

# THE HIDDEN HEALTH CHALLENGES

THE IMPORTANCE OF  
NUTRITION AS WE AGE



# THE IMPORTANCE OF NUTRITION AS WE AGE

FOREWORD – DR KATHERINE APPLETON, BOURNEMOUTH UNIVERSITY

Improved prevention, detection and treatment of major health problems such as heart disease and cancer mean we are living longer. Average life expectancy in the UK is now 82.8 years for women and 79 for men, and it's continuing to rise.<sup>1</sup>

But these statistics mask a hidden, and growing, health concern — we are living longer; but we are not living better. Far too many of these extra years of life are being spent in frail health.

On average, a woman who was 65 in 2011 will spend more than 18 years, or 22.2 per cent of her life, with poor health, while a man of the same age faces 15 years, or 19 per cent of his life, in poor health.<sup>2</sup>

Furthermore, the number of years we can expect to spend in failing health is rising more rapidly than life expectancy.

The Royal College of GPs has predicted an “explosion” of people living with more than one serious long-term, life-threatening condition in the next decade and estimates that almost one million people will be living with long-term health problems by 2025.<sup>3</sup>

It is universally acknowledged that good nutrition is a foundation for good health,<sup>4,5</sup> and repeated studies show a healthy diet protects against heart disease, cancers, diabetes and other serious conditions.<sup>6,7,8,9</sup>

And while nutrition is important at any time, our needs do begin to change in our 50s.<sup>10</sup> Metabolism slows and we burn calories at a slower rate, so many older adults will cut back on calories and may therefore unwittingly cut back on important nutrients too.

We also begin to lose muscle mass, although studies show that a combination of exercise and ensuring a protein intake of around 30mg per meal will help stall this sarcopenia (age-related muscle loss).<sup>11</sup>

Certain nutrients, such as vitamin D, also become increasingly important as we age. The British Nutrition Foundation advises that iron, calcium and folate are particularly important for women while nutrients relevant for men include selenium and lycopene, which may play roles in protecting against prostate cancer.

However, we also know that our ability to absorb some nutrients declines with age and other factors such as smoking and alcohol consumption can also impair nutrient absorption.

An expert report published in 2014 for the European Union identifies “undernutrition and micronutrient deficiency” as “a common problem in older adults.”<sup>12</sup> The authors point to gaps in existing research and advice: “Above all, there is a need to provide better guidance on diet and nutrition for older people.”

They argue that, “a set of age-specific, up-to-date dietary recommendations is essential to achieve active and health ageing.”<sup>13</sup>

Busy lifestyles and poor food choices can make optimal nutrition difficult at any age, but ageing presents additional challenges such as lack of appetite and impaired absorption of nutrients while increasing disability can make it more difficult for older adults to buy, prepare and consume nutritious food.<sup>14</sup>

So it's not surprising that a systematic review just published in the *Journal of Human Nutrition and Dietetics* has identified a number of worrying nutritional gaps common among older adults.

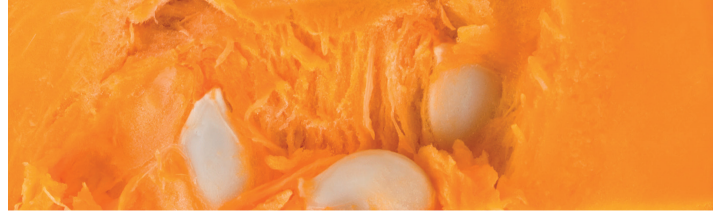
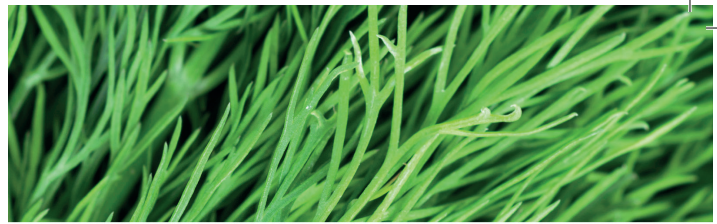
The authors warn we must do more to help this group achieve the optimal nutritional intakes needed to support healthy ageing.

And while they acknowledge the need for more research, they suggest improvements to the nutritional status of many older Britons could be achieved through the: "judicious use of supplements."

This report explores the nutritional gaps which are putting over-50s at increased risk of poor health and explores the possible use of supplements to address this hidden health challenge.



DR KATHERINE APPLETON,  
Bournemouth University



# SECTION ONE

## HEALTHY AGEING: THE NEW AGE CHALLENGE

As a nation we are getting older. In the past four decades the average age has climbed from 33.9 years to 40<sup>15</sup> and by 2035 almost a quarter of the population will be 65 or older.<sup>16</sup>

Hanging onto our health for as long as possible will become increasingly important because we will all be expected to work past the age of 65.

Three factors drive the cellular damage which makes us age — inflammation, metabolic stress and oxidative stress — and nutrition influences all of them.<sup>17</sup>

In an ideal world, we should be able to get all the nutrients we need from a healthy, balanced diet. But in the real world, there are myriad challenges which can make it difficult to ensure optimal intakes of all the vitamins and micronutrients needed to maintain good health — and these become increasingly onerous as we get older.

Appetite declines and this can be exacerbated by a loss of taste and smell which reduces the pleasure of eating. Ageing also impacts on the body's ability to absorb some nutrients. Poor dental health makes some foods difficult to manage, lack of mobility or disability makes it more difficult to shop for food and prepare meals, poverty may restrict food choices and depression and confusion can sap the ability or desire to prepare nutritious meals.<sup>18,14</sup>

Given the many hurdles to maintaining optimal nutrition in older age, shortfalls are likely. European survey data confirms that deficits of vitamin D, iron, magnesium, potassium, zinc

and copper are common.<sup>19</sup> Intakes of heart-protective omega-3 fatty acids also fall short of the targets for optimal health.<sup>20</sup>

However there is compelling evidence that this data only scratches the surface and the real deficits could be deeper, and more damaging.

