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Dairy and Healthy Ageing

The increased life expectancy of current generations is very much a success story. And, as the number of older people increases, numerous factors need to be considered in order to facilitate positive and healthy population ageing. Such factors are wide-ranging, for example, from social to economic to public health considerations. Maintaining good health for as long as possible is a primary concern, and nutrition is a key modifiable factor in that regard.

Dairy can play a significant role in supporting healthy ageing. It is often, and quite rightly, proposed that healthy ageing isn't something that becomes relevant at 50 or 60 or 65 years of age but is, in fact, a life-long process. The benefits of dairy during childhood and adolescence are well accepted; however, dairy offers numerous benefits throughout our lives with research also exploring the specific benefits of dairy in the older years.

Various lifestyle and health-related factors associated with older age can impact food intake and, therefore, the quality of the diet. As a result, malnutrition can be an important issue among older people. Milk, yogurt and cheese offer a convenient, versatile and affordable source of nutrition. Yet, here in Ireland, the National Adult Nutrition Survey indicates that the overwhelming majority of adults aged 65 years and over are falling short of their recommended three daily servings from the 'milk, yogurt and cheese' food group.

The age-related progressive decline of skeletal muscle mass and strength is a natural process. However, such changes can negatively impact on quality of life, as well as increasing the risk of certain diseases. Research is exploring how dietary protein, for example in relation to the protein source and timing of intake, can benefit muscle maintenance in the older person. Work within Food for Health Ireland (FHI) is focusing on nutrient support from milk protein to prevent age-related deterioration of muscle mass and strength in combination with a lifestyle intervention that will help people enjoy active, healthy ageing.

Another area relevant to healthy ageing



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currently being explored within FHI is the appetite-modulating effects of dairy-derived peptides. This represents a very novel area of research and may have significant functional ingredient applications with regards to malnutrition, cachexia and sarcopenia – common problems in the older person.

“Considering the global trends regarding population ageing, the development of effective nutritional and lifestyle interventions that support healthy ageing are extremely timely and pertinent,” says Jens Bleiel, CEO of FHI. “Our research aims to contribute to such interventions through the development of dairy-derived solutions with the principal aim being to keep healthy people healthy.”



EDITORIAL

In this issue of *DN Forum*, the spotlight is on the very timely issue of healthy ageing. Global population ageing has resulted in a focus on interventions and solutions to support healthy ageing – and it is very clear that dairy has many benefits to offer.

The Expert Review by FHI researchers – Dr Harriët Schellekens, University College Cork and Dr Will McCormack, Carbery Food Ingredients and the University of Limerick – summarises FHI work directed at healthy ageing. The review focuses particularly on dairy/dairy components with regards to muscle mass maintenance and appetite modulation in the older person, respectively.

Details of the recent NDC-commissioned research exploring dairy intakes and trends among Irish adults aged 65 years and older is highlighted on page 4. This research represents a dairy-specific analysis of data from the National Adult Nutrition Survey.

We look forward to any feedback or comments you wish to share: nutrition@ndc.ie

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Expert Review

The Benefits of Dairy for an Ageing Population

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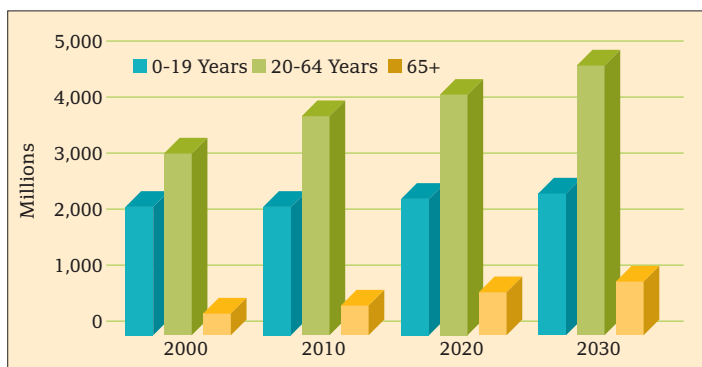
Dr Harriët Schellekens



Dr Will McCormack

Introduction

The proportion of the general population termed ageing or aged is expanding. This is not only due to a greater number of people entering the age group above 65, but life expectancy is also increasing, with people living into their 80s and above (Figure 1). More than one billion people globally will be over the age of 50 by 2015 and individuals in this age group are likely to experience one or more chronic, age-related diseases such as diabetes, heart disease or obesity as they age. In addition, under-nutrition affects 5% of the general population, 15% of 75-80-year-olds living at home, and 35-40% of hospital admissions. In Ireland, 140,000 adults are estimated to be at risk of diet-related malnutrition at an estimated cost of €1.4 billion, representing 10% of the health-care budget.



▲ Figure 1. Global population by selected age group and selected years, 2000-2030. Source: US Census Bureau, International Database.

