ROLE OF NUTRITION AND INFLAMMATION ON AGEIN BRAIN

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Aging Brain

Changes in Cognitive Functions- attention & Memory

Aging Brain and Inflammation

Nutrition in Cognitive function

Dementia - Impact, prevention, and challenges

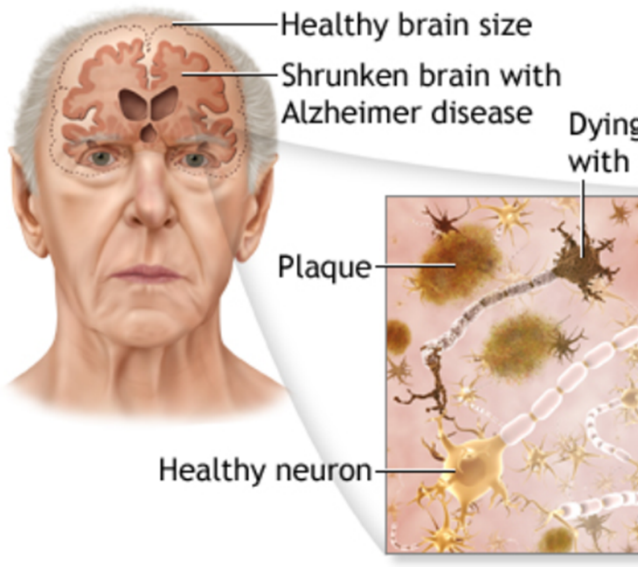
Aging Brain

ing has been described as a physiological process involving all body tissues

pectives of what can be considered normal ageing have continued to evolve over time, interventions are u
eted at adults who are 60 years of age and older

cturally, brain volume and/or brain weight have been shown to decrease about 5% per decade beginning
ge of 40 years

n atrophy with increasing age, (70 and above), has reduction in
n volume, plus decrease in neuronal volume and neuronal metabolic
vity.



se TA. When does age-related cognitive decline begin?. Neurobiol Aging. 2009;30(4):507-514.
1016/j.neurobiolaging.2008.09.023

Aging Brain...

cline in neuronal volume rather than number contributes to the changes in an ageing brain and t it may be related to sex with different areas most affected in men and women.

anges in dendritic arbour, spines, and synapses.

ndritic sprouting may occur thus maintaining a similar number of synapses and compensating any cell death.

nversely a decrease in dendritic synapses or loss of synaptic plasticity has also been found.

rs R. (2006). Ageing and the brain. Postgraduate medical journal, 82(964), 84–88. ://doi.org/10.1136/pgmj.2005.036665

Brain Changes in Aging

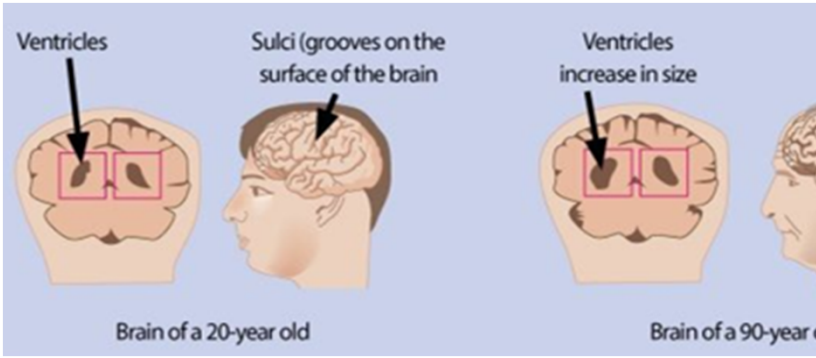
ain shrinks in volume and the ventricular system expands in lthy aging. Largest changes seen in the frontal and temporal tex, and in the putamen, thalamus, and accumbens

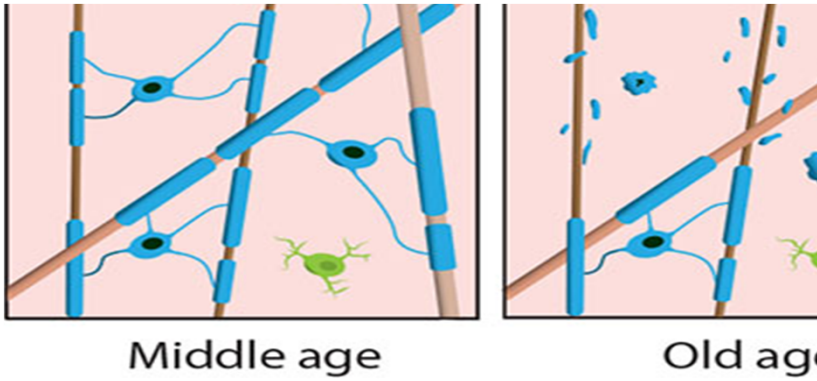
rtical thickness and subcortical volume can be tracked over iods as short as one year, with annual reductions of between % and 1.0% in most brain areas.

e length of myelinated axons is greatly reduced, up to almost %

ductions in specific cognitive abilities - processing speed, cutive functions, and episodic memory—are seen in healthy ng.

