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Optimizing nutrition in older people

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Abstract

Older adults are at increased risk of malnutrition due to a variety of physiological and psychological reasons. This has implications for health, quality of life, independence and economic circumstances. Improvements in nutrition are known to bring tangible benefits to older people and many age-related diseases and conditions can be prevented, modulated or ameliorated by nutrition. However practical and realistic approaches are required to optimise diet and food intake in older adults. One area where improvements can be made is in the area of appetite. Encouraging older adults to prepare meals can increase appetite and food intake, and providing opportunities for older adults to eat in company with a wide variety of foods available are simple strategies to increase food intake.

Protein requirements in older adults is subject to controversy and although considered the most satiating macronutrient, it appears that it does not elicit as great a satiating effect in older adults as it does in younger individuals. This indicates that there is potential to increase protein intake without impacting on overall energy intake. Other areas where simple practical improvements can be made is in both packaging of foods that are easy to prepare and in the education of older adults on the safe storage and preparation of food. Research into improving the diets and nutritional status of older adults has indicated that many of the known strategies can be easily and cost effectively undertaken in practice.

Keywords

Older adults; elderly; nutrition; diet; appetite; ageing

1. Introduction

Increased life expectancy coupled with a decline in fertility rates has led to a global demographic shift towards an ageing population. The number of older persons (those aged 60 years or over) is expected to more than double by 2050 and to more than triple by 2100, [1]. From an individual's perspective this is a positive phenomenon, however at a societal level it presents numerous challenges in terms of managing people's health, quality of life, and economic circumstances.

Even though life expectancy has increased, for many the quality of these latter years has not improved, which has a significant impact on healthcare costs. With ageing comes an increased likelihood of developing chronic diseases such as diabetes, cancer and heart disease, and an increased risk of frailty, cognitive decline and disability. Improvements in nutrition are known to bring tangible benefits to older people and many age-related diseases and conditions can be prevented, modulated or ameliorated by nutrition [2]. The current review will focus on dietary issues and nutrition requirements of older adults. Furthermore, it will examine how foods and diets can be adjusted to enhance appetite and optimize dietary intake.

2. Methodology

This review presents a comprehensive detail of the nutritional problems and potential solutions in available in older adults in order to enhance appetite and optimize dietary intake. The review was written using peer-reviewed articles known to the authors and complemented through a search of PubMed and CINAHL. Keywords used included "ageing", "elderly" and

"older" alongside "nutrition", "appetite" and "food intake". Articles published in peer-reviewed; English language journals up to January 2018 were reviewed and considered for inclusion. Reference lists from articles retrieved were also checked."

3. Dietary issues in older adults

A range of psychosocial and physiological factors influence nutritional intake and status in older adults. For example a change in body composition with ageing has a profound effect on nutritional status and requirements. From 70 years onwards both lean body mass and total body weight decrease [3]. This reduction in body weight and loss of lean body mass, results in an increased risk of sarcopenia, osteoporosis, frailty, a resulting increased propensity for falls and fractures, infection and an overall increased risk of mortality and morbidity. Other physiological factors include reduced physical function, visual impairment, poor dentition, and gastrointestinal changes. From a psychological and social perspective bereavement, depression, isolation, dementia and socioeconomic constraints are all factors that impact on the nutritional status of older adults. Collectively these factors can result in a reduction in appetite, and a reduced ability and motivation to purchase and prepare food [2]. Depression and isolation are major contributors to weight loss in older people. Depression can lead to increases in serotonin and corticotropin releasing hormone which are potent anorectic neurotransmitters [4] and it is well established that people living alone consume less food [5] and have a poorer diet quality [6]. The need to prepare foods or catering limitations for just one person is also an issue [7].

Risk of malnutrition (characterised by low body mass and weight loss) increases [8] after 65 years of age. The UK National Diet and Nutrition Survey (NDNS)[1] showed that free-living men and women aged 75 to 84 years were consuming just 88% and 77% of estimated requirements for energy, respectively [9]. A secondary analysis of this data was performed using the criteria of the Malnutrition Advisory Group (MAG) for detecting risk of malnutrition. Approximately 14% of adults over 65 years of age were at medium or high risk of undernutrition based on the composite measure of low body mass index (BMI) and recent reported weight loss [8]. More recent data from the NDNS (combined 2012/13-2013/14) shows that low energy intake persists in the UK, with the average for men and women 65 years and older falling below the estimated average requirements for individuals over 75 years of age [10].