We know, for instance, that more than half the older adults admitted to hospital in the UK are malnourished<sup>21</sup> and the Malnutrition Task Force — an independent expert group which spans health, social care and local government — estimates that £1.3 million UK adults who are 65 or older suffer from malnutrition.<sup>22</sup>

As the Report on the Inaugural Conference of the European Nutrition for Health Alliance put it: "Malnutrition is 'alive and killing'. It must be recognised as a disease in its own right."<sup>23</sup>


Poor nutrition has a corrosive impact on health. Someone who is malnourished sees their GP twice as often as someone who is not, they are three times more likely to be admitted to hospital and when they are, hospitalised patients who are malnourished stay in more than three days longer than those who are not.<sup>24</sup>

Apart from the personal price patients are paying, there is a huge economic burden too. Overt malnutrition is estimated to cost the UK

economy £5 billion a year in direct healthcare costs and a further £13 billion a year in associated health and social care expenditure.<sup>25</sup>

GP, Dr Gill Jenkins says: "This is a shocking state of affairs, for both the individuals affected, and the wider community who are left picking up the bill for a problem which simply should not exist in a first-world nation like the UK.

"Nutrition is an absolute fundamental for good health. Our bodies need the right fuel, in the right amounts and correct balance, to function effectively. It is a scandal that in the UK today there are so many older adults at risk of failing health because their diet is not delivering the nutrients they need."



“Nutrition is an absolute fundamental for good health. Our bodies need the right fuel, in the right amounts and correct balance, to function effectively. It is a scandal that in the UK today there are so many older adults at risk of failing health because their diet is not delivering the nutrients they need.”

Dr Gill Jenkins, GP

# SECTION TWO

## HOW WE ARE BEING CAUGHT SHORT

A recent review exploring the role of fatty acids and micronutrients in healthy ageing identified a number of worrying gaps and deficiencies among older adults.<sup>26</sup>

“Two of them, omega-3 fatty acids and vitamin D, stand out as being crucially important for older adults. The omega-3 fats have a proven anti-inflammatory action and inflammation is a key driver for many age-related health problems and vitamin D is closely linked to immunity, which becomes increasingly compromised as we get older,” says Professor Michael Crawford director of the Institute of Brain Chemistry and Human Nutrition at Imperial College and an international authority on omega marine oils.

### OMEGA-3 OILS

The review found that intakes of saturated fats and omega-6 polyunsaturated fatty acids (PUFAs) are generally too high, but levels of heart-protective omega-3 fatty acids (0.5% to 2% of energy intake) fall well short of the range needed for prevention of chronic disease (6% to 11% of energy intake).

This aligns with the Scientific Advisory Committee on Nutrition (SACN) warning that shortfalls in omega-3 PUFA consumption are common across all age groups in the UK.<sup>27</sup>

Low intakes of omega-3 PUFAs and the high intakes of omega-6 PUFAs reported in European studies are particularly problematic for an ageing population.

“There is a lot of evidence to support the cardiovascular benefits of omega-3 oils. These healthy fats help lower cholesterol, particularly high-risk fats called triglycerides, and they protect

against abnormal heart rhythms and buildup of plaque in the arteries. They even have a small effect on lowering blood pressure.<sup>28, 29, 30, 31</sup>

“However, omega-3s oils have also been shown to have an anti-inflammatory effect and there has been a lot of research in the past decade or so which suggests that inflammation is an important contributing factor to a wide range of different problems including cancers, heart disease and diabetes.”<sup>32, 33, 34</sup>

Professor Michael Crawford adds: “Our high intakes of omega-6 PUFAs make this particularly significant as omega-6 PUFAs, which are found in many supposedly healthier vegetable oils, not only inhibit uptake of omega-3 PUFAs, but can also promote inflammation.”<sup>35</sup>

“Some scientists believe the imbalance between omega-3 and 6 PUFA consumption in modern diets is a factor in many health problems.”<sup>36</sup>

And there are clues that this balance may become increasingly important as we age. For instance, inflammation is now recognised as an important driver for osteoarthritis, the age-related form which affects around 8.75 million people in the UK.<sup>37</sup> Many experts also believe inflammation plays a part in dementia.<sup>38</sup>

“A study mapping the prevalence of micronutrient deficiencies across eight different European countries found that over 90 per cent of older people had inadequate vitamin D intakes.”

Journal of Human Nutrition and Dietetics

“All the evidence suggests that healthy ageing is impossible without adequate levels of vitamin D.”

Dr Gill Jenkins, GP

## VITAMIN D

Some foods, such as meat and eggs, contain small amounts of vitamin D, but our primary source is sunshine, or to be more exact, our skin produces it in response to sunshine. But from October to April the angle of the sun is such that the UK doesn't get enough UVB radiation for us to make vitamin D and we must rely on any stores built up over summer.<sup>39</sup>

Deficiency is common across all age groups, but is particularly problematic as we get older. Ageing is known to diminish the skin's capacity to produce vitamin D<sup>40</sup> and being overweight or obese, which is increasingly common across all age groups, reduces the amount of vitamin D available as vitamin D is fat soluble and gets trapped in fatty tissue.<sup>41</sup>

As the review in the Journal of Human Nutrition and Dietetics points out: “A study mapping the prevalence of micronutrient deficiencies across

eight different European countries found that over 90 per cent of older people had inadequate vitamin D intakes.”

