

« FRUIT & VEGETABLES AND COGNITIVE FUNCTION »

Editorial

Cognitive impairment is a broad term to describe a wide variety of impaired brain function relating to the ability of a person to think, concentrate, reason and remember. The most severe degree of cognitive impairment is dementia. Currently, no pharmaceutical treatment is available to cure dementia. Prevention is however a way to reduce the burden of dementia in western countries, and diet might be a successful candidate. Several epidemiological studies have shown that high intake of Fruits and Vegetables (F&V) was associated with a decreased risk of developing dementia in cohorts of elderly people. But few studies have addressed the impact of food intake during infancy or at midlife on cognitive function.

The results presented in this Newsletter show that people engaged in a healthy diet have a lower risk of cognitive and functional decline. They also highlight that F&V intake is closely linked to other favorable behaviours (such as no smoking, low alcohol consumption and high physical activity). Children fed a diet characterized by high consumption of fruit, vegetables and home prepared foods had higher IQ, verbal IQ and better memory performance at age 4 years. Adjustment for maternal education, intelligence and social class attenuated the association but it remained significant.

These findings show that F&V intake might be associated with better cognitive performances but one must keep in mind that unmeasured confounding factors (especially social and cultural ones) may partly explain these results.

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Dietary patterns in infancy and cognitive function in childhood

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Several studies in developing countries suggest that poor nutrition in infancy is linked with impaired cognitive development¹ but a number of confounding factors could explain these relations (for example, parental education, home environment, or birthweight). In developed countries most studies have focused on the importance of the type of milk and especially breastfeeding in infancy². Whether cognitive development is affected by the composition of the diet babies receive once they start the transition to solid foods is uncertain. The aim of the present study³ was to study relationships between dietary patterns in infancy and cognitive development at age four years.

The Southampton Women's Survey (SWS)

The SWS started in 1998⁴, with the aim of identifying influences in the fetal and postnatal environment that influence growth, development and health.

The "Infant guidelines" pattern

The children's diet was assessed at age six and twelve months using a Food Frequency Questionnaire (FFQ)⁶. Dietary patterns at each age were determined using principal components analysis. The first pattern was characterized by a high consumption of "vegetables, fruits, meat and fish, other home-prepared foods and breast milk" and a low consumption of "commercial baby foods and formula milk". As this pattern conforms to infant feeding guidelines⁷, we called it the 'infant guidelines' pattern.

Neuropsychological assessment

At age four years, 396 mothers and children were invited to take part in a study of cognitive function. The children's IQ was measured with the Wechsler Pre-School and Primary Scale of Intelligence; visual attention, visuomotor precision, sentence repetition and verbal fluency were measured with the NEPSY (Developmental Neuropsychological Assessment) and visual form-constancy was measured with the Test of Visual Perceptual skills. The quality of the child's home environment was assessed using a short version of the Home Observation for Measurement of the Environment Scale (HOME-SF)⁵.

Higher intake of fruit, vegetables, meat, fish and home-prepared foods in infancy linked with higher intelligence at age 4 years

Two hundred and forty one children had complete data on the neuropsychological tests, diet in infancy and parental characteristics. There were no differences in dietary patterns between boys and girls at either six or twelve months of age. Girls had higher scores for full-scale and verbal IQ, visual attention, visuomotor precision and sentence repetition.

In analyses adjusted for sex only, children whose diet in infancy was characterized by high consumption of fruit, vegetables and home-prepared foods ('infant guidelines' dietary pattern) had higher full-scale and verbal IQ and better memory performance at age four years. Further adjustment for maternal education, intelligence, social class, quality of the home environment and other potential confounding factors, weakened these associations but the relations between higher 'infant guidelines' diet score and full-scale and verbal IQ remained. For a standard deviation increase in 'infant guidelines' diet score at six or twelve months full scale IQ rose by 0.18 (95% CI 0.04 to 0.31) of a standard deviation. For a standard deviation increase in 'infant guidelines' diet score at six months verbal IQ rose by 0.14 (0.01 to 0.27) of a standard deviation. There were no associations between dietary patterns in infancy and four-year performance on the other tests. Further adjustment for breastfeeding had no effect on the associations described above.

