

# Evidence-based Preventative Strategies for Dementia

Selected Scientific Literature on the Topic

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## Introduction

This paper cites the many factors that contribute to preventing dementia, delaying the onset or slowing the decline. Rather than wait for definitive answers (or indeed a ‘silver bullet’ cure), we can sketch out a road map for prevention based on the evidence of scientific studies. Most of them only prove a relationship *between A and B*, but do not prove that A *causes* B. We now believe that a number of factors actually cause dementia. It’s back to ‘common sense’ as most of the advice is about sensible eating, enjoyable stimulation, using your brain and keeping fit. Evidence is accumulating that health conditions such as diabetes, obesity, and cardiovascular disease are risk factors for Alzheimer’s.<sup>53, 198</sup> Published in 2015, a study from Finland is the first randomised controlled trial of a lifestyle intervention. Targeting multiple lifestyle factors, including physical activity, diet, vascular risk factors, and brain training, slowed cognitive decline among older healthy individuals. Findings showed that “a multidomain intervention could improve or maintain cognitive functioning in at-risk elderly people from the general population”.<sup>238</sup>

The Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER) study was led by Professor Miia Kivipelto, Karolinska Institute, Stockholm, Sweden. "We have seen epidemiological studies suggesting associations between various risk factors and cognitive impairment or dementia but now we actually have a randomized study showing that lifestyle interventions can reduce the risk. That is a real breakthrough and feels very exciting.

"It has been very difficult to prove anything works for reducing dementia or cognitive impairment in a randomized trial. Now we have done it. Our results suggest prevention is key. We can do things before memory problems develop... our interventions are not difficult to do — they are very simple and pragmatic." <http://www.medscape.com/viewarticle/841355>

Hence, the focus of this paper is on lifestyle changes to reduce your risk of Alzheimer’s disease and other dementias.

Dementia may not be preventable in everyone, because the risk factors include things about us that we cannot change, like our genetic makeup or past occupation. By the time Muhammed Ali was diagnosed, he could not change the fact that he had repeated head injuries throughout his boxing career. But there are many factors we can change. Beneficial factors associated with reduced risk include diet, activity, cognitive stimulation, exercise, optimizing sleep and GI health, music, dance, social interaction, connection to nature and living a life with meaning and purpose. These help to offset our age, ill-health, injuries, socio-cultural life experiences and genetics. There are also things to avoid, such as smoking, toxic metals and stress. So even if we are destined towards dementia for reasons beyond our control, the onset can be delayed and its progress can be slowed through intervention. Instead of waiting for a miracle cure, we must educate ourselves to do everything in our power to prevent dementia in ourselves and our loved ones.

## Activity & Physical Exercise

A large European study of over 25,000 people analysed both physical and mental health activity and found that all activities are positively related to cognitive functioning in elderly people.<sup>51</sup> Work contributes to the

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development of cognitive reserve, and more complex intellectual work increases cognitive functioning. Professional activity also increases social interaction and self-efficacy. This study explored the relationship between cognitive performance and occupational activity, defined in a broad sense (ie, including professional, leisure, physical, and other activities). They found a positive association between participation in intellectual, social, and physical activity and performance on a wide range of cognitive tasks.

Interestingly, this study sheds light on the consequences of *inactivity after retirement*. Cognitive scores in the elderly are better for countries in which the age of eligibility for retirement benefits is higher. A 60-year-old individual delays cognitive aging by 1.38 years by continuing to work. They delay it by 1.75 years by undertaking regular charity or voluntary work. The strongest positive association is observed for attending an educational or training course. Social interaction or affiliation has been associated in several studies with a decreased risk of cognitive impairment in elderly people. Globally the effect of retirement on cognitive functioning occurs with a delay of about one year post retirement. In conclusion, this study shows that all types of occupational activity (professional and nonprofessional) clearly have a positive effect on cognitive functioning, and underscores the importance of activity in a general sense, not just professional activity.

