

« Dietary patterns and cognitive decline »

Editorial

Dealing with cognitive decline – a public health emergency in ageing populations

The identification of effective preventive strategies to slow cognitive decline and postpone the diagnosis of dementia and its more frequent form, Alzheimer's disease (AD), has become a public health emergency in ageing populations throughout the world. Indeed, there is no etiological treatment for AD available yet, and the strongest risk factors for dementia and AD - being older or carrying susceptibility genes - are not able to be modified. Yet, epidemiological studies indicate that there might be a room for prevention of dementia and AD. Vascular and cardio-metabolic factors (such as hypertension, overweight/obesity) are strong risk factors for dementia and AD (especially in midlife), and these factors could be managed by improvement of the environment, in particular physical activity and a balanced nutrition. Hence, exercise and healthy diets might be successful candidates for the prevention of age-related cognitive impairments. In particular, greater intake of fruits and vegetables (F&V) as part of a healthy diet, have been consistently associated with lower risks of cognitive decline and AD dementia.

Current knowledge on F&V and brain ageing has been expanded by several studies highlighted in this Newsletter. First, novel findings from Kesse-Guyot and coll. suggest that an early exposure to a carotenoid-rich dietary pattern starting at midlife would have strong benefits for cognitive health later in life. Second, Yannakoulia and coll. and Pastor-Valero and coll. suggest that diet quality might not be considered alone for the maintenance of cognitive performances, but within a cluster of healthy behaviours with a potentially synergistic effect on cognitive health (i.e. higher F&V intakes, higher socio-demographic levels, higher practice of physical activity) - altogether defining a general healthy lifestyle.

Indeed, beyond dietary intakes, the social, cultural and traditional practices, and obviously their interactions, all certainly participate since midlife, or even earlier, to modulate disease risk. Understanding the complex interplay between individual environmental factors over the life-course and the genetic background in relation to cognitive ageing certainly constitute a new challenge for future research. Hopefully, a more holistic vision of disease risk will lead to design optimal multimodal interventions for the prevention of AD and dementia, which will eventually help lowering the burden of the devastating disease.

Catherine Féart & Cécilia Samieri
INSERM U897, University of Bordeaux, FRANCE

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« HEALTHY DIET, HEALTHY ENVIRONMENT WITHIN A FRUITFUL ECONOMY: THE ROLE OF FRUIT AND VEGETABLES »

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Mediterranean diet and cognitive health

Mary Yannakoulia^a and Nikolaos Scarmeas^{b,c}

a. Department of Nutrition and Dietetics, Harokopio University, Athens, GREECE

b. Taub Institute for Research in Alzheimer's Disease and the Aging Brain, Gertrude H. Sergievsky Center, Department of Neurology, Columbia University, New York, NY, USA

c. Department of Social Medicine, Psychiatry and Neurology, National and Kapodistrian University of Athens, GREECE

Mediterranean diet is a term used to describe the diet traditionally followed in Crete, South Italy and other Mediterranean countries. The traditional Mediterranean diet is characterized by high consumption of vegetables, fruits and legumes. It also includes moderate amounts of dairy products (principally cheese and yogurt), low to moderate amounts of seafood and poultry, and red meat in low amounts. Olive oil is the main type of added fat and wine is consumed modestly, normally with meals.

The Mediterranean diet has been consistently linked with long life expectancy and lower prevalence of several chronic diseases (cardiovascular disease, cancer, type 2 diabetes, metabolic syndrome). Many observational studies have explored the potential association between adherence to the Mediterranean diet and cognitive decline.

For that purpose, this review evaluates existing evidence on the effect of the Mediterranean diet as a pattern on cognitive function and risk of dementia and explores potential interactions between this dietary pattern and other behaviors, implying the potential synergistic effect of a lifestyle pattern.

Effect of the Mediterranean diet on cognition and dementia

Many studies investigated the hypothesis of a potential relationship between adherence to the Mediterranean diet and Alzheimer Disease and/or cognitive decline. Among the foods and nutrients abundant in the Mediterranean Diet, olive oil (through monounsaturated fatty acids and tyrosol, caffeic acid and other phenolic compounds), fish (and n-3 polyunsaturated fatty acids), wine (through alcohol, and phenolic compounds like resveratrol) and fruits and vegetables abundant in flavonoids and vitamins like C and E, have been associated with lower inflammatory and oxidative load and have been inversely associated with cardio metabolic risk factors, cognitive decline and dementia¹. However, other studies failed to detect an association between a score related to adherence to the Mediterranean diet and prospectively assessed measures of cognitive decline.

Several explanations have been given for this conflicting aspect. Although diet may share important associations with cognitive health, these associations are complex and could vary across geographic, cultural, or socio demographic contexts. Mediating factors, gene-environment interactions, or environmental interactions may be present and influence outcomes in different population groups. Thus, lifestyle behaviors seem to be an important component of the Mediterranean way of living.

