



# Nutrition and dementia

A review of available research: Introduction

**Compass Group and Alzheimer's Disease International (ADI)** have come together in commissioning this joint report to investigate how the right nutrition may help make life better for people affected by dementia. This is reflected in ADI's mission and vision: 'an improved quality of life for people with dementia and their carers'.

In this first summary document (prepared by Martin Prince and Matthew Prina from the King's College London Institute of Psychiatry Global Observatory for Ageing and Dementia Care) we have introduced a number of areas of research on the relevance of nutritional factors to primary and secondary prevention of dementia, undernutrition in dementia and interventions to improve the nutrition of people with dementia.

Later in 2013 we will publish a full and more detailed review of the available research in these areas produced by the Observatory team, with additional input from international experts in the field.

ADI and Compass Group believe that a focus on diet, nutrition and wellbeing is a positive approach to supporting people with dementia and carers of this terrible disease. It is not only a good collaboration but the right thing to do.

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## Background

The global epidemic of Alzheimer's disease and other types of dementia is recognised by the World Health Organization as a public health priority. It is estimated that 36 million people worldwide live with dementia, with numbers affected doubling every 20 years, to reach 115 million by 2050<sup>1</sup>. The societal cost is enormous: US\$604bn in 2010 according to Alzheimer's Disease International estimates<sup>2</sup>. Current priorities to address this issue include:

- 1 prevention
- 2 earlier diagnosis
- 3 continuous support and care for the person with dementia, their family and other carers
- 4 optimising health, functioning and social participation – 'living well with dementia'

Diet (what you eat and drink) and nutrition (the whole process by which the body ingests, digests, processes and uses food) play an important role in maintaining health and wellbeing. You are, after all, what you eat. Undernutrition (insufficient calories, protein or other nutrients needed for tissue maintenance and repair) is the commonest nutritional problem, affecting up to 10% of older people living at home, 30% of those living in care homes, and 70% of hospitalised older people. Consequences include frailty, reduced mobility, skin fragility, an increased risk of falls and fractures, exacerbation of health conditions, and increased mortality. Risk factors include; the older person's social, economic and environmental situation; problems with mouth, teeth and swallowing; mental, neurological and other chronic physical diseases; and side effects of long-term treatment with certain drugs. Older people are also at risk of micronutrient deficiency (vitamins and minerals, needed in small quantities), often as part of a generally inadequate diet, but also seen in normal weight or obese people due to lack of meat, dairy products, or vegetables in the diet.

Nutrition can influence our risk of developing dementia, and our chances of 'living well with dementia' if we develop the condition.

- Good nutrition contributes to healthy brain development, which may protect against the onset of dementia in late life
- Obesity in midlife and diets rich in saturated fat, which predispose to cardiovascular disease, also increase the risk of developing dementia in late life
- The onset of dementia is associated with a decades long gradual decline in body mass
- Maintaining an adequate diet is challenging for people with dementia, leading to a particularly high prevalence of undernutrition.