The Rotterdam Study looked at the association between physical activity and dementia in a population of 4,406 persons aged 61-97. It found a borderline significant association between higher levels of physical activity and a lower risk of dementia.<sup>159</sup> A study in 2009 looked at physical activity and risk of neurodegenerative disease and pooled data from 16 previous studies which included 163,797 people without dementia. Of those 3,219 went on to develop dementia. Their findings suggested that physical activity was inversely associated with risk of dementia – higher activity, lower risk.<sup>160</sup> A meta-analysis in 2010 looked at physical activity as a potential preventative factor for vascular dementia. Five studies fulfilled the criteria for the meta-analysis, including 10,108 people without dementia and 374 individuals with vascular dementia. These demonstrated a significant association between physical exercise and a reduced risk of developing vascular dementia.<sup>166</sup>

### *Exercise and the Brain*

Aerobic exercise can have positive effects on cognition and brain function.<sup>141</sup> A number of studies support the idea that physical exercise is a lifestyle factor that might lead to increased physical and mental health throughout life.<sup>165</sup> Aerobic exercise training increases the size of the anterior hippocampus, leading to improvements in spatial memory. So, very much like other muscles in the body, fitness protects against volume loss or brain shrinkage. Aerobic exercise training is effective at reversing this loss in late adulthood, which is accompanied by improved memory function.<sup>59</sup> Furthermore, cardiorespiratory (CR) fitness is associated with progression of dementia severity and brain atrophy in AD, suggesting a link between progression of dementia severity and cardiorespiratory health.<sup>27</sup>

Exercise impacts brain circuitry by promoting neuronal repair and enhance learning and memory by increasing neurotrophic support. The central nervous system is capable of plasticity throughout one's lifespan. Exercise could be used to augment synaptic plasticity, promote behavioral rehabilitation, and counteract the deleterious effects of aging.<sup>149</sup> Cognitive stimulation also helps to build the brain through a process called neuroplasticity.

A study of 72 healthy older people who wore an electronic accelerometer during waking hours for 3 months to record activity, then had their brain activity measured with MRI scans. This was able to show that physical activity slowed the normal rate of cognitive decline. Enhancing moderate daily physical activity could be helpful for lowering the rate of neurocognitive degradations in healthy elderly individuals.<sup>40</sup> A randomised controlled trial of endurance exercise training was carried out in Italy with 120 healthy older adults, aged 69-74. They were supervised in a gym 3 hours a week for a year. The MMSE scores of the control group decreased significantly. It showed that this type of intervention may reduce the progression of age-related cognitive decline.<sup>235</sup>

#### *Leisure time activity*

Leisure-time physical activity at midlife at least twice a week was associated with a reduced risk of dementia and Alzheimer's disease. This was in spite of their age, sex, education, disabilities or genetics. Regular physical activity may reduce the risk or delay the onset of dementia and AD, especially among genetically susceptible individuals.<sup>102</sup> Other reviews showed that the benefits of physical exercise or physical activities promote brain and cognitive vitality well into older adulthood,<sup>137</sup> and that the evidence for a protective effect of moderate exercise on cognitive decline in elderly people is growing.<sup>138</sup> A review of 18 studies showed that fitness training was found to have robust but selective benefits for cognition.<sup>136</sup>

An active and socially integrated lifestyle in late life (social network, physical leisure, and non-physical activity) has a beneficial effect on cognition and a protective effect against dementia and AD.<sup>144</sup> Different types of activities seem to benefit different cognitive domains. In a study in China a high level of *mental* activity was related to less decline in global cognition, language, and executive function; high *physical* activity was related to less decline in episodic memory and language and high *social* activity was associated with less decline in global cognition. The same pattern was observed in men and in women.<sup>91</sup>

#### *Mild Cognitive Impairment (MCI)*

The term mild cognitive impairment (MCI) has been used to describe the population of older adults who experience memory complaints within the context of normal everyday functioning, but who neither have dementia or evidence of a cognitive deficit. Older adults with MCI are at higher risk than the normal older adult population for developing dementia. Several studies showing that increased levels of physical activity, such as walking, are associated with preserved or improved cognitive function.<sup>142</sup> They also find that older adults who engage in exercise are less likely to develop dementia than those who are not. For individuals with MCI, physical activity programs may aid in terms of improving cognition and preventing further cognitive decline.<sup>140</sup>

#### *Walking*

Greater amounts of walking are associated with greater gray matter volume, which is in turn associated with a reduced risk of cognitive impairment.<sup>101</sup> Physically capable older men who walked less than a quarter mile a day had almost twice the risk of developing dementia compared with those who walked more than 2 miles a day. This study took into consideration the possibility that limited amounts of walking could be the result of a decline in physical function due to preclinical dementia. These findings suggested that walking is associated with a reduced risk of dementia, and that promoting active lifestyles in physically capable men could help

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late-life cognitive function.<sup>131</sup> In another study on walking, women with a greater physical activity level at the beginning of the study were less likely to experience cognitive decline during the 6 to 8 years of follow-up. This supported the study hypothesis that physical activity prevents cognitive decline in older community-dwelling women.<sup>150</sup> One study looked at group walking and/or taking B vitamins for 152 community-dwelling adults aged 70–80 with MCI. Memory improved in men and memory and attention improved in women.<sup>148</sup>