Moving from the Mediterranean diet to a Mediterranean lifestyle

In the early Mediterranean diet pyramid², lifestyle behaviors have not been strongly emphasized as important components of the Mediterranean way of living: apart from physical activity, lifestyle factors that have been mentioned as being of particular interest are social support, sharing food, having lengthy meals and post-lunch siestas. Thus, there are no studies considering other diet-related habits,

including meal patterns, structure and commensal rituals as full-fledged elements of the Mediterranean diet.

For that purpose, the Mediterranean Diet Foundation launched the new Mediterranean diet concept in 2011³. It was again depicted in the form of a pyramid, but, interestingly, it refers more to a lifestyle pattern. The new model takes into account qualitative and quantitative elements for the selection of foods in which social and cultural elements characteristic of the Mediterranean way of life are incorporated. This new model underlines the conviviality aspect of eating as it contributes to strengthening socialization, communication and social support and adequate sleep and resting during daytime as basic complements to the dietary pattern.



Effect of the New Mediterranean diet on dementia

This revised clustering of patterns related to food intake, physical activity and social life has not been evaluated in relation to dementia. However, there is evidence indicating that these factors individually are important to cognitive function and decline; they may inter-correlate or act synergistically.

Indeed, social interaction such as mealtime conversations, group leisure activities or other forms of social engagement has been studied in relation to the prevalence, incidence of a dementia or in the context of non-pharmacological treatments, mainly along with physical activity.

According to many studies^{2,4}, socialization has been related to better cognitive performance and social interactions have been found to maintain and reaffirm individual and group identities in families living with dementia⁵. It has also been hypothesized that increased social interaction may benefit Alzheimer's patients by minimizing the sense of loneliness, isolation, stress, and, also vascular factors that contribute to cognitive decline. It can also improve patients' sense of self-worth⁶.

This new approach may help understand in more depth the role of the Mediterranean diet and to develop even more comprehensive intervention strategies with a promising potential regarding cognitive health.

Based on: Yannakoulia M, Kontogianni M, Scarmeas N. 2015 Mar. Cognitive health and Mediterranean Diet: Just diet or lifestyle pattern? Ageing Res Rev.

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Carotenoids-rich dietary patterns and cognitive function

Emmanuelle Kesse-Guyot* and colleagues

* Université Paris 13, Equipe de Recherche en Épidémiologie Nutritionnelle,
Centre de Recherche en Épidémiologie et Statistiques, Inserm (U1153), Inra (U1125), Cnam, COMUE Sorbonne Paris Cité, FRANCE

Most of the available epidemiological literature on carotenoid-based prevention of brain ageing has been focused on β -carotene. Other carotenoids seem also to have interesting properties.

This study evaluated the association between a carotenoid-rich dietary pattern and subsequent cognitive function in 2,983 adults initially aged 45–60 years participating in the SU.VI.MAX (Supplémentation en Vitamines et Minéraux Antioxydants) study.

Dietary data and measurements of carotenoids (lutein, zeaxanthin, β -cryptoxanthin, lycopene, α -carotene, trans- β -carotene and cis- β -carotene) were assessed in 1994–1996 (baseline concentrations).

Cognitive performance was assessed in 2007–2009 using six neuropsychological tests to define a composite cognitive score.

Using the reduced rank regression (RRR) in 381 participants, a dietary pattern explaining most of variability in plasma carotenoid concentrations was extracted and extrapolated across the whole sample.

Associations between carotenoid-rich dietary patterns and cognitive function measured 13 years later were estimated, with ANCOVA providing mean difference values and 95% CI across the tertiles of carotenoid-rich dietary patterns.

Association between cognitive function and carotenes, β -cryptoxanthin and lutein

The data showed that the first extracted dietary pattern was most strongly correlated with the plasma status of β -carotene, α -carotene, β -cryptoxanthin and lutein reflecting a diet rich in carotenoids. The study exhibited a strong association between lutein and carotenoid-rich dietary patterns, whereas zeaxanthin showed a weaker association.

vegetables, vegetable oils, orange coloured fruits and vegetables and soup and was negatively correlated with that of beer, cider and wine.

Furthermore, it was positively associated with the composite cognitive performance score assessed 13 years later, even after accounting for confounders such as sociodemographic factors, lifestyle characteristics and health status.

More specifically, high carotenoid-rich dietary patterns scores were related to better episodic memory, semantic fluency, working memory and executive functioning.

Major interest from a public health point of view

This work highlighted the food groups whose consumption is directly involved to plasma carotenoid status. The RRR procedure gives understandable diet-based public health messages. Such messages are of utmost importance because prevention is a cost-effective strategy and the prevention of dementia should be initiated in middle age when potential cognitive disorders are pre-symptomatic^{8,9}.

In conclusion, the present study adds new support to the positive association between carotenoid-rich dietary patterns in midlife and subsequent cognitive function, especially in terms of executive functioning and episodic memory. These findings showed that a diet with sufficient quantity and variety of coloured fruits and vegetables may help to maintain the health of the brain during ageing.

What we know?

- Concerning β -carotene: previous studies showed a better cognitive status^{1–3}, lower cognitive decline^{4,5} or risk of dementia⁶ among subjects with high β -carotene intake or biomarker status.
- Concerning xanthophylls: lutein and zeaxanthin may represent 70% of the carotenoids in the brain and could play a role in the maintenance of cognitive function⁷.