Data from the UK National Diet and Nutrition Survey (NDNS) confirms that on average men aged 65 or older get 38 per cent of the recommended nutrient intake (RNI) and women (aged 65 years) manage just 29 per cent.<sup>42</sup>

Dr Gill Jenkins says: “This is very worrying as vitamin D plays an important role in supporting our immune system, lung function, cardiovascular health, healthy bones and teeth and the brain and nervous system. It helps regulate insulin levels and influences the expression of genes involved in cancer development.”<sup>43</sup>

“All the evidence suggests that healthy ageing is impossible without adequate levels of vitamin D.”



# SECTION THREE

## THE BIGGER PICTURE: NUTRITION AND AGEING – AN A-Z

Apart from these gaps in vitamin D and omega-3 PUFA intakes the National Diet and Nutrition Survey has identified significant shortfalls in copper, magnesium, potassium and zinc and smaller deficits in calcium, folate and iron, while European studies have added vitamin B12, vitamin C and selenium to that list.<sup>44</sup>

Dietitian and author, Dr Carrie Ruxton notes: “Nutrition not only lays the foundation for good health, it also provides the materials and tools needed to protect and maintain that good health, so it is difficult to see how we can achieve healthy ageing in the face of any deficit.”

As this top-line summary shows:

### B VITAMINS

are important for the nervous system and for enzymes involved in energy and protein metabolism.

### FOLATE

(or vitamin B9 as it is also known), is essential for the production of red blood cells and low levels can lead to anaemia. It also supports brain and neural functions. Folate works with vitamins B6 and B12 to reduce levels of homocysteine, an amino acid linked to cardiovascular disease.<sup>45, 46</sup>

### VITAMIN B12

which is only found in animal products, is needed for production of the genetic building blocks RNA and DNA and the red blood cells which transport oxygen around the body.<sup>47</sup> Our ability to absorb vitamin B12 declines with age and it is estimated that up to 15 per cent of people over the age of 60 are deficient.<sup>48</sup> Deficiency can lead to anaemia.<sup>49</sup>

Low levels have also been linked to poor performance on tests of brain function,<sup>50</sup> but supplementation with vitamin B12 has been shown to slow brain shrinkage by 30 per cent.<sup>51</sup>

### VITAMIN C

is an antioxidant which helps protect cells by neutralising potentially damaging free radicals and so supports the immune system.<sup>52</sup> It helps maintain healthy connective tissue, supports wound healing<sup>53</sup> and aids absorption of iron from plant sources.

It is a key component of the AREDS formula which has been shown to reduce the risk of age-related macular degeneration by 25 per cent<sup>54</sup> and clinical trials have shown that topical application of vitamin C helps reduce wrinkles and skin damage from the sun.<sup>55, 56</sup>

### VITAMIN A

is vital for maintenance of good eyesight, immune function and skin. Good dietary sources include oily fish and fish liver oils, animal liver, eggs and full-fat milk. Beta-carotene, a precursor of vitamin A was used in the original AREDS study which confirmed that antioxidant vitamins can help reduce the risk of age-related macular degeneration.<sup>57</sup>

### VITAMIN D

is important for the immune system and enhances uptake of calcium and phosphorous which are essential for strong bones.<sup>58</sup>

Epidemiological studies suggest it helps protect against a number of auto-immune conditions.<sup>59</sup> There is also increasing evidence of a key role in ageing. Telomeres, little tails at the ends of strands of DNA become shorter as we get older, and reduced telomere length is a recognised predictor of ageing-related disease. However a study of 2,160 twins found a clear link between higher levels of vitamin D and longer telomeres.<sup>60</sup> Laboratory studies have also linked low levels of Vitamin D to contributing to premature ageing.<sup>61</sup>

### VITAMIN E

is an antioxidant which counters the free radicals responsible for cell damage and is particularly important for maintaining a healthy heart and cardiovascular system, muscles, and red blood cells.<sup>62</sup>

### VITAMIN K

is important for the formation of several proteins which regulate blood clotting.<sup>63</sup> Studies suggest it protects against age-related degenerative diseases including osteoporosis and atherosclerosis.<sup>64</sup>





“Nutrition not only lays the foundation for good health, it also provides the materials and tools needed to protect and maintain that good health, so it is difficult to see how we can achieve healthy ageing in the face of any deficit.”

Dr Carrie Ruxton, dietitian and author

## CALCIUM

helps build strong bones and teeth, regulates muscle contractions, including heartbeat; acts in cell signaling and nerve transmission<sup>65</sup> and helps to ensure normal blood clotting.<sup>66</sup> Deficiency can lead to osteoporosis.

## COPPER

supports the formation of collagen, an essential component of all connective tissue, increases absorption of iron and plays a role in energy production. Deficiency increases the risk of infection, osteoporosis and impaired neurological function.<sup>67</sup>

## CHROMIUM

is an essential trace element involved in glucose metabolism.<sup>68</sup> A number of studies have shown supplementation improves blood sugar control and cholesterol levels in people with type 2 diabetes.<sup>69,70</sup>

## IODINE

is a trace element needed to produce the thyroid hormones thyroxine and tri-iodothyronine, which regulate metabolism.<sup>71</sup> The risk of thyroid disorders increases with age and can lead to problems with concentration and memory.<sup>72</sup>

## IRON

deficiency is a common trigger for tiredness and fatigue because iron is essential for production of haemoglobin, the substance which carries oxygen around the body.<sup>73</sup> Low levels can force the heart to work harder to compensate for poor oxygenation of the blood and over time this can lead to abnormal cardiac rhythms or heart failure.