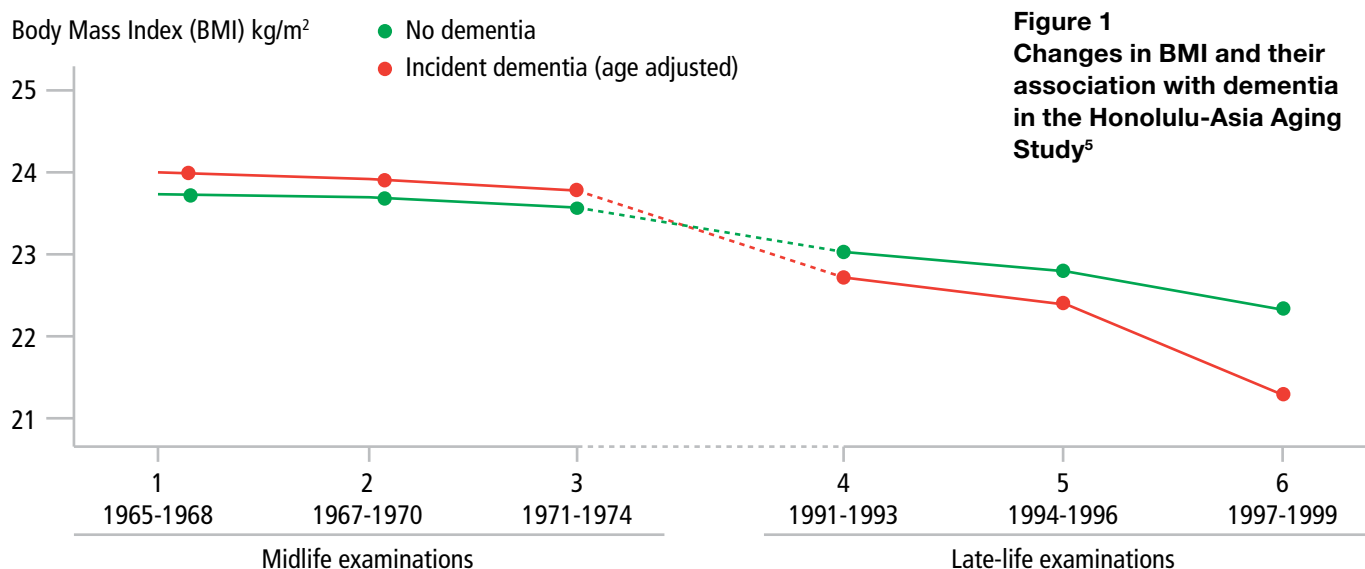
## Nutrition and the prevention of dementia

With an estimated 7.7 million new cases each year, dementia prevention is an urgent priority, both to reduce incidence and slow the progression of the condition. We need to identify important risk factors, particularly those that can be modified. Nutrition, brain development and adult brain health are linked together by complex pathways across the life course, suggesting multiple opportunities for prevention.





Good nutrition in the womb and early years are important for child cognitive and motor development. Trials suggest that improving infant nutrition has a beneficial effect on cognition into adulthood. In turn, childhood intelligence predicts cognitive performance in later life and dementia<sup>3</sup>. A well-nourished, and hence well-developed brain probably confers ‘cognitive reserve’, spare capacity that reduces the impact of neurodegeneration on everyday activities, hence delaying or preventing the onset of dementia. Foetal undernutrition is also relevant because small-for-dates babies tend to grow into adults with obesity, type II diabetes and cardiovascular disease. Meta-analysis (summarising findings across several long-term cohort studies) shows that obesity in mid-life predicts onset of dementia in late life<sup>4</sup>. However, when body mass is measured in later life there is either no relationship or a lower risk for dementia onset among obese older people. The explanation seems to be that weight declines faster among those in the process of developing dementia, often for decades before dementia onset (figure 1)<sup>5</sup>. Changes in body metabolism, adipose tissue and muscle mass may predispose to cognitive decline, and vice versa. The link to obesity may be particularly important, because of the current global epidemic of this problem; if the association between midlife obesity and dementia is causal, projected future numbers of people with dementia may have been significantly underestimated<sup>6</sup>.



**Figure 1**  
Changes in BMI and their association with dementia in the Honolulu-Asia Aging Study<sup>5</sup>



### Box 1

## Biological mechanisms suggesting a role for micronutrient deficiency

### Antioxidants (eg vitamins C and E)

Oxidative stress directly damages cell components, resulting in damage to synapses and nerve cell death. Antioxidants are thought to protect against neurodegeneration by limiting generation of toxic substances and by reducing damage by free radicals<sup>18</sup>.

### Folate and B12

These have related roles in DNA metabolism and protein synthesis. They are both essential for the remethylation of homocysteine to methionine. When folate or Vitamin B12 are deficient, homocysteine levels rise, which may contribute to amyloid and tau protein accumulation and neuronal death. Homocysteine stimulates apoptosis and neurotoxicity (leading to nerve cell death), and platelet activation (contributing to white matter lesions, vascular injury and ischaemic strokes<sup>19</sup>).