Positive association between carotenoid-rich dietary patterns and consumption of orange and green coloured fruits and vegetables, vegetable oils and soup

This dietary pattern, estimated with midlife exposure data, was highly correlated with the consumption of green coloured fruits and



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Education and WHO Recommendations for Fruit and Vegetable Intake Are Associated with Better Cognitive Function in a Disadvantaged Brazilian Elderly Population: A Population-Based Cross-Sectional Study

Maria Pastor-Valero^{a,b}, Renata Furlan-Viebig^c, Paulo Rossi Menezes^c,
Simone Almeida da Silva^c, Homero Vallada^d, Marcia Scazufca^d

a. Departamento de Salud Pública Historia de la Ciencia y Ginecología, Universidad Miguel Hernández, ESPANA

b. CIBER en Epidemiología y Salud Pública (CIBERESP), Madrid, ESPANA

c. University of Sao Paulo, Faculty of Medicine, Department of Preventive Medicine, BRAZIL

d. University of Sao Paulo, Faculty of Medicine, Institute of Psychiatry and LIM-23, BRAZIL



Due to increased longevity worldwide, cognitive decline and dementia are increasing exponentially¹. Evidence suggests that age-dependent accumulation of mtDN² leads to the production of free radical species (ROS), resulting in mitochondrial and synaptic damage in neurons which is present from the early stages of Alzheimer disease (AD)³. Fruit and vegetables are rich in antioxidant micronutrients, which have anti-inflammatory properties and can scavenge free radicals offering neuron-protection^{4,5}. These properties might have the potential to delay cognitive decline and prevent progression to dementia.

Epidemiological studies suggest a positive association between the intake of fruit and vegetables and decreased risk of cognitive impairment or dementia, but little is known about the optimal amount of fruit and vegetables associated with a lower risk of cognitive impairment. In 2004, the WHO launched a strategy to reduce the prevalence of non-communicable diseases. This strategy included recommendations of five or more servings of fruit and/or vegetables a day (400 g/day)⁶. However, no studies have examined whether the WHO recommendations offer protection against cognitive impairment. Apart from genetic factors, social determinants of mental health are associated with increased risk of cognitive decline and dementia⁷, such as income, education and healthy lifestyles including physical activity^{8,9,10}.

Brazil has one of the fastest-aging populations in the world, with the prevalence of dementia ranging from 5 (1%) to 8 (8%)¹. This study¹¹ examined the relationship between cognitive impairment and daily intake of fruit and vegetables, including "five a day" WHO recommendations, in Brazilian elderly participants from the Sao Paulo Ageing and Health Study (SPAH study). The relationship between cognitive impairment and factors such as years of education, physical activity, APOE gene, co-morbidities and lifestyle variables was also assessed.

The SPAH study

The SPAH study is a cross-sectional population-based study carried out with elderly participants ≥ 65 years of age from census sectors which represented the lowest Human Development Indexes in Brazil at the time. Eligible participants were recruited through door-knocking of all households within the census sector boundaries. Institutionalized individuals and those with a dementia diagnosis at entry ($n = 105$),

were not included. A total of 2,072 agreed to participate - a response rate of 91.4%. The assessment of cognitive function was carried out using the protocol developed by the 10/66 Dementia Research Group for use in population-based and validated in elderly Brazilians^{12,13}. To assess the fruit and vegetable intake, the corresponding section of a Brazilian Food Frequency Questionnaire (FFQ) was used¹⁴. A detailed description of the whole protocol has been published previously¹¹.

Key findings and plausible explanations

The results of the SPAH study suggested a protective role for those meeting WHO recommendations against cognitive impairment. In fact, for daily intakes of fruit and vegetables ≥ 400 grams/day there was a 47% decreased prevalence of cognitive impairment. Moreover, within the group of those with one or more years of education compared to no education (illiteracy), to be physically active compared to sedentary or to have HDL cholesterol levels above 50 mg/dl compared to levels ≤ 50 mg/dl strongly decreased the prevalence of cognitive impairment. This study found the important interaction between decreased prevalence of cognitive impairment and both years of education and physical activity, and between years of education and increased HDL-cholesterol levels, confirming the importance of social determinants in healthier choices and better quality of life in this elderly population. Even though the population presented very low levels of years of education, those with one or more years showed a strong decrease of prevalence of cognitive impairment. Although education is not directly related to the neuropathologic lesions in dementia, studies suggest that it may reduce the impact of such lesions by increasing the cognitive reserve and by shaping food choices⁸. Recent evidence demonstrates that literacy and the first years of education are associated with remarkable changes in cortical network organization and function¹⁵.

Translation to public health guidance

These findings support recommendations to increase F&V intake at least to meet WHO recommendations. The present results show that promoting education and health policies to encourage and enable healthy lifestyles in disadvantaged populations could make a significant difference. A more comprehensive understanding of the social determinants of mental health is needed to develop effective public policies to prevent or delay age associated cognitive impairment.

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