## MAGNESIUM

is an essential mineral which plays an important part in more than 300-enzyme driven processes, including the metabolism of food and the synthesis of fatty acids and proteins.<sup>74</sup>

Deficiency is associated with insulin resistance, coronary heart disease and osteoporosis.<sup>75,76,77,78</sup>

## POTASSIUM

regulates electrical activity in the heart and is essential for maintaining the correct balance of fluids and electrolytes needed for cell function.<sup>79</sup> Higher intakes have been shown to reduce the risk of stroke by 24 per cent.<sup>80</sup>

The World Health Organisation recommends an intake of 3,510 mg per day but warns most of the world's population does not meet this recommendation.<sup>81</sup>

## PHOSPHORUS

binds with calcium to strengthen teeth and bones.<sup>82</sup> It is integral to the formation of all membranes, is essential in the metabolism of carbohydrates, fats and proteins and is used in multiple enzyme processes.<sup>83</sup>

## SELENIUM

is a trace element which protects against oxidative damage and infection and supports thyroid hormone metabolism.<sup>84</sup> Higher levels are associated with a reduced risk of heart disease and some cancers.

## ZINC

is important for immune function and appears to act in a number of ways. It activates the T-cells which fight infection,<sup>85</sup> supports basic cellular functions, acts as an antioxidant and helps stabilise cell membranes.<sup>86</sup> It is involved with over 200 enzyme processes and is essential to metabolism; it is needed for wound healing and has a role in the body's insulin response.<sup>72</sup>

High concentrations are found in the brain and recent research suggests it may support learning and memory.<sup>87</sup>

SECTION FOUR  
**STRATEGIES  
AND SOLUTIONS**



We know the risk of many health problems increases with age, and we know that good nutrition underpins good health. Evidence shows that any effective strategy to support and promote healthy ageing must address nutritional concerns, including inadequate nutrition or nutritional deficit.

However, we also know that it becomes increasingly difficult to obtain sufficient nutrition from diet alone as we get older. Challenges include reduced appetite, impaired nutrient absorption, poor dental health, cognitive decline, poverty and mobility problems.

So is there a place for supplementation?  
The review in the *Journal of Human Nutrition and Dietetics* looked at the evidence across a number of key areas:

## BRAIN HEALTH

Clinical trials are not clear-cut, but the omega-3 fatty acids EPA and DHA, vitamin B12 and folate appear to play an important part in supporting cognitive function.

A randomised control trial of 485 healthy adults aged 55 or older found that those who took 900mg of DHA for 24 weeks significantly improved immediate and delayed verbal recognition memory scores.<sup>88</sup>

Another found that taking 3g of omega-3 fish oil daily for five weeks led to significant improvements in working memory,<sup>89</sup> while a small study in adults with mild cognitive impairment found those given a combination of 1.55g of DHA and 0.40g of EPA for six months had significantly improved geriatric depression scores and self-reported physical health.<sup>90</sup>

A two-year study of 900 adults aged 64 to 74 found that taking 400mcg of folic acid and 100mcg of vitamin B12 daily significantly improved immediate and delayed memory recall.<sup>91</sup>

Similarly, a Cochrane Review confirmed that Vitamin B12 and folic acid reduce blood levels of homocysteine, an amino acid associated with cognitive impairment and an increased risk of cardiovascular disease.<sup>92,93</sup>

MRI scans have also confirmed that vitamin B12 slows the loss of brain volume which occurs with age and which is almost certainly associated with dementia and other cognitive issues.<sup>94</sup>

To put the potential benefits of supplementation to improve brain health in context, the Alzheimer's Society estimates there will be a million people with dementia in the UK by 2025 and delaying the onset of dementia by five years would reduce deaths directly attributable to dementia by 30,000 a year.<sup>95</sup>

There is a huge financial cost, too. The King's Fund estimates the cost of dementia in England alone will rise from £14.8 billion in 2007 to £34.8 billion in 2026.<sup>96</sup>

## BONE HEALTH

Around three million people in the UK have osteoporosis and there are 300,000 fragility fractures every year.<sup>97</sup>

The National Osteoporosis Society estimates hospital and social care for patients with hip fracture in the UK costs £2.3 billion per year, more than £6 million a day.<sup>98</sup>

The *Journal of Human Nutrition and Dietetics* review found good evidence for the benefits of both vitamin D and calcium for bone health. Vitamin K may also have a part to play.

A six-month trial in 159 healthy post-menopausal women found 1200mg of calcium a day reduced markers for bone turnover<sup>99</sup> while data from the Women's Health Initiative trial of 36,282 post-menopausal women showed that 1000mg of calcium plus 10mcg of vitamin D3 reduced the risk of hip fracture.<sup>100</sup>

A three-year study found that 180mcg of vitamin K2 reduced age-related bone loss,<sup>101</sup> although earlier studies found no effect for vitamin K2.<sup>102</sup>

## SECTION FOUR **CONTINUED**

One study identified in the review found a link between lower levels of omega-6 in relation to omega-3 fatty acids and longer telomeres, which suggests improving the balance between omega-6 and 3 PUFA consumption could influence cell ageing.<sup>114</sup>

### **EYE HEALTH**

The review<sup>19</sup> by Dr Ruxton, Dr Derbyshire and Miguel Toribio-Mateas found that taking 1000mg of the omega-3 DHA improved vision after 90 days<sup>103</sup> and that a combination of essential fatty acids and antioxidants reduced levels of inflammatory chemicals associated with dry-eye disorders.<sup>104</sup>

Compelling evidence for the benefits of supplements for eye health also comes from the long-running AREDS trial. The Age-Related Eye Disease Study reported: "High levels of antioxidants and zinc significantly reduce the risk of advanced age-related macular degeneration (AMD)."<sup>105</sup>

AMD is the biggest single cause of blindness in the UK. It affects more than 600,000 people and one in 10 people over the age of 65 has some degree of AMD.<sup>106</sup>

Some people inherit an increased risk of developing AMD, but the original AREDS trial found that a combination of vitamin C, vitamin E, beta-carotene, and zinc cuts this risk by 25 per cent.

### **IMMUNE HEALTH**

There are very few studies looking at the direct impact of nutrition on components of immune function, but those which have been done suggest the omega-3 fatty acids ALA and EPA and vitamin D3 reduce markers associated with inflammation.