### *Exercise for People with Dementia – slowing the decline*

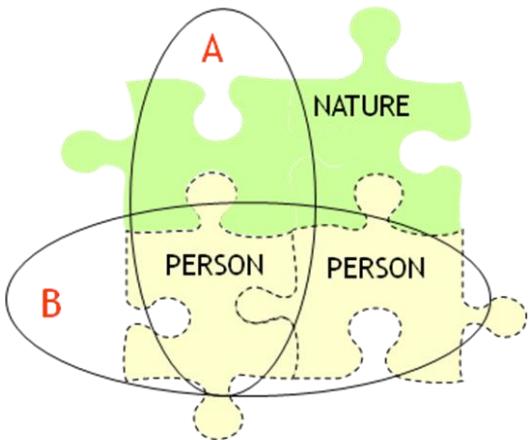
For people with dementia the benefits of physical activity are well-known. In a study of people with Alzheimer's, those who were sedentary have shown a significant decline in MMSE scores, while the active people actually reduced the amount of decline. Importantly, among the active AD patients, those individuals who engaged in walking for more than 2 hours a week had a significant improvement in MMSE scores.<sup>39</sup> (The MMSE is a brief 30-point questionnaire test that is used to screen for cognitive impairment.) Exercise appears to be beneficial in reducing some of the behavioral and psychological symptoms of dementia (BPSD), especially depressed mood, agitation, and 'wandering', and may also improve night-time sleep.<sup>9</sup> Brain areas such as the prefrontal cortex, hippocampus and amygdala that respond positively to physical activity are affected in the three most prevalent subtypes of dementia (Alzheimer's, frontotemporal and vascular). A dysfunction of these areas has serious consequences for cognition and behavior. A deterioration of executive functions, such as taking initiative, results in apathy, a lack of motivation, and agitation which has been shown to decrease after participation in an exercise program.<sup>18, 19</sup> Engaging in regular physical activity (aerobic/endurance activities, strength training, balance, and flexibility training) among other health benefits, may delay or prevent the onset of behavior problems and sleep disorders in frail elderly people with dementia living in nursing homes.<sup>132, 133</sup>

### *Mind-body*

A study of Chinese elders showed it is not just the exercise that is therapeutic, but this can be enhanced by intentionally involving the mind as well. A total of 389 subjects at risk of cognitive decline participated in an exercise intervention program. They found that by using Tai Chi, a mind-body exercise with integrated cognitive and motor coordination, the group showed a trend for lower risk of developing dementia at 1 year, as well as other clinical improvements. Such activity helped with preservation of global ability in elders at risk of cognitive decline.<sup>41</sup>

This overlapping of the mind and the body supports the Prosentia Hypothesis which proposes that the combination of engagement with nature as well as social interaction is therapeutic for people with dementia.<sup>227, 228</sup>

This model illustrates the two interactions that work together to improve wellbeing. While (**B**) is the communication between two people, (**A**) shows the interaction between the person and nature. In line with the Prosentia Hypothesis, one study looked at the effect of planned walking on communication in residents with dementia in two nursing homes. It found that communication performance improved significantly in the planned walking group, as compared to the conversation-only group. The results suggest that a planned walking program has the capacity to improve the communication performance of patients with Alzheimer's disease.<sup>145</sup>



### PROSENTIA HYPOTHESIS

Nature is a tool for interaction between people to enable well-being for a person with dementia.

(Chalfont, 2008)

Of particular interest is a person's total daily physical activity. One study showed that the level of total daily physical activity was associated with the rate of global cognitive decline and AD in older adults.<sup>201</sup> Another one examined the relationship of total physical activity, objectively measured by actigraphy, with incident AD and cognitive decline. Subjects with lower overall physical activity had a higher risk of AD and a faster rate of cognitive decline after controlling for several confounders, including motor function. Total daily activity, including non-exercise physical activity, may be particularly important to augment cognition and forestall AD.

In summary, physical activity and exercise have been consistently associated with decreased risk for cognitive decline and dementia and its positive effects are evident both for Alzheimer disease (AD) and vascular dementia. Physical activity provides a promising, low-cost, easily accessible, and side-effect-free means to prevent AD... and has other beneficial effects on quality of life, combating cardiovascular disease, risk of falls, disability, and depression.<sup>200</sup>

## DIET

'You are what you eat' continues to ring true, as diet may be the single more important cause of dementia, according to the evidence. Increased intake of vegetables is associated with a lower risk of dementia and slower rates of cognitive decline in older age.<sup>194</sup> Before giving dietary advice, a mention of homocysteine, antioxidants, resveratrol and flavonoids is in order.