The prevalence of sarcopenia, the progressive loss of skeletal muscle mass and strength with age, for those over 64 years of age, has been shown to be 22.6% in women and 26.8% in men. This rises to 31.0% and 52.9%, respectively, in those over 80 years of age (data presented by PsiOxus Therapeutics). It is estimated that over 3% of the total world population will be affected by sarcopenia by 2015. A 2004 study in the *Journal of the American Geriatrics Society* estimated the direct healthcare cost attributable to sarcopenia in the US in 2000 to be \$18.5 billion, or \$860 for every sarcopenic man and \$933 for every sarcopenic woman¹.

Dietary intake

The consumption of dairy (the 'milk, yogurt and cheese' food group) by Irish people aged 65 and over is lower than the recommended three servings per day. The average Irish person aged 65 and over consumes just 1.9 average daily servings². It has been suggested that people aged 50+ have been actively reducing dairy consumption in order to reduce fat intakes. However, reducing dairy intake may inadvertently result in the removal of an important source of protein, which contributes to the maintenance of muscle mass, and, therefore, is of particular importance for the older population.

As longer life expectancies will increase, the question posed by FHI researchers and industry partners is could dairy-based functional foods contribute to healthy ageing? In particular could they be an option for the treatment and prevention of age-related diseases?

Dairy and maintenance of functional capacity in older people

Skeletal muscle mass and strength decline naturally with age. This process can begin as early as the third decade of life. The

decline in muscle mass often goes unnoticed as fat tissue mass can concurrently increase over time resulting in no net change in total body mass or BMI. This does, however, result in a deterioration in body composition. The loss of muscle mass and strength below a critical threshold compromises an individual's ability to complete activities of daily living (stair climbing, grocery shopping and food preparation for example) and disability can ensue. The age-related loss of skeletal muscle mass is also associated with risk for numerous metabolic diseases including, but not limited to, type 2 diabetes, obesity, and cancer³.

Interest has grown in strategies designed to preserve and/or increase muscle mass with advancing age, thus maintaining or improving the functional and metabolic benefits that an appropriate muscle mass affords. The role of appropriate nutrition in supporting active and healthy ageing is receiving ever increasing attention⁴. Muscle protein net balance, the difference between muscle protein synthesis (MPS) and breakdown is maintained through the normal daily pattern of feeding and fasting that stimulates MPS during relatively short, fed periods to replace muscle protein broken down during the periods between meals⁵. As we age, our ability to maintain a suitable muscle protein net balance is diminished⁶ – a phenomenon termed 'anabolic resistance'⁷.

Dairy protein is a high quality protein, meaning that it is a rich source of essential amino acids (EAA) (those that the body cannot manufacture itself and must be taken in through the diet). An increase in the consumption of dairy proteins and its constituent EAA stimulates MPS and the amino acid leucine has been identified as having particular importance in the stimulation of new muscle protein in response to a meal.

A meal levels analysis of dietary protein intakes in older individuals⁸ reveals a skewed distribution of daily protein intake towards the main meal of the day, typically eaten in the evening. This skewed distribution of protein intake in the elderly who are less sensitive to the anabolic action of protein, may mean that MPS is optimally stimulated at only one eating occasion per day. When considered over a period of 12 months, there are almost 1,100 main eating occasions (three per day, seven days per week, and 52 weeks per year). Consensus opinion indicates that a quantitative and qualitative modification of dietary protein intake is necessary to counteract progressive loss of muscle mass associated with ageing^{9,10}. This strategy advocates ingesting sufficient high quality dietary protein (25–30 g protein) at each of the three main meals of the day in order to stimulate a robust increase in MPS and assist with the retention of muscle mass over time. Dairy protein from milk, cheese and yogurt offers an attractive option to increase protein intake, including the smaller meals of the day (typically breakfast and lunch), thus stimulating the synthesis of muscle protein at each main eating occasion as opposed to only the main evening meal. The maintenance of muscle mass in older populations will be enhanced when the provision of a high quality protein source, such as dairy protein, is consumed in close proximity to some form of physical activity. This may range from structured physical activity such as a programme of resistance exercise in the local gym or community hall, to a daily walk and even to simple household chores such as gardening and cleaning that involve physical exertion.

Appetite modulation via milk-derived peptides

One strategy to boost intake of dietary protein is to enhance appetite. The regulation of appetite is modulated via a plethora of gut hormones and receptors, as well as central neuropeptides¹¹. Food and ingestion of nutrients triggers the release of hormones

and peptides from the gastrointestinal tract, which communicate with the central nervous system to coordinate appetite and satiety. An impairment within this bidirectional brain-gut axis communication¹², which normally ensures a constant energy supply for cellular functions and protects against periods of food scarcity, may result in disorders of feeding behaviour and weight gain (obesity)^{13,14} or may lead to weight loss (anorexia and cachexia)¹⁵.

Milk proteins are considered one of the most studied natural sources of bioactive animal-derived peptides¹⁶⁻¹⁸. The two major milk proteins are casein and whey protein, which constitutes 80% and 20% of the total protein fraction in milk, respectively¹⁹.