ch reductions are largely mediated by neuroanatomical nges





Farokhian, F., Yang, C., Beheshti, I., Matsuda, H., & Wu, S. (2017). Age-Related Gray and White M Changes in Normal Adult Brains. Aging and disease, 8(6), 899–909. https://doi.org/10.14336/AD.2

Aging Hippocampus

ructure of interest when considering aging and cognitive decline is the hippocampus

rain region important for learning and memory consolidation, affective behaviours and mood regulation

Where both functional and structural plasticity (e.g., neurogenesis) occur well into adulthood

terations seen in the aging hippocampus --

xidative stress, neuroinflammation, altered intracellular signalling and gene expression, reduced neurogene
d synaptic plasticity

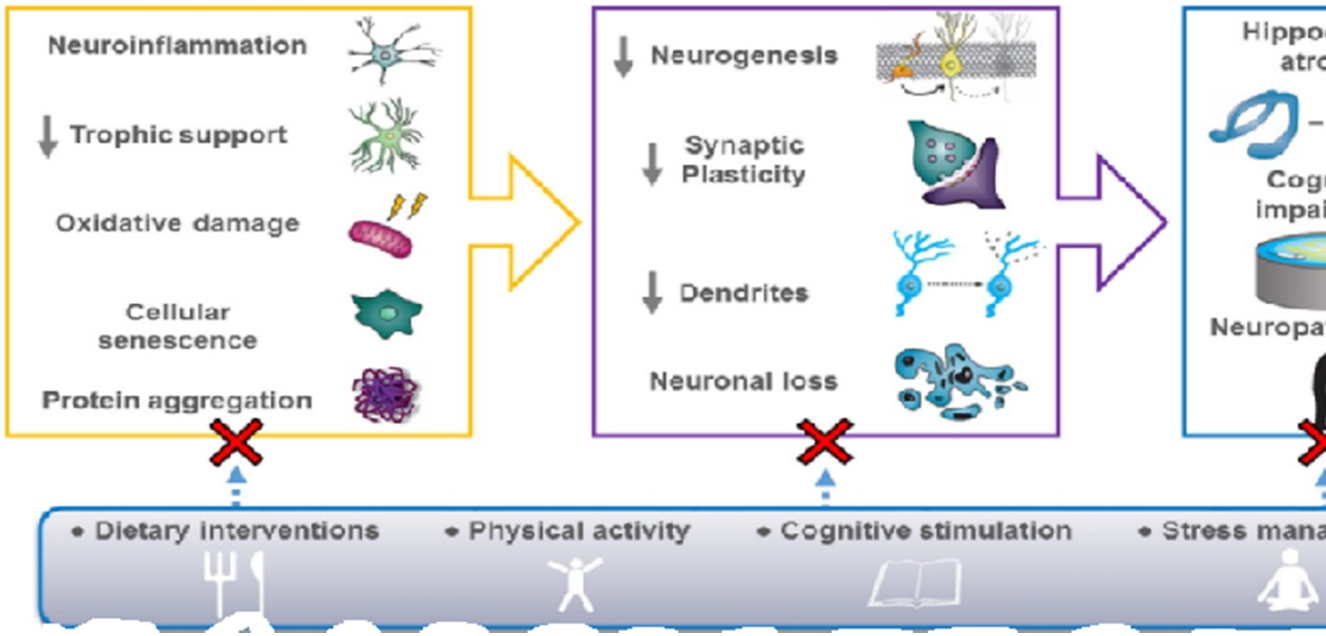
n-invasive strategies-

oric restriction

ysical exercise

vironmental enrichment

nteract many of the age-induced
ations in hippocampal signalling,
cture, and function.



ttio, Luckshi Rajendran, Joana Gil-Mohapel. The effects of aging in the us and cognitive decline,Neuroscience & Biobehavioral Reviews, 2017, Pages 66-86