### *Homocysteine*

Low levels of the two B-vitamins, folate and vitamin B12, cause an excess of homocysteine in the blood, and two enzymes to be increased. These enzymes work on the amyloid-beta proteins that become snipped off and form amyloid plaque. People with the highest levels of blood homocysteine had almost double the risk of AD and other dementias as compared to people with lower blood homocysteine.<sup>95</sup> There is a statistically significant association between serum homocysteine and the incidence of dementia.<sup>104</sup> Food processing destroys up to 85% of vitamin B6 and folate. Clearly we must be eating whole foods in their natural state. So both high levels of homocysteine and low levels of vitamin B12 may be involved in the development of Alzheimer's disease.<sup>130, 83, 84, 95, 43, 203</sup> Because older people cannot easily utilise folic acid in food they need it in supplement form. Although vitamin deficiency is quite pervasive (as many as 45% of elderly British are foliate deficient) taking a multiple vitamin can remedy the problem. Furthermore, high levels of homocysteine have

been linked in numerous studies to an increased risk of depression. Whereas, testing for homocysteine is a very simple solution.<sup>96, 97, 98, 100</sup> A diet to lower homocysteine would include many natural sources of B-vitamins like fresh fruits and vegetables and would limit animal protein. However, eggs, meat and butter can play a role in maintaining a healthy body and brain, as long as they are balanced with the necessary fresh foods and regular exercise. Vegetarians and vegans may need to take supplements.

#### *Antioxidants, Resveratrol and Flavonoids*

Antioxidants are used therapeutically to address brain aging and neurodegenerative diseases of the elderly.<sup>111</sup> An autopsy will reveal inflammatory processes and oxidative damage in the brains of people with dementia. Free radicals build up in the body when we are exposed to toxins and they are generated in our body when we experience stress. Avoidable sources of free radicals include fried foods, cigarette smoke, radiation, stress and alcohol.<sup>187</sup> Maintaining a healthy lifestyle and reducing stress in our lives is important to help prevent free radical damage. Having abundant antioxidants in the diet prevents or treats such damage by neutralizing free radicals and inflammation.<sup>82</sup> Resveratrol may be useful in reducing the risk of neurodegenerative disorders, especially Alzheimer's disease (among many other diseases and ailments).<sup>210, 217</sup> Resveratrol is obtained from red grapes, red grape juice, red wine, blueberries, peanuts, peanut butter and dark chocolate.

Dietary intake of flavonoid-rich foods or supplements could impact the development and progression of dementia.<sup>113</sup> Flavonoids are common plant pigment compounds which may protect brain neurons from injury, improving metabolism and the molecular structure responsible for memory. Indirectly, flavanols may help by improving brain blood flow, allowing more blood — and therefore more oxygen — to reach key areas of the brain, resulting in higher cognitive scores.<sup>120</sup> For instance, in one study blueberries and strawberries appeared to slow cognitive decline in older women. Those with higher berry intake delayed cognitive aging by up to 2.5 years.<sup>115</sup> A study looking at data from 23 countries to see if different genetic backgrounds made a difference, found that higher consumption of dietary flavonoids, especially flavonols, is associated with lower population rates of dementia.<sup>192</sup>

#### *Mediterranean Diet*

The Mediterranean diet (MeDi) consists of vegetables, fruits, nuts, whole grains, and fish. It is known that elevated saturated fatty acids could have negative effects on age-related cognitive decline and mild cognitive impairment (MCI).<sup>186</sup> Evidence suggests a possible association between fish consumption and unsaturated fatty acids in reducing the risk of cognitive decline and dementia.<sup>106</sup> Light to moderate alcohol use may be associated with a reduced risk of incident dementia and Alzheimer's (AD), and perhaps a protective effect for vascular dementia, cognitive decline, and predementia syndromes. Another study found that people who followed the MeDi were less likely to develop depression during the next 4 years than those who ate more meat, meat products, or whole-fat dairy. Researchers felt that healthier food habits may have lead to an improved brain function and consequently to a greater resilience to better face the frustrations of every day, to control stress, and to overcome personality deficits. Rates were about 30% lower in those with the highest consumption of fruit, nuts, legumes, and monounsaturated vs saturated fats.<sup>107</sup>