### Omega-3 long-chain polyunsaturated fatty acids (PFAs)

PFAs may reduce amyloid pathology, improve blood flow in the brain, and help to maintain the structural integrity of neuronal membranes. Of the three main types of PFA, docosahexaenoic acid (DHA) is the most relevant to the central nervous system, being the main component of membrane phospholipids and also involved in reducing free radicals and oxidative stress.

The relationship between dementia and dyslipidaemia (an abnormal lipid profile, with more 'bad' than 'good' cholesterol and high triglyceride) is not clearly established. Total serum cholesterol in mid-life is consistently associated with increased risk of dementia but this association is not seen in late life<sup>7</sup>, with some studies reporting significant lowering of cholesterol levels before the onset of dementia<sup>8</sup>. Reducing cholesterol with statin drugs reduces risk of heart disease and stroke, but does not seem to affect risk of developing dementia<sup>9</sup>. Genes influencing cholesterol metabolism, such as apolipoprotein E and J also influence risk for dementia.

Regular intake of fish, fruits and vegetables and a 'Mediterranean diet' (high consumption of unrefined cereals, fruits, vegetables and olive oil) are associated with reduced risk of developing dementia and a lower conversion rate from mild cognitive impairment to dementia<sup>10</sup>. If there is a causal link, it seems likely that the micronutrient profile of these diets is responsible.

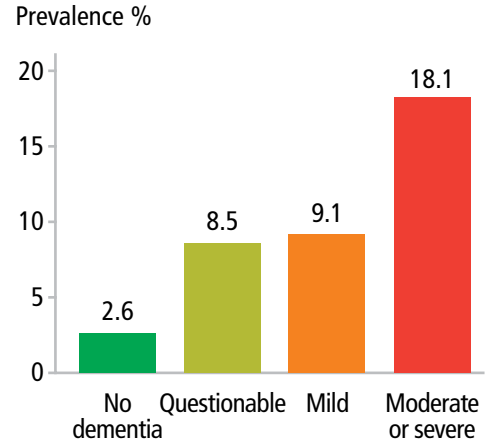
Gross deficiency in vitamin B3 (niacin) or B12 has long been recognised as potentially reversible causes of dementia. Guidelines for 'dementia screens' at the time of diagnosis typically include checking vitamin B12 and folate levels. Frequent consumption of omega-3 rich oils has been associated with a lower incidence of dementia in some observational studies. However, the epidemiological evidence that sub-clinical deficiency in vitamin B12 and folate, or deficiency in antioxidants such as vitamin C and E increase risk for cognitive decline or dementia is weak. More critically, randomised controlled trials (RCTs) of supplementation have failed to show any effects on cognitive decline in those with or without dementia for supplementation with vitamin B12 or folate (alone or in combination), vitamins C or E, and omega-3 fatty acids. The review conducted for the 2011 World Alzheimer Report concluded 'There is, as yet, no evidence to recommend the use of (micro)nutritional supplementation at any stage of dementia'<sup>11</sup>. There is, however, a strong theoretical basis for implicating deficiencies in these micronutrients in the known mechanisms of neurodegeneration (box 1). Trials have been few in number, and often small and underpowered. Not all have focused on those with deficiencies of the supplemented micronutrient. The duration of supplementation may have been too short to demonstrate an effect. It has also been suggested that simultaneous supplementation with multiple micronutrients (fatty acids, phospholipids, vitamins E, C, B6 and B12, and folic acid) might be required synergistically to increase brain levels of molecules that are essential building blocks of brain synapses. However, results from RCTs of such 'medical foods' are mixed, with preliminary data showing some improvement in specific cognitive tasks but not in overall cognition, clinical status, or functioning<sup>12</sup>.

In the full report we will critically review the expanding epidemiological and clinical trial evidence-base linking nutrition to cognitive impairment and dementia.