Malnutrition is associated with an increase in morbidity and mortality rates in older adults and a decrease in their quality of life. In residential and nursing homes, malnutrition often associates with cognitive impairment, hypotension, infection and anaemia, and impaired physical performance at everyday tasks such as dressing and washing. In hospitals, malnutrition is related to longer length of hospital stay, increased morbidity and mortality rate and increased complications such as fracture, infections and specific nutrient deficiencies [11].

Decreases in physical function can cause a variety of issues in terms of eating and preparing food. These include oral problems, impairment of masticatory function and swallowing problems that can lead to food avoidance [11, 12]. Similarly decreases in enjoyment of food

[1] The National Diet and Nutrition Survey assesses the diet, nutrient intake and nutritional status of the general population of the UK. More information can be found here: https://www.gov.uk/government/collections/national-diet-and-nutrition-survey

due to reduction in taste, smell and sight. Another major contributor to decreased food intake is the use of medication and polypharmacy with many drugs and medications required by older adults having a direct effect on appetite [13]. This decrease in appetite that occurs in older adults is known as the anorexia of ageing.

4. Appetite in older adults

Anorexia of aging, has been defined by Morley and Silver [14] as ‘‘the physiological decrease in food intake occurring to counterbalance reduced physically activity and lower metabolic rate, not compensated in the long term’. Reduced appetite in older individuals has been well documented [15] with changes in appetite correlated with the delayed gastric emptying (GE) seen with advancing age. Most but not all studies suggest that the rate of GE and gastrointestinal transit slows in older compared with younger adults [15, 16]. This means that food remains in the stomach for longer resulting in prolonged postprandial satiety. This delayed GE is caused by less compliant fundus of the stomach in older adults which further contributes to anorexia due to more rapid antral filling and an earlier antral stretch [17].

Satiety hormones are also known to change with age. Several studies have demonstrated the presence of higher circulating concentrations of the anorexigenic hormone cholecystokinin (CCK) in older compared to young individuals, and a greater satiating effect of CCK in older people [18]. Greater increases have also been found postprandially in glucagon-like peptide 1 (GLP-1), following a high fat meal in older compared to younger people [19]. Ghrelin is the only peripheral hormone known to stimulate hunger. However, there is little consensus about its effects on appetite in older adults [20]. It has been suggested that hyperinsulinemia in the elderly could also be responsible for inhibiting ghrelin gastric expression and central

sensitivity [21]. Furthermore in older males, the decline in testosterone results in a further increase in leptin [22] which may also decrease appetite. The combined actions of these hormones convey important anorexigenic signals to the hypothalamus which may have significant implications for food intake in the elderly.

5. Nutrient requirements of older adults

There is discussion in the extant literature as to the optimum nutrient requirements of older adults. Energy requirements tend to be lower due to altered body composition and reduced physical activity, however the requirements for many nutrients are thought to be unchanged [2] resulting in a need for a lower energy, yet more nutrient dense diet.

There is considerable debate regarding protein requirements in older age. Adequate dietary protein is particularly important in older adults to maintain muscle mass, support wound healing, skin integrity, immunity, and recovery from illness [23]. UK dietary reference nutrient intake values indicate that protein requirements for adults are 0.75g/kg body weight per day [24]. However it has been proposed that this should be increased to 1.0 to 1.2 g protein/kg body weight/day for a healthy older adult, and to 1.2 to 1.5 g protein/kg body weight/day for older people who are malnourished or at risk of malnutrition [25]. One argument for increasing protein intake is that older adults may develop resistance to the positive effects of dietary protein on synthesis of protein, a phenomenon termed anabolic resistance that limits muscle maintenance and accretion. Older adults may also have higher protein needs to offset the elevated metabolism of inflammatory conditions. In healthy older adults and in a variety of diseases, protein anabolism is related to net protein intake. However others argue that increased dietary protein is not required in the elderly due to reduced needs

associated with declines in lean body mass and the association between high protein intake and impaired renal function [23]. Up to 10% of community-dwelling older adults and 35% of those in institutional care in Europe do not have a sufficient food intake to meet a protein intake of 0.7 g/kg body weight/day [26].