A separate study reported in the Journal of Investigative Medicine found that vitamin D influences both the innate and adaptive immune responses and pointed out that deficiency increases the risk of developing auto-immune disease and infections.<sup>108</sup> This has been confirmed by laboratory tests which show vitamin D arms and activates the immune system's T cells.<sup>109</sup>

The ZENITH study found that 15mg a day of zinc maintained a balance of T-Helper and T-lymphocyte cells and enhanced adaptive immunity.

### **CARDIOVASCULAR HEALTH**

The review<sup>110</sup> found that fish oils reduce triglycerides — unhealthy fats associated with hardening of the arteries which increase the risk of heart disease in people who are genetically predisposed to problems.<sup>110</sup>

And a four-month trial found that women who took 20mcg of vitamin D3 enjoyed significant reductions in blood pressure<sup>111</sup> while a three-year study found that people with a history of coronary artery disease who took 500mcg a day of vitamin K could stall the progression of problems.<sup>112</sup>



## OTHER MARKERS

Each time a cell divides, the telomeres at the end of each strand of DNA get shorter, and this provides important clues to how well we are ageing. Some experts liken these telomeres to the fuse on a bomb, because when they get too short the cell can no longer divide and becomes inactive, or dies.<sup>113</sup>

One study identified in the review found a link between lower levels of omega-6 in relation to omega-3 fatty acids and longer telomeres, which suggests improving the balance between omega-6 and 3 PUFA consumption could influence cell ageing.<sup>114</sup>

A large scale US study found taking a daily multivitamin reduces the risk of cancer.<sup>115</sup> Another study found that older adults who took multivitamins also reported significantly better energy levels and mood as well as improvements in sleep.<sup>116</sup>

The take-home message is clear: Supplements can provide an effective strategy for maintaining health, supporting nutrient intakes, plugging dietary gaps and helping to address the nutritional challenges associated with ageing.

The review authors believe: “There is emerging evidence that omega-3 fatty acids, B vitamins, vitamin D and calcium are the most promising nutrients to support healthy ageing.”

And they concluded: “As it may be challenging for elderly people to obtain all their nutrient needs from food sources, there is a positive role for supplements, e.g. multivitamins, minerals and fish oils, alongside advice on healthy eating.”

“As it may be challenging for elderly people to obtain all their nutrient needs from food sources, there is a positive role for supplements, e.g. multivitamins, minerals and fish oils, alongside advice on healthy eating.”

# LAST WORD

Healthy ageing is the challenge of our age and evidence suggests that good nutrition can play a key role helping people remain well as they get older.

Dr Katherine Appleton notes: “The surveys described in this review suggest that the diets of older adults are deficient in various nutrients, and numerous studies demonstrate the value of supplementation for improving nutrient profiles and health, well-being and functional outcomes. These findings suggest a potential positive role for supplementation in healthy ageing.”

The human and economic costs of inadequate nutrition are enormous, and an analysis by the Malnutrition Task Force points out that providing oral nutritional supplements in hospitals will save £849 per patient.<sup>117</sup>

Dr Gill Jenkins adds: “Food alone will not meet the needs of an ageing population, as we can see from the fact that malnutrition is a widespread problem among residents of care-homes and hospital patients, who are given meals which supposedly provide adequate nutrition.

Dr Katherine Appleton explains: “However, supplements will only be of benefit to those who take them, and there is a real need for further research not just into the diets and dietary needs of older adults, but also into their dietary practices. Poverty, mobility issues, low motivation and the onset of various health conditions can impact negatively on healthy dietary practices, at a time when healthy practices are particularly important.

We know though that appetite also declines with age, and so, too, does our ability to absorb many important nutrients. As the authors of the recent review suggest it may be challenging for elderly people to obtain all their nutrient needs from their diet, and in this situation, there is a positive potential role for supplements.”

Dr Appleton concludes: “Healthy ageing, and ongoing healthy nutrition are major current societal challenges. Supplements could play an important role in addressing these challenges.”

“Healthy ageing, and ongoing healthy nutrition are major current societal challenges. Supplements could play an important role in addressing these challenges.”