Even in well-nourished populations, dietary pattern in early life may be important for cognitive development

These results suggest that a dietary pattern characterized by high consumption of vegetables, fruits, meat and fish and other home-prepared food in infancy could have some positive effect on cognitive development. The findings persisted after adjustment for a wide range of potential confounding factors, but we cannot exclude the possibility that they could be explained by other factors in the child's environment we are unable to measure.



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Health Behaviours From Early to Late Midlife as Predictors of Cognitive Function - The Whitehall II Study

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Background

There is growing evidence of an association between health behaviours and cognitive ageing. Smoking, alcohol abstinence, lack of physical activity, and poor dietary behaviour has all been found to be associated with cognitive decline and dementia. Although prospective studies have shown individual health behaviours to be associated with cognition, their combined impact on cognition remains unexplored. The objective of the present study is to assess the association of individual health behaviours and their combination with poor cognition in late midlife. We used health behaviours assessed three times over a 17-year period to examine whether unhealthy behaviours, separately and together, are associated with poorer executive function and memory and whether the risk associated with unhealthy behaviours accumulate over the adult lifecourse.

The Whitehall II Study

The target population for the Whitehall II study was all London-based office staff, aged 35–55 years, working in 20 civil service departments. Health behaviours were assessed in early midlife (mean age=44 years, Phase 1, 1985–1988), in midlife (mean age=56 years, Phase 5, 1997–1999) and in late midlife (mean age=61 years, Phase 7, 2002–2004). Smoking status at the three phases was assessed using questions on current smoking behaviour; high risk was defined as being a “current” smoker. Alcohol consumption was assessed via questions on the number of alcoholic drinks (“measures” of spirits, “glasses” of wine, and “pints” of beer) consumed in the last seven days, converted to number of units of alcohol with each unit corresponding to eight grams of ethanol. Alcohol consumption was categorized as: no alcohol, 1–14 units, and 15 or more units of alcohol per week. Compared to moderate alcohol consumption (1–14 units/week), alcohol abstinence was associated with a higher risk of poor executive function and poor memory. As no increase in risk was found among participants who consumed more than 14 units per week, the high risk category was thus defined as “abstinence from alcohol” rather than excessive alcohol consumption¹. In this cohort, heavy alcohol use was rare. Physical activity was assessed using questions on the frequency and duration of participation in different level of physical activities that were used to compute hours per week of each intensity level. Low risk was defined at each of the three phases as more than 2.5 hours per week or more of moderate physical

activity or one hour or more per week of vigorous physical activity (30). Dietary behaviour was assessed using a measure of frequency of Fruit and Vegetable (F&V) consumption. The low risk category was defined as eating F&V two or more times a day. A score of the number of unhealthy behaviours (smoking, alcohol abstinence, low physical activity, and low F&V consumption) was defined as ranging from 0 to 4. Poor (defined as scores in the worst sex-specific quintile) executive function (assessed using factor score of measures of reasoning (AH4-I) and phonemic and semantic fluency) and memory in late midlife (Phase 7) were analyzed as outcomes.

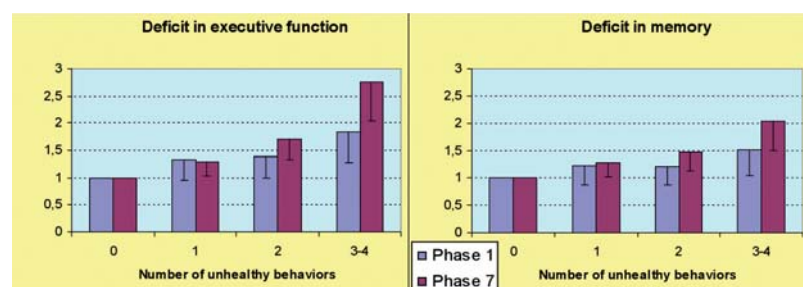
Association between health behaviours and cognitive deficit

Each of the four unhealthy behaviours examined - smoking, alcohol abstinence, low physical activity, poor dietary behaviour - at any of the three measures over the 17-year follow-up was associated with poor executive function and memory in late midlife. Compared to those with no unhealthy behaviours, those with 3–4 unhealthy behaviours at Phase 1 (Odds Ratio (OR)=1.84; 95% Confidence Interval: 1.27, 2.65), Phase 5 (OR=2.38; 1.76, 3.22) and Phase 7 (OR=2.76; 2.04, 3.73) were more likely to have poor executive function. A similar association was observed for memory (Figure 1). Odds of poor executive function and memory were the greater the more times the participant reported unhealthy behaviours over the three phases.