UK dietary references values for vitamins and minerals are the same for older adults (65+) as they are for the adult population (50+) [24], yet some micronutrients are of particular concern for certain sub-groups of the older adult population. Micronutrients that are highlighted as important for older adults include calcium and vitamin D primarily for the preservation of bone mineral density and fracture prevention. Current recommendations established in 2016 indicate all population groups aged 4 years and older should have a Reference Nutrient Intake (RNI) of 10 µg/d (400 IU/d) vitamin D [27]. However a systematic literature review carried out by Lamberg-Allardt et al [28] suggested that intakes greater than 10 µg/d vitamin D may be required in older adults where the synthesis of vitamin D in the skin may be reduced and the intestinal absorption of vitamin D may be lower than in younger persons.

There is evidence of low intake, impaired absorption and low status of certain B vitamins in older adults. Vitamins B_{12}, B_6 and folic acid are all involved in homocysteine metabolism, and elevated homocysteine has been linked with cardiovascular disease, impaired cognitive function and dementia [29, 30]. Despite strong observational evidence to suggest that B vitamins could benefit older adults through homocysteine lowering mechanisms, intervention studies with B vitamins designed to lower homocysteine have failed to demonstrate any convincing benefit to cardiovascular or cognitive health [31, 32].

There has been considerable interest in the putative benefits of antioxidants for the protection of free radical damage implicated in a range of age-related chronic diseases including Alzheimer's disease and cancer. However, whilst deficiency of these nutrients is likely to be detrimental in terms of risk of infection and wound healing, results from randomised controlled trials aimed at chronic disease prevention have been inconsistent [33, 34]. A meta-analysis of nutrition supplementation trials concluded that there was no benefit of antioxidant supplements in the absence of deficiency for primary and secondary mortality prevention, and some evidence that vitamin E , ß carotene high dose vitamin A, could even increase mortality [35].

6. Optimising the dietary intake of older adults.

While understanding which nutrients are most needed by older adults is of importance, insufficient food intake is a primary cause of malnutrition in older adults. Reduced food intake is partly caused by a reduction in appetite. This can often occur alongside or because of a decline in sensory perception including small and taste, poor dentition, and medication [36]. Because of this innovative approaches are needed to increase energy intake but also to ensure that the diets of older adults is optimal.

6.1 Food products

The palatability of food is related to the properties of the food such as taste, smell, texture and temperature, as well as the visual appearance that invokes an enjoyable response. Several of these parameters have been shown to influence food intake in older adults. Previous research has indicated that providing older adults with food variety [37] and

enhanced flavoured foods can, via the use of enhancers such as mono-sodium glutamate, increase their food intake [38].One study examining the effect of natural food flavours on food and nutrient intake in hospitalised older patients in Hong Kong found that total energy and protein intakes were increased by 13-26% and 15-28%, respectively, with flavour enhancement [39]. However not all studies have been as successful in increasing food intake by altering palatability [40] which may be due to the heterogeneity in chemosensory losses among elderly people. Presenting older people with a varied meal may also be a valid strategy to improve food intake in this group [37]. However there are obvious cost and waste implications associated with this strategy. Several other tactics have been developed such as sauces with additional nutritional value [41]. The addition of sauce to a test meal was shown to increase protein intakes that was not fully (or even partially in some cases) compensated for later on in the day. This potentially indicates that increases in protein intake can occur with only minimal effects on satiety [42].

Protein is well known to be the most satiating macronutrient, and because of this has the potential to decrease food intake. However studies that manipulated the portion size and protein content of meals found that the protein enriched meals increased the protein intake [43]. Recent research also showed that although whey-protein loaded drinks slowed GE and increased secretion of satiety hormones, they had no suppressive effect on subsequent ad libitum energy intake in older adults [44]. This body of research indicates that protein rich ingredients are unlikely to hinder food intake potentially due to the reduced satiating effect of satiety hormones, and offers a potential means to increase protein intake in older adults.