## FOOTNOTES AND REFERENCES

- 1 <http://www.ons.gov.uk/ons/rel/lifetables/national-life-tables/2012-2014/stb-life-tables-2012-2014.html>
- 2 <http://www.ons.gov.uk/ons/rel/disability-and-health-measurement/sub-national-health-expectancies/disability-free-life-expectancy-by-upper-tier-local-authority--england-2009-11/stb-disability-free-life-expectancy.html#tab=England>
- 3 [http://www.theguardian.com/society/2015/oct/01/royal-college-of-gps-predicts-explosion-of-long-term-health-problems-in-next-decade?CMP=Share\\_AndroidApp\\_Tweet](http://www.theguardian.com/society/2015/oct/01/royal-college-of-gps-predicts-explosion-of-long-term-health-problems-in-next-decade?CMP=Share_AndroidApp_Tweet)
- 4 <http://www.who.int/topics/nutrition/en/>
- 5 <http://www.nhs.uk/Livewell/Goodfood/Pages/eight-tips-healthy-eating.aspx>
- 6 <https://www.bhf.org.uk/heart-health/preventing-heart-disease/healthy-eating>
- 7 <http://www.cancerresearchuk.org/about-cancer/causes-of-cancer/diet-and-cancer/how-healthy-eating-prevents-cancer>
- 8 <http://www.nhs.uk/Livewell/Blackhealth/Pages/Diabetes.aspx>
- 9 <http://www.theguardian.com/society/2015/sep/11/poor-diet-biggest-contributor-early-deaths-world-study>
- 10 <http://www.nutrition.org.uk/nutritionscience/life/adults.html>
- 11 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2760315/>
- 12 JRC Science and Policy Reports: The Role of Nutrition in Active and Healthy Ageing 2014. Page 5
- 13 JRC Science and Policy Reports: The Role of Nutrition in Active and Healthy Ageing 2014. Page 5
- 14 Ruxton C.H.S., Derbyshire E. & Toribio-Mateas M. (2015) Role of fatty acids and micronutrients in healthy ageing: a systematic review of randomised controlled trials set in the context of European dietary surveys of older adults. *J Hum Nutr Diet*. doi: 10.1111/jhn.12335
- 15 Best RL, Appleton KM. (2013). Investigating protein consumption in older adults: A focus group study. *Journal of Nutrition Education and Behaviour*, 45, 751-5
- 16 Ruxton C.H.S., Derbyshire E. & Toribio-Mateas M. (2015) Role of fatty acids and micronutrients in healthy ageing: a systematic review of randomised controlled trials set in the context of European dietary surveys of older adults. *J Hum Nutr Diet*. doi: 10.1111/jhn.12335
- 17 Ref Best RL, Appleton KM. (2013). Investigating protein consumption in older adults: A focus group study. *Journal of Nutrition Education and Behaviour*, 45, 751-5 of the total population.
- 18 [http://www.nutrition.org.uk/attachments/126\\_1.%20Prof%20John%20Mathers%20An%20Introduction%20to%20the%20Task%20Force%20Report.pdf](http://www.nutrition.org.uk/attachments/126_1.%20Prof%20John%20Mathers%20An%20Introduction%20to%20the%20Task%20Force%20Report.pdf)
- 19 [https://www.rcn.org.uk/\\_data/assets/pdf\\_file/0018/12537/malnutrition.pdf](https://www.rcn.org.uk/_data/assets/pdf_file/0018/12537/malnutrition.pdf)
- 20 Ruxton C.H.S., Derbyshire E. & Toribio-Mateas M. (2015) Role of fatty acids and micronutrients in healthy ageing: a systematic review of randomised controlled trials set in the context of European dietary surveys of older adults. *J Hum Nutr Diet*. doi: 10.1111/jhn.12335 (At beginning of discussion section)
- 21 [https://www2.rcn.org.uk/\\_data/assets/pdf\\_file/0018/12537/malnutrition.pdf](https://www2.rcn.org.uk/_data/assets/pdf_file/0018/12537/malnutrition.pdf)
- 22 [https://www2.rcn.org.uk/\\_data/assets/pdf\\_file/0018/12537/malnutrition.pdf](https://www2.rcn.org.uk/_data/assets/pdf_file/0018/12537/malnutrition.pdf)
- 23 <http://www.malnutritiontaskforce.org.uk/resources/malnutrition-factsheet/>
- 24 [https://www2.rcn.org.uk/\\_data/assets/pdf\\_file/0018/12537/malnutrition.pdf](https://www2.rcn.org.uk/_data/assets/pdf_file/0018/12537/malnutrition.pdf) page 3
- 25 <http://www.malnutritiontaskforce.org.uk/resources/malnutrition-factsheet/> (Guest, J. F., Panca, M., Baeyens, J.P., de Man, F., Ljungqvist, O., Pichard, C., Wait, S & Wilson, L. (2011) 'Health economic impact of managing patients following a community-based diagnosis of malnutrition in the UK', *Clinical Nutrition*, Volume 30, Issue 4, Pages 422-429, August 2011)
- 26 A review and summary of the impact of malnutrition in older people and the reported costs and benefits of interventions
- 27 [https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CCoQFjABahUKewiR2Mj-muXIAhXG2BoKHWicCSw&url=ht tp%3A%2F%2Fwww.ilcuk.org.uk%2Fimages%2Fuploads%2Fpublication-pdfs%2FCosts\\_and\\_Benefits\\_Report\\_June\\_2013.pdf&usq=AFQjCNHKO brrXTFiR2pVqsGf7ImU4N8-BQ&cad=rja](https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CCoQFjABahUKewiR2Mj-muXIAhXG2BoKHWicCSw&url=ht tp%3A%2F%2Fwww.ilcuk.org.uk%2Fimages%2Fuploads%2Fpublication-pdfs%2FCosts_and_Benefits_Report_June_2013.pdf&usq=AFQjCNHKO brrXTFiR2pVqsGf7ImU4N8-BQ&cad=rja)
- 28 Ruxton C.H.S., Derbyshire E. & Toribio-Mateas M. (2015) Role of fatty acids and micronutrients in healthy ageing: a systematic review of randomised controlled trials set in the context of European dietary surveys of older adults. *J Hum Nutr Diet*. doi: 10.1111/jhn.12335
- 29 [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/338801/SACN\\_Advice\\_on\\_Fish\\_Consumption.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/338801/SACN_Advice_on_Fish_Consumption.pdf)
- 30 [http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Fish-and-Omega-3-Fatty-Acids\\_UCM\\_303248\\_Article.jsp#.Vjtk27TZ5E1](http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Fish-and-Omega-3-Fatty-Acids_UCM_303248_Article.jsp#.Vjtk27TZ5E1)
- 31 <http://www.ncbi.nlm.nih.gov/pubmed/6712540>
- 32 <http://circ.ahajournals.org/content/116/10/e320.full>
- 33 <http://www.ncbi.nlm.nih.gov/pubmed/22760980>
- 34 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1994795/>
- 35 <http://www.ncbi.nlm.nih.gov/pubmed/16470012>
- 36 <http://www.nature.com/nrd/journal/v13/n6/full/nrd4275.html>
- 37 <http://www.ncbi.nlm.nih.gov/pubmed/12442909>
- 38 <http://www.ncbi.nlm.nih.gov/pubmed/12442909>
- 39 <http://www.arthritisresearchuk.org/arthritis-information/data-and-statistics/data-by-condition/osteoarthritis.aspx>