Higher adherence to MeDi was found to be associated with a lower likelihood of cognitive impairment, in spite of differing demographic characteristics, environmental factors, vascular risk factors, depressive symptoms, and self-reported health status.<sup>216</sup> Another study found that adherence to the MeDi may affect not only risk for AD but also subsequent disease course, and that higher adherence to the MeDi is associated with lower mortality in AD.<sup>211</sup> In summary, higher adherence to a Mediterranean-type diet could be associated with slower cognitive decline, reduced risk of progression from MCI to AD, reduced risk of AD and a decreased all-cause mortality in AD patients.<sup>186, 213</sup>

Attain the vitamins and minerals you need through food if possible, but through supplements if necessary. Table 1 in the Appendix tells you the elements the body needs, why they are important and what foods provide them. Natural elements that are also therapeutic include *Ginkgo biloba*<sup>189, 190, 191</sup>, *Gotu kola*<sup>187</sup>, cinnamon<sup>218, 219</sup>, coffee and caffeine<sup>121, 123, 124</sup>, Sea buckthorn berry<sup>193</sup>, Ginseng<sup>152</sup> and Saffron (*Crocus sativus*)<sup>185</sup>. In particular, curcumin/turmeric<sup>172, 173, 174, 175, 176, 177, 178, 179</sup> has shown dramatic results in recovery from symptoms such as irritability, agitation, anxiety, and apathy. Also, drink enough water to keep hydrated so that your urine is light/pale yellow.

Avoid eating sugar<sup>186, 187, 86</sup>, sugar substitutes (aspartame, saccharin, acesulfame potassium, high-fructose corn syrup, neotame, sucralose)<sup>186, 214</sup>, and an excess of highly processed carbohydrates (sugar, flour and all the products made from them).<sup>220</sup>

#### Risk Factor: *Obesity*

Obesity at midlife is associated with an increased risk of dementia and Alzheimer's disease later in life.<sup>67</sup> Clustering of vascular risk factors increases the risk in an additive manner. Central obesity in midlife increases risk of dementia independent of diabetes and cardiovascular comorbidities.<sup>66</sup> As many as fifty percent of adults have central obesity. Being overweight in midlife is associated with lower cognitive ability and steeper cognitive decline in late life.<sup>62</sup> Obesity during middle age (40 to 45 years) was strongly associated with an increased risk of dementia 30 years later. People with obese body-mass index (BMI) scores (30 or above) were 75% more likely to develop dementia compared to those with a normal BMI.<sup>63</sup> A BMI less than 20 and an increasing BMI of 22.5 or greater were associated with increased risk from midlife to old age of dementia.<sup>65</sup> Overweight and obesity are major preventable factors.

#### Risk Factor: *Cardiovascular Disease*

Over the last 15 years, researchers have found a significant association between vascular diseases (hypertension, atherosclerosis, diabetes type 2, hyperlipidemia, and heart disease) and an increased risk of Alzheimer's disease.<sup>52</sup> Hypertension (high blood pressure) may cause cerebrovascular disease that may increase the risk of AD. Vascular disease can affect cerebral blood flow and impair signaling. Hypertension may also lead to vessel wall changes in the brain, leading to hypoperfusion, ischemia and hypoxia. Both of these may initiate the pathological beginnings of dementia. Also, early AD may lead to increased blood pressure. Similar biological mechanisms may be involved in the development of both disorders. By avoiding vascular risk factors we can markedly reduce incident dementia. The same is true for heart disease in all its forms - coronary artery disease, myocardial infarction, atrial fibrillation, valvular disease, and heart failure. Several of the cardiovascular risk factors are preventable and treatable. In summary, lifestyle modifications

known to be effective in preventing vascular disease, such as controlling high blood pressure, managing your cholesterol levels, and engaging in physical activity, may also help prevent Alzheimer's disease.<sup>55, 58, 71, 232, 222, 233, 225</sup>

It has been shown that diet alone reduces plaque and reverses carotid atherosclerosis. In the study, middle-aged people with heart disease or diabetes who lost more than 12 pounds over a two-year period successfully reduced the size of the deposits (or plaques) clogging their arteries, rather than merely halting their growth. A low-carb, low-fat, or Mediterranean-style diet all had positive effects on artery health.<sup>105</sup> Vitamin therapy has also been shown to slow and even reverse clogging of the carotid arteries that feed the brain, which should reduce the risk of stroke. Vascular dementia is preventable. Therefore, early detection and an accurate diagnosis are important.