## Nutrition in dementia

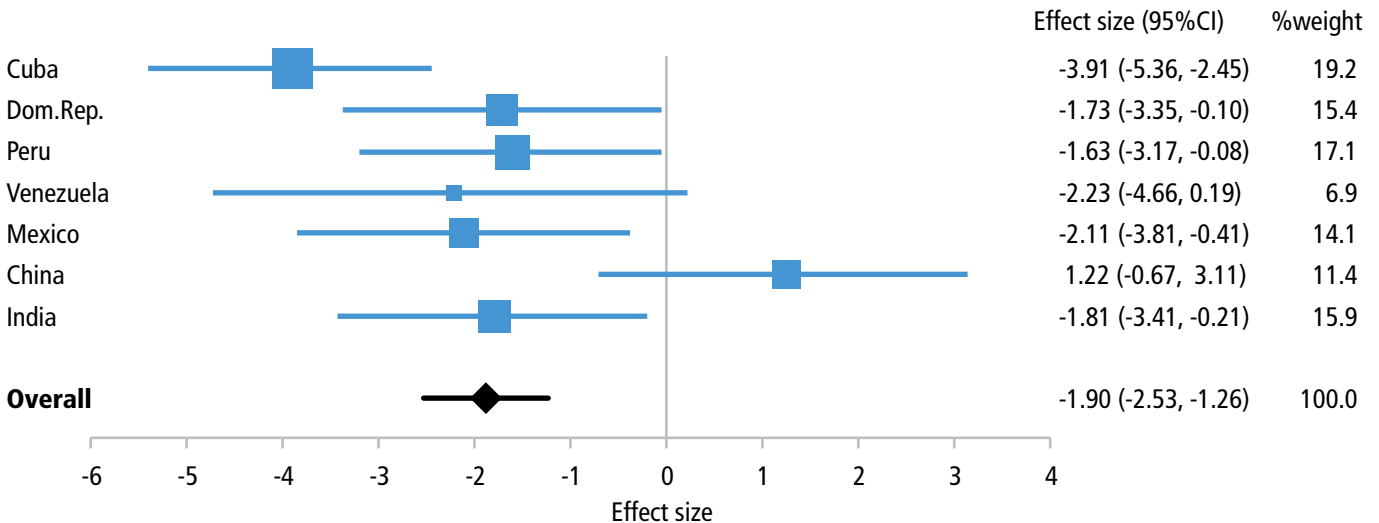
Progressive weight loss is common in older age. Among older people, undernutrition probably poses a bigger threat to health than obesity, being associated with ill health, reduced mobility, loss of independence and mortality. The loss of weight that precedes the onset of dementia seems to gather pace in the 3-6 years before clinical onset, and continues thereafter. Thus, even controlling for age, undernutrition is both more common in those with, than without dementia, and in later compared with earlier stages of dementia (figures 2a and 2b).

All of the risk factors for undernutrition described in part 1 are potentially relevant, but others are more specific to dementia, arising from the effects of neurodegeneration on cognition, behaviour, motor function and sense organs. Loss of taste and smell (which decline with increasing age, particularly in people with dementia) may occur early in the disease course. Cognitive impairment (memory impairment, apathy and impaired executive function) lead to progressive difficulties with obtaining food, planning and cooking meals and maintaining safety in the kitchen. The person with dementia may need to be prompted to eat. In the later stages of dementia aversive feeding behaviours (box 2) can seriously disrupt dietary intake, necessitating supervision and extensive assistance at mealtimes.



**Figure 2b**  
Prevalence of undernutrition in the Latin American sites of the 10/66 study by dementia category<sup>17</sup>

**Figure 2a**  
Forest plot of country specific estimates of mean difference in waist circumference in centimetres between those with and without a dementia diagnosis ('effect size' adjusted for age, sex, education, assets, markers of chronic disease and smoking), and pooled estimate from fixed-effect model meta-analysis<sup>16</sup>



### Box 2

## Aversive feeding behaviours

### Dyspraxia/agnosia

Unable to use utensils, inability to distinguish food from non-food, walks away from table.

### Resistance

Turns head away, blocks mouth with hands, bites assistant, spits or throws food.

### Oral neuromuscular incoordination

Will not open mouth, continuous tongue or mouth movements preventing ingestion, chews without swallowing.

### Selective behaviours

Prefers or will only eat particular types of food, flavours or consistencies, including, sometimes, fluids only.