38 <http://www.ncbi.nlm.nih.gov/pubmed/17705097>  
39 [https://www.rnoh.nhs.uk/sites/default/files/downloads/dr\\_robert\\_moy.pdf](https://www.rnoh.nhs.uk/sites/default/files/downloads/dr_robert_moy.pdf)  
40 <http://www.ncbi.nlm.nih.gov/pubmed/2997282>  
41 <http://ajcn.nutrition.org/content/72/3/690.full>  
42 Bates B, Lennox A & Prentice A (2012) National Diet and Nutrition Survey: Headline Results from Years 1, 2 and 3 (Combined) of the  
Rolling Programme 2008/09 – 2010/11. London: FSA.  
43 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1495109/>  
44 Ruxton C.H.S., Derbyshire E. & Toribio-Mateas M. (2015) Role of fatty acids and micronutrients in healthy ageing: a systematic review  
of randomised controlled trials set in the context of European dietary surveys of older adults. J Hum Nutr Diet. doi: 10.1111/jhn.12335  
45 <http://www.ncbi.nlm.nih.gov/pubmed/9569395>  
46 <https://umm.edu/health/medical/altmed/supplement/vitamin-b9-folic-acid>  
47 <http://www.hsis.org/supplements.html>  
48 <http://www.ncbi.nlm.nih.gov/pubmed/10448529>  
49 <http://www.nhs.uk/conditions/Anaemia-vitamin-B12-and-folate-deficiency/Pages/Introduction.aspx>  
50 <http://www.livescience.com/16238-vitamin-b12-spurs-dementia.html>  
51 <http://www.nhs.uk/news/2010/09September/Pages/vitamin-B12-brain-shrink-dementia.aspx>  
52 <http://www.hsis.org/factsheets/vitc.html>  
53 <http://www.nhs.uk/Conditions/vitamins-minerals/Pages/Vitamin-C.aspx>  
54 <https://nei.nih.gov/areds2/PatientFAQ>  
55 <http://www.ncbi.nlm.nih.gov/pubmed/11896774>  
56 <http://www.ncbi.nlm.nih.gov/pubmed/12823436>  
57 <https://nei.nih.gov/areds2/MediaQandA>  
58 <http://www.hsis.org/factsheets/vitd.html>  
59 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3166406/>  
60 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2196219/>  
61 <http://www.ncbi.nlm.nih.gov/pubmed/19444937>  
62 <http://www.hsis.org/factsheets/vite.html>  
63 <http://www.hsis.org/AZhealthsupplements/PDFs/Vitamin%20K.pdf>  
64 <http://www.ncbi.nlm.nih.gov/pubmed/21427421>  
65 Pamela Mason; Dietary Supplements (Third Edition; 2007; the Pharmaceutical Press)  
66 <http://www.nhs.uk/Conditions/vitamins-minerals/Pages/Calcium.aspx>  
67 <http://www.medicalnewstoday.com/articles/288165.php>  
68 <http://www.hsis.org/factsheets/chromium.html>  
69 <http://www.ncbi.nlm.nih.gov/pubmed/17109600>  
70 <http://care.diabetesjournals.org/content/27/11/2741.full>  
71 <http://www.hsis.org/AZhealthsupplements/PDFs/Iodine.pdf>  
72 <http://www.thyroidresearchjournal.com/content/5/1/16>  
73 <http://www.webmd.com/vitamins-and-supplements/lifestyle-guide-11/iron-supplements>  
74 <http://www.medicalnewstoday.com/articles/286839.php>  
75 <http://najms.net/v06i01p009w/>  
76 <http://care.diabetesjournals.org/content/28/5/1175.full>  
77 <http://www.sciencedirect.com/science/article/pii/S0002870398702248>  
78 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3775240/>  
79 <http://www.medicalnewstoday.com/articles/287212.php>  
80 <http://www.bmj.com/content/346/bmj.f1378>  
81 The World Health Organization recommends an intake of 3,510 mg per day and agrees that most of the world's population is  
not meeting this recommendation.  
82 <http://www.hsis.org/AZhealthsupplements/PDFs/Phosphorus.pdf>  
83 <http://cot.food.gov.uk/sites/default/files/cot/vitmin2003.pdf>  
84 <https://ods.od.nih.gov/factsheets/Selenium-HealthProfessional/>  
85 <http://www.medicalnewstoday.com/articles/263176.php>  
86 <http://www.ncbi.nlm.nih.gov/pubmed/9701160?dopt=Abstract>  
87 <http://www.ncbi.nlm.nih.gov/pubmed/9701160?dopt=Abstract>