#### Risk Factor: *Diabetes*

Studies indicate that there is a high correlation between Type 2 diabetes and the incidence of Alzheimer's disease (AD). The elevated glucose levels typical of diabetes lead to the overproduction of reactive oxygen species, resulting in oxidative stress, which is a common factor in both diabetes and AD.<sup>219</sup> There is a strong connection between diabetes and dementia which can largely be explained through diet. The Glycaemic Index (GI) is a ranking of carbohydrate containing foods based on their overall effect on blood glucose levels. Slowly absorbed foods have a low GI rating, whilst foods that are more quickly absorbed have a higher rating. This is important because choosing slowly absorbed carbohydrates, instead of quickly absorbed carbohydrates, can help even out blood glucose levels when you have diabetes. It can be seen that abnormal lipid, cholesterol and glucose metabolism are consistently indicated as central in the pathophysiology, and possibly the pathogenesis of AD.<sup>54</sup> Avoiding high blood pressure, controlling cholesterol and diabetes as well as maintaining a healthy diet and lifestyle may lower the risk of developing dementia.<sup>64</sup>

#### Diet - Conclusion

Lower the risk of cardiovascular and metabolic disorders by eating fats from fish, vegetable oils, nonstarchy vegetables, low glycemic index fruits, and a diet low in foods with added sugars.<sup>186</sup> In general, your diet should be low in salt, sugar and bad fat, and contain plenty of vegetables and fruit. Diet is such a powerful component for good health - you truly are what you eat. When in doubt about any food or drink, ask yourself these three simple questions,

- 1) Is it **natural**? (It is a whole food, organic or biodynamic, not invented or mucked about for profit.)
- 2) Is it **logical**? (There is a scientific reason why it may prevent or delay the onset of dementia.)
- 3) Is it **proven**? (There is some evidence that it has achieved this.)

*Feed your body and your brain. Let food be your medicine. Eat Clean. Stay Well.*

## Cognitive Stimulation

Findings underline the need for targeted efforts to stimulate and educate the ageing brain.<sup>1</sup> For instance, processing speed is the ability to automatically and fluently perform relatively easy elementary cognitive tasks, especially when attention and focused concentration are required. The cognitive domains of spatial abilities and processing speed have predicted life satisfaction.<sup>199</sup> Furthermore, impaired processing speed could cause difficulties in the partaking of social and societal life.<sup>199</sup> Brain size continues to be an important predictor of cognition in old age.<sup>2</sup>

### *Cognitive Reserve*

The concept of cognitive reserve is the idea of building up additional abilities to compensate for the possibility of declining memory or thinking. Cognitive reserve describes the mind's resistance to damage of the brain. It was discovered in 1988 at autopsy when some elderly persons without Alzheimer's symptoms displayed AD pathology of plaques and tangles.<sup>48</sup> Why did they not manifest the disease symptoms? The brains of these people weighed more and had a greater number of neurons. This higher reserve was found to provide a greater threshold before clinical deficit appears.<sup>229</sup> As well as building up additional abilities to strengthen cognitive reserve, preservation of the functional integrity of the neural network may be an important component of strengthening cognitive reserve and significantly delaying the onset and progression of dementia, particularly in females.<sup>47</sup>

### *Neuroplasticity*

While some interventions like diet, socialising, dancing, cooking and gardening have been shown to offer a protective and positive effect for cognition, there is one area of study that aims to positively and physically impact the brain directly. Both a walk in the park and weight-lifting in the gym are a benefit in various ways. But the gym workout has the added intention of changing muscle. Novel challenges present unexpected obstacles, forcing your brain to remodel its existing circuitry and build new pathways for information processing. This is the field of neuroplasticity, the idea that the brain is able to change through routine practice, much like any professional athlete or musician becomes better at what they do through practice. The expression 'what fires together, wires together' helps explain the process whereby neuronal connections or pathways strengthen the more they are activated. "Just as our brains shape us, we can shape our brains" (pg 8), says Barbara Arrowsmith-Young, born with severe learning difficulties who 'fixed' herself and went on to found a school and a movement in North America that overturns the belief that our brains are hardwired for life.<sup>226</sup>

In a study comparing the brains of professional musicians (keyboard players) with a matched group of amateur musicians and non-musicians, researchers found gray matter volume differences in motor, auditory, and visual-spatial brain regions. These differences may represent structural adaptations in response to long-term skill acquisition and the repetitive rehearsal of those skills.<sup>205</sup> Another group of people, so-called SuperAgers over the age of 80 who seem immune to age-related memory impairment, were compared to matched elderly 50-65 year-olds. The SuperAgers' cerebral cortex was significantly thicker and displayed no atrophy compared to the younger group.<sup>3</sup>

## *Cognitive Training*

There are three different types of computerised programmes in use: classic cognitive training tasks, neuropsychological software, and video games. Findings from these are comparable or better than those from reviews of more traditional, paper-and-pencil cognitive training approaches - effective and less labor intensive. This type of training has been useful for people with no impairment, with mild cognitive impairment (MCI) and with early Alzheimer's disease.