Poor dentation is a common reason given for lack of food intake in older adults however research has shown that increased chewing does not influence meal size in older adults but

did influence palatability, which may cause reductions in intake due to sensory specific satiety [45]. Liquids were also found to be less filling in older adults which suggests liquids are the best route for increasing food intake especially protein intake [46]. A 24 week protein shake intervention has been shown to have positive impacts on body composition with increases in lean tissue mass of 0.45 kg [47]. Another recent novel study incorporating the addition of walnuts (15% energy) to an ad libitum diet resulted in significantly higher intake of total protein, vegetable protein, total polyunsaturated fatty acids (PUFA) and omega-3and omega-6 PUFA; and significantly lower intake of total carbohydrate, animal protein, saturated fatty acids, and sodium [48].These measures indicate that simple manipulations to meals and diets can result in increases in energy and nutrient intake.

6.2 Food packaging, preparation and the eating environment

Older adults living alone may not consume meals due to lack of desire in preparing single portions [49]. Loneliness is one of the key factors causing decreased food intake in older adults and living alone is a major contributor to malnutrition as those that dine alone eat less. Eating with others, particularly with friends, is associated with increased energy intake due to a social facilitation effect [7]. Companionship can mitigate the impact of age-related appetite loss on energy intake too, this is particularly true for older adults who live alone [50].

Declining functional abilities can increase the risk of malnutrition, a decline in general health, increased risk of injuries or food poisoning [51]. Loss of strength and dexterity can make packaging difficult to open resulting in an avoidance of certain foods [52]. This is not helped by packaging and labelling of food products in font sizes that are difficult to read for older adults due to declines in eyesight. Older adults are at a much greater risk of becoming ill from

food borne disease due to a weakened immunity. Listeriosis in particular can be fatal in high risk groups such as the elderly [53]. The World Health Organization reported that adults aged >60 years are 2.6 times more likely to develop serious illness as a result of consuming high concentrations of L. monocytogenes (the form of listeria that is pathogenic to humans) than the healthy general population [54]. The incidence of listeriosis over the last decade has increased among those aged 60 years and older and in particular among adults older than 70 years [55]

In a survey conducted in the domestic kitchens of adults over 60 years in South Wales, forty-one percent of foods in home refrigerators were beyond the use-by date, of which 11% were unopened ready to eat (RTE) food products commonly associated with listeriosis. Sixty-six percent of opened RTE foods had been or were intended to be stored beyond the recommended 2 days after opening. Fifty per cent of central storage and 85% of door storage areas were operating at temperatures >5°C. The study demonstrated that many older adults fail to adhere to food storage recommendations and subject RTE foods associated with L. monocytogenes to prolonged storage at unsafe temperatures, which may render food unsafe for consumption [56].

One way to avoid these pitfalls is through home delivered meals. Home-delivered meals have the advantage of providing quality food to individuals at risk; and helps these individuals to remain living independently. Research indicates that that home delivered meals can improve both dietary intake and quality. The greatest health benefits are achieved when home delivered meals reach the neediest individuals, resulting in a decrease in institutionalization of older adults and associated healthcare costs [57]. However, in contrast to this regular meal preparation can stimulate appetite and interest in food resulting in improved nutrition and

lower risk of mortality [49]. Mealtime interventions that constitute a shared mealtime have also been used effectively in institutionalised older adults in long-term residential care to improve energy intake [58].

7. Conclusions

Nutrition is a major determinant of health and wellbeing in old age, however there is considerable debate with regards to the nutrient requirements of older adults and risk of malnutrition is known to increase with advancing age. Evidence-based strategies are needed to combat declines in food intake and enhance nutrient intake, particularly in the very old and in socially isolated older adults. Recent studies suggest that the satiating properties of protein are lower in older adults and protein enriched beverages can promote positive changes in food intake and lean body mass. Encouraging older adults to prepare meals can improve appetite and food intake, however strategies are also needed to develop food packaging that is suitable for older adults and to ensure food safety education is provided to improve food handling and storage practices. Shared meals remain an important mediator of food intake as depression and loneliness are a key cause of age related anorexia.

In view of the increasing age of the population and the associated health and social care costs, further research is needed to help combat nutrition-related problems and to define specific nutrient requirements in old age for the benefit of individuals and society as a whole.

Contributors

Miriam Clegg developed the original outline of the review. Both authors contributed equally to the research and the writing of the manuscript. Both authors approved the final submission

Competing interest

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