## FOOTNOTES AND REFERENCES

- <sup>88</sup> Yurko-Mauro K, McCarthy D, Rom D et al. (2010) Beneficial effects of docosahexaenoic acid on cognition in age-related cognitive decline. *Alzheimers Dement* 6, 456–464.3g
- <sup>89</sup> Nilsson A, Radeborg K, Salo I et al. (2012) Effects of supplementation with n-3 polyunsaturated fatty acids on cognitive performance and cardiometabolic risk markers in healthy 51 to 72 years old subjects: a randomized controlled cross-over study. *Nutr J* 11, 99.
- <sup>90</sup> Sinn N, Milte CM, Street SJ et al. (2012) Effects of n-3 fatty acids, EPA v. DHA, on depressive symptoms, quality of life, memory and executive function in older adults with mild cognitive impairment: a 6-month randomised controlled trial. *Br J Nutr* 107, 1682–1693.
- <sup>91</sup> Walker JG, Batterham PJ, Mackinnon AJ et al. (2012) Oral folic acid and vitamin B-12 supplementation to prevent cognitive decline in community-dwelling older adults with depressive symptoms—the Beyond Ageing Project: a randomized controlled trial. *Am J Clin Nutr* 95, 194–203.
- <sup>92</sup> Malouf M, Grimley EJ & Areosa SA (2003) Folic acid with or without vitamin B12 for cognition and dementia. *Cochrane Database Syst Rev* 4, CD004514.
- <sup>93</sup> <http://www.nutritionj.com/content/14/1/6>
- <sup>94</sup> <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3179651/>
- <sup>95</sup> <https://www.alzheimers.org.uk/statistics>
- <sup>96</sup> [https://www.alzheimers.org.uk/site/scripts/documents\\_info.php?documentID=418](https://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=418)
- <sup>97</sup> <https://www.nos.org.uk/document.doc?id=904>
- <sup>98</sup> <https://www.nos.org.uk/document.doc?id=904>
- <sup>99</sup> Aloia JF, Dhaliwal R, Shieh A et al. (2013) Calcium and vitamin d supplementation in postmenopausal women. *J Clin Endocrinol Metab* 98, E1702–E1709
- <sup>100</sup> Prentice RL, Pettinger MB, Jackson RD et al. (2013) Health risks and benefits from calcium and vitamin D supplementation: Women's Health Initiative clinical trial and cohort study. *Osteoporos Int* 24, 567–580.
- <sup>101</sup> Knapen MH, Drummen NE, Smit E et al. (2013) Three- year low-dose menaquinone-7 supplementation helps decrease bone loss in healthy postmenopausal women. *Osteoporos Int* 24, 2499–2507.
- <sup>102</sup> MK, O'Donnell CJ, Hoffmann U et al. (2009) Vitamin K supplementation and progression of coronary artery calcium in older men and women. *Am J Clin Nutr* 89, 1799–1807.
- <sup>103</sup> Stough, C, Downey, L, Silber, B et al. (2012) The effects of 90-day supplementation with the omega-3 essential fatty acid docosahexaenoic acid (DHA) on cognitive function and visual acuity in a healthy aging population. *Neurobiol Aging* 33, 824.e1–824.e3.
- <sup>104</sup> Pinazo-Duran MD, Galbis-Estrada C, Pons-Vazquez S et al. (2013) Effects of a nutraceutical formulation based on the combination of antioxidants and x-3 essential fatty acids in the expression of inflammation and immune response mediators in tears from patients with dry eye disorders. *Clin Interv Ageing*. 8, 139–148.
- <sup>105</sup> <https://nei.nih.gov/news/pressreleases/101201>
- <sup>106</sup> <http://www.nhs.uk/Conditions/Macular-degeneration/Pages/Introduction.aspx>
- <sup>107</sup> Hodkinson CF, Kelly M, Alexander HD et al. (2007) Effect of zinc supplementation on the immune status of healthy older individuals aged 55–70 years: the ZENITH Study. *J Gerontol A Biol Sci Med Sci* 62, 598–608.
- <sup>108</sup> <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3166406/>
- <sup>109</sup> <http://www.nhs.uk/news/2010/03March/Pages/Vitamin-D-and-the-immune-system.aspx>
- <sup>110</sup> <https://www.bhf.org.uk/research/where-we-fund-research/centres-of-research-excellence/university-of-cambridge/the-harmful-fat-in-blood>
- <sup>111</sup> Bischoff-Ferrari HA, Dawson-Hughes B & Stocklin E (2012) Oral supplementation with 25(OH)D3 versus vitamin D3: effects on 25(OH)D levels, lower extremity function, blood pressure, and markers of innate immunity. *J Bone Miner Res* 27, 160–169.
- <sup>112</sup> Shea MK, O'Donnell CJ, Hoffmann U et al. (2009) Vitamin K supplementation and progression of coronary artery calcium in older men and women. *Am J Clin Nutr* 89, 1799–1807.
- <sup>113</sup> <http://learn.genetics.utah.edu/content/chromosomes/telomeres/>
- <sup>114</sup> Kiecolt-Glaser JK, Epel ES, Belury MA et al. (2013) Omega-3 fatty acids, oxidative stress, and leukocyte telomere length: a randomized controlled trial. *Brain Behav Immun* 28, 16–24.
- <sup>115</sup> Gaziano JM, Sesso HD, Christen WG et al. (2012) Multivitamins in the prevention of cancer in men: the Physicians' Health Study II randomized controlled trial. *JAMA* 308, 1871–1880.
- <sup>116</sup> Sarris J, Cox KH, Camfield DA et al. (2012) Participant experiences from chronic administration of a multivitamin versus placebo on subjective health and wellbeing: a double-blind qualitative analysis of a randomised controlled trial. *Nutr J* 11, 110.
- <sup>117</sup> A review and summary of the impact of malnutrition in older people and the reported costs and benefits of interventions  
[https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CCoQFjABahUKEwiR2Mj-muXIAhXG2BoKHWicCSw&url=ht tp%3A%2F%2Fwww.ilcuk.org.uk%2Fimages%2Fuploads%2Fpublication-pdfs%2FCosts\\_and\\_Benefits\\_Report\\_June\\_2013.pdf&usq=AFQjCNHKO brrXTFiR2pVqsGf7ImU4N8-BQ&cad=rja](https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CCoQFjABahUKEwiR2Mj-muXIAhXG2BoKHWicCSw&url=ht tp%3A%2F%2Fwww.ilcuk.org.uk%2Fimages%2Fuploads%2Fpublication-pdfs%2FCosts_and_Benefits_Report_June_2013.pdf&usq=AFQjCNHKO brrXTFiR2pVqsGf7ImU4N8-BQ&cad=rja)





**THE PROPRIETARY ASSOCIATION  
OF GREAT BRITAIN (PAGB)**  
VERNON HOUSE  
SICILIAN AVENUE  
LONDON  
WC1A 2QS



**THE HEALTH SUPPLEMENTS  
INFORMATION SERVICE (HSIS)**  
52A CROMWELL ROAD  
LONDON  
SW7 5BE