## Interventions to improve the nutrition of people with dementia (with evidence-base)

Strategies to improve nutrition of people with dementia will be reviewed in detail in the forthcoming report, with a particular focus on evidence for their effectiveness. It will be important to consider the special contexts of care homes and hospitals, as well as the prevention and management of undernutrition in the home setting. As well as individual approaches, we will highlight case studies of systems level interventions, where for example a hospital or care home seeks to change the way that staff are trained, clients with dementia are assessed, and the environment, ambience and context in which food is provided.

Studies have assessed the effect of five main types of interventions:

- 1 nutritional supplements
- 2 training and education for caregivers
- 3 feeding assistance
- 4 modifying mealtime environment or routine
- 5 mixed interventions

A simple structured assessment of the problem should always be the first step. This should include the degree of undernutrition, dietary intake and habits, risk factors, aversive feeding behaviours, and needs for assistance. Suitable assessments and scales will be highlighted in the full report, with evidence for their validity. Nutritional support is the next step, since simple dietary advice, coupled with assessment and management of risk factors, and attention to needs for feeding assistance may be enough to address the problem. Current guidelines for older people highlight the need for protein to build muscle mass (for example, two to three servings a day of meat, fish or eggs), three or four servings a day of milk and dairy products, and at least five portions of fruit and vegetable per day.

Attempts should be made to meet nutrition needs with foods first (such as adding additional protein and calories to favourite foods). Only if this approach fails, or in the case of more severe undernutrition, high-energy and/or high-protein oral nutritional supplements (ONS), usually provided in liquid form, can be considered, as a quick and generally well-tolerated way of improving nutritional status. For older undernourished people ONS improve energy and nutrient intake, maintain or improve nutritional status, and reduce mortality. For older undernourished people with dementia, evidence is less extensive and has yet to be synthesised in a definitive review. However, it does appear that ONS is feasible, and can improve nutrition, but there is no evidence that it improves overall function or prolongs life. Tube feeding, usually in advanced dementia, is much more controversial, and the benefits are not clearly established; decisions are complex and difficult, and should be made with regard to quality of life, prognosis, and patient preferences, involving relatives, legal custodians, doctors and therapists, and, sometimes, following legal advice.

There is moderate evidence that education and training programmes reduce feeding difficulty and increase eating time. These programmes have mainly targeted professional carers in hospitals or care homes, but may also help family carers. The quality of the relationship between the carer and the person with dementia is important. Aversive feeding behaviours may be more likely to develop when the carer is strained. Conversely, better interaction between the nurse providing assistance and the patient with dementia is associated with a better dietary intake<sup>13</sup>.



Modifications to the mealtime environment and routine show some promising effects, but the poor quality and small number of trials is a limitation. Interventions assessed include playing soothing music during mealtimes, and using high contrast coloured tableware. In some nursing homes, meals are individually served on trays in a non-stimulating social environment. For nursing home residents without dementia, creating a more informal ‘family style’ eating environment with staff involvement, but without distractions, was associated with impressive improvements in body weight, quality of life and physical performance<sup>14</sup>. A smaller trial of a similar intervention in cognitively impaired nursing home residents also suggested nutritional benefits<sup>15</sup>. In the full report we shall examine the grey literature, and solicit case studies of other promising examples of such system level interventions.



## Summary and conclusion

Our aims for the ADI-Compass Group nutrition report are to access, and critically review all of the available evidence regarding the importance of nutrition to the onset and clinical progression of dementia, and the health and well-being of people living with dementia. This is a relatively new, but rapidly developing field. Where possible, we shall make evidence-based recommendations for policy and practice. However, it is already clear that more research is needed to clarify risk associations and inform preventive and treatment interventions. Important gaps in the evidence-base will be identified and highlighted as future research priorities.

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Alzheimer's Disease International (ADI) is the umbrella organisation of Alzheimer associations around the world. We aim to help establish and strengthen Alzheimer associations throughout the world, and to raise global awareness about Alzheimer's disease and all other causes of dementia. Alzheimer's Disease International: The International Federation of Alzheimer's Disease and Related Disorders Societies, Inc. is incorporated in Illinois, USA, and is a 501(c)(3) not-for-profit organization.



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