The gastrointestinal digestion of these milk protein results in the generation of several bioactive peptides and amino acids²⁰⁻²², which stimulates the release of several gut hormones associated with the regulation of food intake, including cholecystokinin (CCK)²³, GLP-1²⁴, PYY²⁵ and ghrelin²⁶.

Indeed, dairy-derived peptides have been associated with suppression of food intake and satiety enhancing potential and may be utilised for the development of anti-obesity bioactives (for review, see,^{16, 18, 19, 27}). Within FHI, we have shown that dairy-derived peptide hydrolysates suppress food intake via stimulation of the serotonin 2C receptor (5-HT_{2C})^{28, 29}. In contrast, certain dairy-derived bioactives may also be able to stimulate food intake, which so far to our knowledge has not yet been investigated. The latter is of particular interest to the malnourished, cachexic or sarcopenic elderly.

The ghrelin system as a target in appetite modulation: Ghrelin, also called the 'hunger hormone', is a 28-amino acid peptide secreted from the stomach and is, so far, the only identified peripheral signal to stimulate food intake³⁰. The appetite-stimulating characteristics of the orexigenic hormone ghrelin and its mimetics result in enhanced food intake and weight gain, making it a logical treatment for malnutrition, cancer-cachexia and anorexia. Several studies have shown that treatment of patients with cachexia and animal models of cachexia, with ghrelin and ghrelin mimetics, increases appetite and improves weight gain, despite elevated endogenous ghrelin levels in the condition^{15, 17, 31-34}.

This is further highlighted by the novel, orally active, ghrelin receptor agonist, anamorelin, currently in clinical development for the treatment of cachexia in cancer. Anamorelin has shown to significantly increase both lean body mass and body weight, and also improved appetite³⁵.

Implications for future research: The significance of ghrelin-targeting bioactives in appetite modulation, as well as in the regulation of growth processes is the subject of ongoing basic and clinical research. Within FHI, dairy-derived peptide hydrolysates are investigated for their ghrelin receptor modulating potential, using an in vitro screening platform, as well as animal models. Specific dairy-derived hydrolysates and bioactives, may act as ghrelin mimetics and stimulate appetite and, therefore, have potential as functional ingredients for the treatment of malnutrition and cachexia. The development of specific dairy-derived bioactives with appetite-enhancing effects is novel as currently no non-pharmaceutical products are marketed.

EVIDENCE TO PRACTICE

Significance of this research to:

A. INDUSTRY

Production of bioactive peptides, or hydrolysates enriched in bioactive fractions, from milk would result in the production of high value-added ingredients from low-cost products with higher acceptance by older people.

B. HEALTH PROFESSIONALS

A deeper understanding of appetite and satiety mediated signalling and the role of dairy in the maintenance of functional capacity would help health professionals to advise their patients on the consumption of functional foods containing dairy-derived bioactives, once available on the market.

C. THE PUBLIC

Older people don't want to be considered 'older people' – an opportunity exists to empower them to choose foods that will help them to live the life they love rather than 'curing them' from getting old.

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Key Points

- The proportion of the general population termed ageing or aged is expanding. This is due to a greater number of people entering the age group above 65, as well as increasing life expectancy. Consequently, the role of dairy foods, dairy components and dairy-based functional foods/ ingredients is being explored to establish their potential to contribute to healthy ageing.
- Skeletal muscle mass and strength decline naturally with age – such changes can negatively impact independent daily living, as well as being associated with increased risk of certain diseases. Therefore, nutrition and lifestyle strategies that may preserve and/or increase muscle mass with advancing age are of huge interest. Protein has been identified as a key nutrient in this regard, with the benefits of dairy protein – offering a high quality source of protein – currently being explored.
- Appetite modulation is another area that may greatly benefit older people – particularly those suffering from malnutrition, cachexia or sarcopenia. Although still in the very early stages, FHI is exploring the ghrelin receptor modulating potential of dairy-derived peptide hydrolysates. Should such components prove effective, this may pave the path towards the development of functional ingredients – with potential benefits for many older people.
- Nutrition is a modifiable factor that can support healthy ageing. Appropriate dietary interventions directed to address health concerns associated with ageing may prove very beneficial. FHI is committed to exploring dairy-based solutions for an ageing population, while the NDC is dedicated to communicating evidence-based information on the benefits of dairy in healthy ageing to relevant stakeholders actively working in this area.

Dairy Intakes Among Adults Aged 65 Years and Over in Ireland

For further insights and statistics on dairy consumption among Irish adults aged 65 years and over, see the NDC-commissioned analysis of the IUNA National Adult Nutrition Survey.

The full report and summary highlights are accessible from the Health Professional Area of the NDC website www.ndc.ie/health

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Mission: To deliver real and unique value to Irish dairy farmers by protecting and promoting the image, quality, taste and nutritional credentials of Irish dairy produce to a wide variety of audiences in a clearly defined, focused, unique and effective manner.

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Food for Health Ireland

Mission: To leverage the world-class capabilities of the Irish academic partners, with the market expertise of the industry partners, into a pipeline of innovative, nutritional functional ingredients/products for the global food industry.