One study of computerised cognitive training for older people with MCI enabled participants to improve their performance across a range of tasks.<sup>42</sup> In a cognitive intervention program people with MCI were able to improve their performance on cognitive and functional measures and it could persist in a long-term follow-up.<sup>50</sup> In another study of computerised cognitive training for older persons with MCI, sixteen participants completed the 30-session program using exercises that target a range of cognitive functions including attention, processing speed, visual memory and executive functions. Results indicated that participants were able to improve their performance across a range of tasks with training.<sup>139</sup>

In a computer-assisted errorless learning-based memory training program (CELP) for people with early Alzheimer's disease in Hong Kong, positive treatment effects on cognition were found in both the computer-assisted and the therapist-led (TELP) sessions. Remarkable changes were shown in cognitive function for subjects receiving CELP and emotional/daily functions in those receiving TELP.<sup>94</sup>

In a meta-analysis of the literature on cognitive training (CT) in Alzheimer's disease, CT showed promise in the treatment of AD. CT was shown to affect learning, memory, executive functioning, activities of daily living, general cognitive problems, depression, and self-rated general functioning.<sup>20</sup> In a study looking at computer use among men, 5506 community-dwelling men in Australia aged 69 to 87 years were interviewed and then later followed-up. The study analysis adjusted for age, educational attainment, size of social network, and presence of depression or of significant clinical morbidity. They found that older men who use computers have lower risk of receiving a diagnosis of dementia up to 8.5 years later.<sup>99</sup>

In summary, cognitive training with or without computers has proven beneficial for both healthy and impaired adults.

## **Environment and Social Interaction**

We need to stay connected to other people and engage in conversation in order to keep our minds intact. In a brief review of people's attitude to home care, it was clear to me how much of what the service provided was about human contact. People needed help with things at home, but often that homecare worker was the only person they would see and talk face-to-face to in a day. Research shows that an extensive social network seems to protect against dementia. In a study of 1,203 people without dementia who had good cognition, living at home in Stockholm, Sweden, were followed for an average period of 3 years. 176 patients were diagnosed with dementia in that time. It was discovered when they analysed the data, that a poor or limited social network increased the risk of dementia by 60%. Infrequent contacts with people in their network did not increase the risk of the disease if such contacts were experienced as satisfying. So it is quality of contact, not just quantity that counts.<sup>234</sup>

## Metabolic Treatment Approach

A recent study has also shown dementia to be treatable. This study in 2014 from UCLA and the Buck Institute for Research on Aging successfully reversed cognitive decline by enhancing the metabolism of patients with memory loss from AD or cognitive impairment. 36 metabolic factors were tested and each was enhanced through diet, exercise, improved sleep, stress reduction, cognitive stimulation, vitamins and supplements, etc. 9 out of 10 patients improved beginning within 3 months. The only participant who did not improve was in very late stage dementia. Some patients were struggling with their jobs or had stopped working. After the intervention all the patients were able to return to work or continue working with improved performance. Follow-up has shown sustained improvement over 2.5 years.<sup>4</sup>

## What to avoid

As well as what to eat and do, there are numerous things to avoid that need a brief mention.

### *Metals*

Mercury - Thirty-two studies, out of 40 testing memory in individuals exposed to inorganic mercury, found significant memory deficits. Some autopsy studies found increased mercury levels in brain tissues of AD patients. In laboratory testing, inorganic mercury reproduces all pathological changes seen in AD. Inorganic mercury may play a role as a co-factor in the development of AD. As the single most effective public health primary preventive measure, industrial, and medical usage of mercury should be eliminated as soon as possible.<sup>70</sup>

Copper - It has been hypothesized that copper toxicity may be a contributory factor in Alzheimer's disease. Serum copper is slightly increased in AD. A specific form of 'free' copper seems to best characterize this increase. Free copper is associated with the typical deficits of AD, incipient AD and mild cognitive impairment, and specific cerebrospinal markers.<sup>76</sup> Its causative role in AD pathology as risk factor can be claimed.<sup>74</sup>

