, Parkinson's disease or other neurological disorder
Diminished Sensory Ability	• Taste changes • Reduced smell perception • Reduced appetite • Eyesight/visual problems
Disease Effect	• Endocrine, gastrointestinal or respiratory disorders • Cancer • Dementia/confusion • Chronic disease and disability • Depression • Side effects of medication, e.g. taste changes, constipation
Socio-economic	• Isolation/loneliness • Inability to shop for or prepare food • Bereavement • Poverty • Institutionalisation • Drugs and alcohol
Malabsorption	• Secondary to infection and bacterial overgrowth • Following surgery

Adapted from Beck *et al*[40]

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