

Neuroprotective Effect of Diet in Ageing and Neurodegeneration

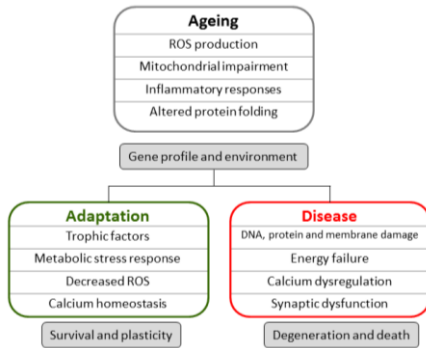
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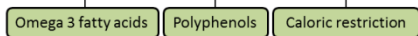
❖ INTRODUCTION

- The greatest factor for cognitive decline and dementia in older adults is age itself.



- There are currently no treatments available for those with neurodegenerative diseases – efforts are focused on prevention and or at delaying disease onset.

- Dietary factors can interact with molecular systems that maintain the mental function. Highlighted examples:



❖ OBJECTIVE

The aim of this review is to analyse the potential protective role of omega-3 fatty acids, polyphenols and caloric restriction in ageing and in neurodegenerative diseases.

❖ METHODOLOGY

Research of reviews and articles in PubMed, selection of books and consult of contrasted food databases.

❖ CONCLUSIONS

1. A wide range of in vitro and animal studies sustain that ω -3 fatty acids, polyphenols and caloric restriction exert potent neuroprotective effects.

2. Their action seems to be more effective at preventing rather than at treating.

3. Similar mechanisms of action: 1) antioxidant, 2) anti-inflammatory and 3) activation of pathways that result in the production neuroprotective factors.

4. Studies in humans are limited. More observational and clinical trials, with the adequate duration, subjects of study and methodology, are required.

5. Implementing diet to fortify neuronal function and battle neurodegeneration could provide an alternative to standard treatment.

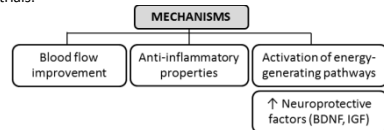
❖ OMEGA 3 FATTY ACIDS

- The most important ω -3 fatty acids are eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), mainly obtained by diet.

Table 1: Food sources of EPA and DHA

FISH	EPA + DHA content (mg/100mg)
Tuna	0,21
Sardines	0,28
Trout	0,28
Salmon	0,31
Crab	0,10
Lobster	0,02

- Animal studies are mainly focused on the beneficial effects of DHA in Alzheimer's disease. Observational studies in humans show an association between ω -3 fatty acids and good cognitive performance, but there is a lack of clinical trials.



- DHA constitutes more than 30% of the phospholipid composition of plasma membranes in brain - it is also crucial for maintaining membrane integrity and fluidity.

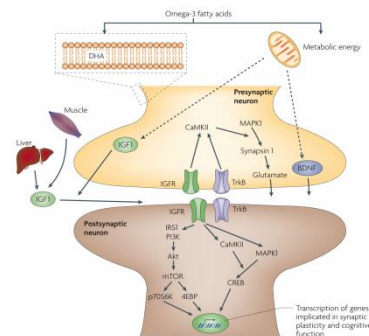


Figure 1: ω -3 fatty acids activate pathways that can affect synaptic plasticity and cognition (Adapted from Gómez-Pinilla et al., 2008)

❖ POLYPHENOLS

- Polyphenols are secondary metabolites of plants which contribute to their pigmentation and play protective roles against biotic and abiotic stress.

Table 2: Richest food groups in polyphenol content

Food group	Polyphenols content (mg/100mL) or (mg/100mg)
Cocoa products	1782,67
Seasonings	870,72
Fruits	367,05
Seeds	321,375
Vegetables	117,47
Non alcoholic beverages	66,10
Alcoholic beverages	40,33
Oil	39,50

- Animal studies reveal they can exert neuroprotective effects. The wide range of observational studies and clinical trials support an association between polyphenol consumption and low prevalence of cognitive disorders.

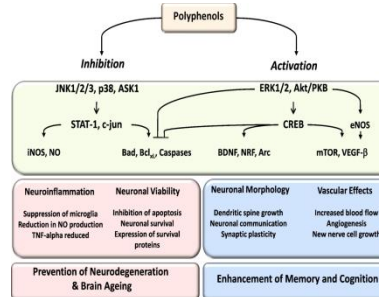
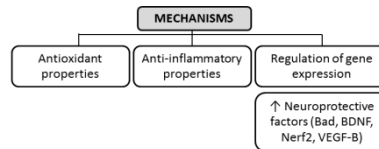


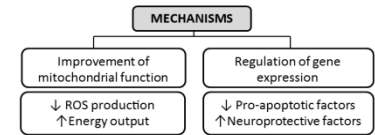
Figure 2: Important cellular pathways activated or inhibited by polyphenols (Adapted from Williams et al., 2012).

❖ CALORIC RESTRICTION

- Caloric restriction (CR) is the reduction of calorie intake without causing malnutrition.

- It can extend the lifespan of a number of organisms, it has shown beneficial effects on the function of brain and it seems to confer resistance to neurodegenerative pathologies.

- Observational studies have concluded that CR can contribute to healthy ageing and longevity in humans, but only two clinical trials have been published and they show controversial results.



- Its molecular basis seems to be mediated by Sirtuins, a family of NAD1-dependent deacetylases, and concretely SIRT1 in mammals.

- Resveratrol, a polyphenol found in red grapes, seems to mimic CR effects.

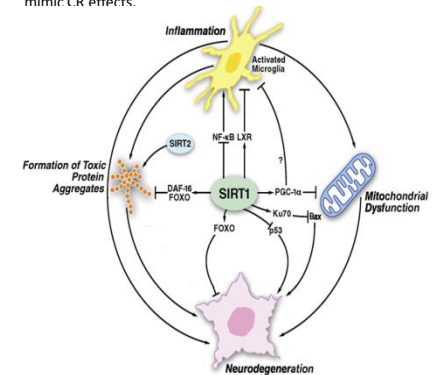


Figure 3: Potential roles of Sirtuins in aging and neurodegenerative diseases (Adapted from Gan L et al., 2008)