In another study, 65% of patients had a higher than normal free copper. Patients who were carriers of the APOE-ε4 allele had higher levels of free copper than non-carriers. After one year, MMSE decreased by 3-4 points, and free copper predicted this change. Hyperlipidemic patients with higher levels of free copper seemed more prone to worse cognitive impairment. Free copper at baseline correlated with the ADL and IADL clinical scales scores at one year. These results show an association between copper deregulation and unfavorable evolution of cognitive function in Alzheimer disease.<sup>75</sup>

Free copper distinguishes mild cognitive impairment subjects from healthy elderly individuals. The probability of acquiring MCI increased by about 24% for each free copper unit increment.<sup>76</sup> An increasing amount of evidence shows that biometals zinc (Zn) and copper (Cu) can interact with amyloid beta (Aβ).<sup>77, 196</sup> Copper, zinc and iron are naturally abundant in the brain but Alzheimer's disease brain contains elevated concentrations of these metals in areas of amyloid plaque pathology.

Aluminium/Aluminum - Since 1911, experimental evidence has repeatedly demonstrated that chronic Al intoxication reproduces neuropathological hallmarks of AD.<sup>72</sup> Aluminum is a neurotoxin omnipresent in

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everyday life and can enter the human body from several sources, most notably from drinking water and food consumption.<sup>209</sup> As a neurotoxin it creates tau tangles in the brain. Whether or not they are identical to the tau tangles created by Alzheimer's disease is really of no importance. It's probably better not to cook with aluminum pans. One dangerous route of exposure is anti-perspirant spray because the spray atomizes the aluminum into the nasal passages, where it can be absorbed directly into the blood in the brain.<sup>187</sup> This is completely avoidable exposure. The photographic evidence available combines with existing evidence to support a role for aluminum in the formation and growth of NFTs in neurons of humans with Alzheimer's disease.<sup>206</sup>

*Smoking* - Smoking is associated with a doubling of the risk of dementia and Alzheimer's disease.<sup>236</sup> Smokers were found to have decreased grey matter density compared with non-smokers, similar abnormalities to those found in people with early AD.<sup>164</sup> To beat dementia, one must quit smoking.<sup>163</sup>

*Stress* - Increasing evidence has been accumulating about the role of stress as an important challenge to the onset and progression of Alzheimer's disease (AD). There are neuroinflammatory mechanisms induced by stress that result in neuronal dysfunction and impaired neurogenesis.<sup>68</sup> Progressive increases in salivary cortisol during a yearly exam over a 5-yr period predicted reduced hippocampal volume and reduced performance on hippocampal-dependent memory tasks.<sup>90</sup>

There are other sources of concern such as *anesthesia, statins,<sup>237</sup> solvents, pesticides and pollution*, for which there is a small amount of research, but the evidence is growing.

## Conclusion

In older subjects, healthy diets, antioxidant supplements, the prevention of nutritional deficiencies, and moderate physical activity could be considered the first line of defense against the development and progression of pre-dementia and dementia syndromes.<sup>215</sup> At this point in time, a full range of beneficial activities and elements, along with the supporting evidence has been identified. From this information we can derive an integrated lifestyle approach to preventing dementia, delaying the onset or slowing the decline. Risk factor modification remains the cornerstone for dementia prevention, in particular looking at whether several simultaneous interventions may have additive or multiplicative effects.<sup>162</sup> Participation in a variety of activities, regardless of the frequency or the cognitive challenge is the recommended approach. One study showed that an 8 to 11% reduction in the risk for cognitive ageing and dementia resulted from this approach.<sup>45</sup> So even though many see the research as 'inconclusive,' multidomain interventions might be more promising in the prevention of cognitive decline and dementias such as Alzheimer's disease.<sup>188</sup>

We also know that greater purpose in life may help stave off the harmful effects of plaques and tangles associated with Alzheimer's disease.<sup>38</sup> So having a positive attitude and being able to identify your role in the grand scheme of things is also important. Does the tapestry of your life have a spiritual thread? Is it meaningful? Is there more to life for you than the material world? Is there more to my illness than the physical body? This road away from modern science and towards the greater importance of heart and spirit can open up further avenues of healing and disease prevention.

It is sometimes difficult in research to tease out the exact causes of improvement (was it the berries, the badminton or singing in the choir?). But does this reductionist approach really matter? Be sensible and adopt a wholistic approach that includes a real food diet, fun exercise, singing and dancing, brain workouts, art, craft, meaningful work, connection to nature through walking and food growing, nurturing your spiritual life and social interaction that builds meaningful relationships. At the end of the day, what matters is our good health, not how we get there. Rather than dying from dementia while waiting for conclusive evidence, we need to act now on what we already know.

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