Promotion of a healthy lifestyle is important for cognitive health

Our results showed a prospective, cross-sectional and cumulative association of smoking, alcohol abstinence, low physical activity, and consumption of F&V less than two times a day with poor cognitive function. Furthermore, we found that a greater number of these unhealthy behaviours were associated with a higher risk of poor cognition, particularly evident in executive function and this risk accumulated over midlife. These results support other studies showing that there is a combined impact of unhealthy behaviors on risk of mortality^{1–4}, coronary heart disease⁵ and ischemic stroke⁶. Health behaviours are modifiable and these results suggest that the promotion of a healthy lifestyle at all ages is important for cardiovascular health and cognitive outcomes.

Figure 1. Odds ratio of deficit in executive function and in memory in late midlife as a function of unhealthy behaviors in early (Phase 1, mean age=44) and late (Phase 7, mean age=61) midlife.



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Dietary habits and cognitive decline in a cohort of elderly French women

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Diet, a promising avenue of investigation to prevent ageing

Cognitive decline is a major cause of autonomy loss in the elderly, and represents an important public health challenge. Emerging evidence suggests that a “prudent diet”, characterized by high intakes of fruits and vegetables, unsaturated fatty acids and whole grains may contribute to slow down cognitive ageing. However, data on the long-term relationship remains limited and even conflicting.

To determine the potential impact of dietary habits on cognitive ageing, we analysed data from 4,809 elderly women (born between 1925 and 1930) participating in the “Etude Epidémiologique de Femmes de la Mutuelle Générale de l’Education Nationale” (E3N), a French prospective cohort. In 1993, cohort participants received an extensive diet history self-administered questionnaire covering daily consumption of 208 foods and beverages. In the present study, diet was evaluated through the usual intakes of 25 food-groups and 33 nutrients. In 2006, another questionnaire on recently-observed cognitive change and Instrumental Activities of Daily Living (IADL) was sent to a close relative of each elderly woman. Logistic models adjusted for various lifestyle and medical factors were performed to evaluate associations between habitual dietary intakes and two aspects of cognitive functioning, based on informant report: cognitive decline over a period of one year and cognitive status as reflected in current impact in IADL functioning.

How was diet associated with aging outcomes?

In 2006, elderly women participating in the E3N cohort that were reported by informants to undergo recent cognitive decline had, 13 years previously, lower intake of poultry, fish, and animal fats, as well as higher intake of dairy desserts and ice-cream. They had lower than usual intake of dietary fibre and n-3 fatty acids, but higher intake of retinol.

Furthermore, elderly women that were reported by informants to have IADL impairment, had in the past, lower intake of vegetables, vitamins B2, B6, and B12.

Our findings of significant associations between age-related decline and lower long-term intake of certain specific nutrients - namely n-3 fatty acids, dietary fibre, and vitamin B6 - has already been described, but generally in studies with shorter prospective design. One of the main interests of our study lies indeed in the more-than-a-decade time interval between dietary and cognitive/functional assessment, which has enabled us to explore the long-term effect of dietary habits in ageing. Our study is not in complete agreement with previous ones in showing that higher intake of retinol and lower intake of animal fats were both associated with cognitive decline. Potential explanations include residual confounding and chance resulting from multiple analyses. Also, where several epidemiologic studies found an association between cognitive decline and lower intake of fruits, vitamin C, vitamin E or β -carotene intake (in agreement with the antioxidant hypothesis), we only observed a borderline association with vitamin C. The limited range of intake in our highly educated population, with few women having low consumption levels in foods rich in antioxidant components may explain the absence of certain associations in our study.

What next?

Anti-inflammatory and antioxidant properties are suggested to account for the inverse association between age-related decline and dietary fibre and vegetables. N-3 fatty acids, in which fish is rich, could act on heart and brain not only through the vascular pathway but also through different cellular mechanisms: heart rhythm, neurotransmission, neuroprotection, neurogenesis. Similarly, some B vitamins and homocystein can act directly on brain cell functioning. Although underlying biological pathways are not yet fully elucidated, our study, together with previous studies, supports that prevention of cognitive decline may be reached through a balanced diet rich in vegetables, fish and poultry, and limited in sweet dairy products, not only in later life but starting in middle age. These recommendations, also suggested for cancer and cardiovascular protection, may well work to enhance the quality of life as a whole.