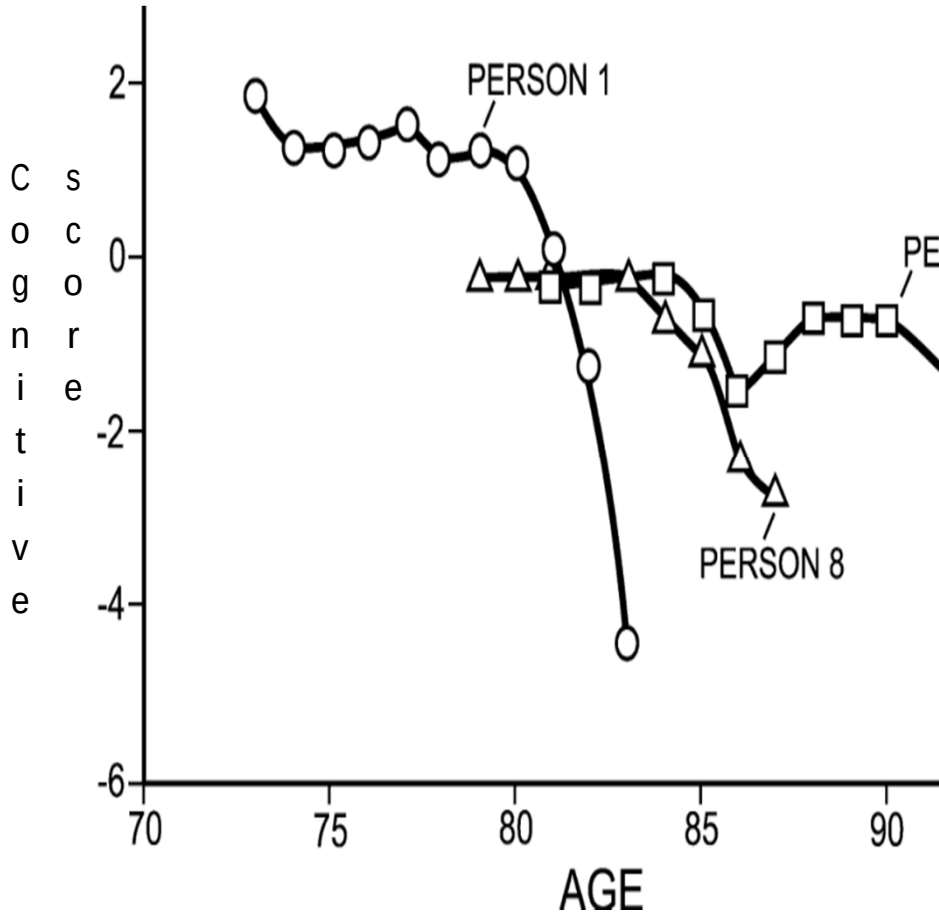
ognitive change

nges in brain structure and function are not uniform across the whole brain or across individuals

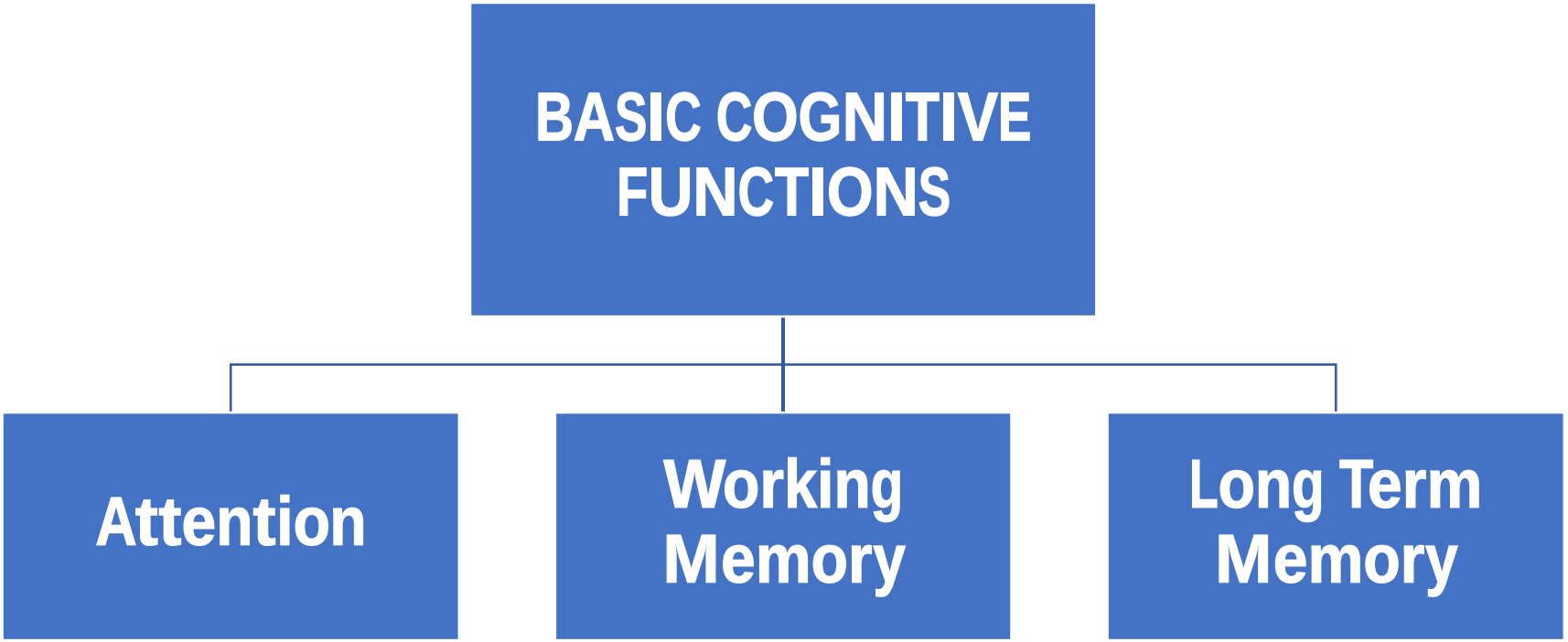
-related changes in cognition are not uniform across all cognitive
ains or across all older individuals.

cognitive functions most affected by age
attention and **memory**

dence suggests that some aspects of
ntion and memory hold up well with age while
ers show significant declines.



CHANGES IN COGNITIVE FUNCTIONS

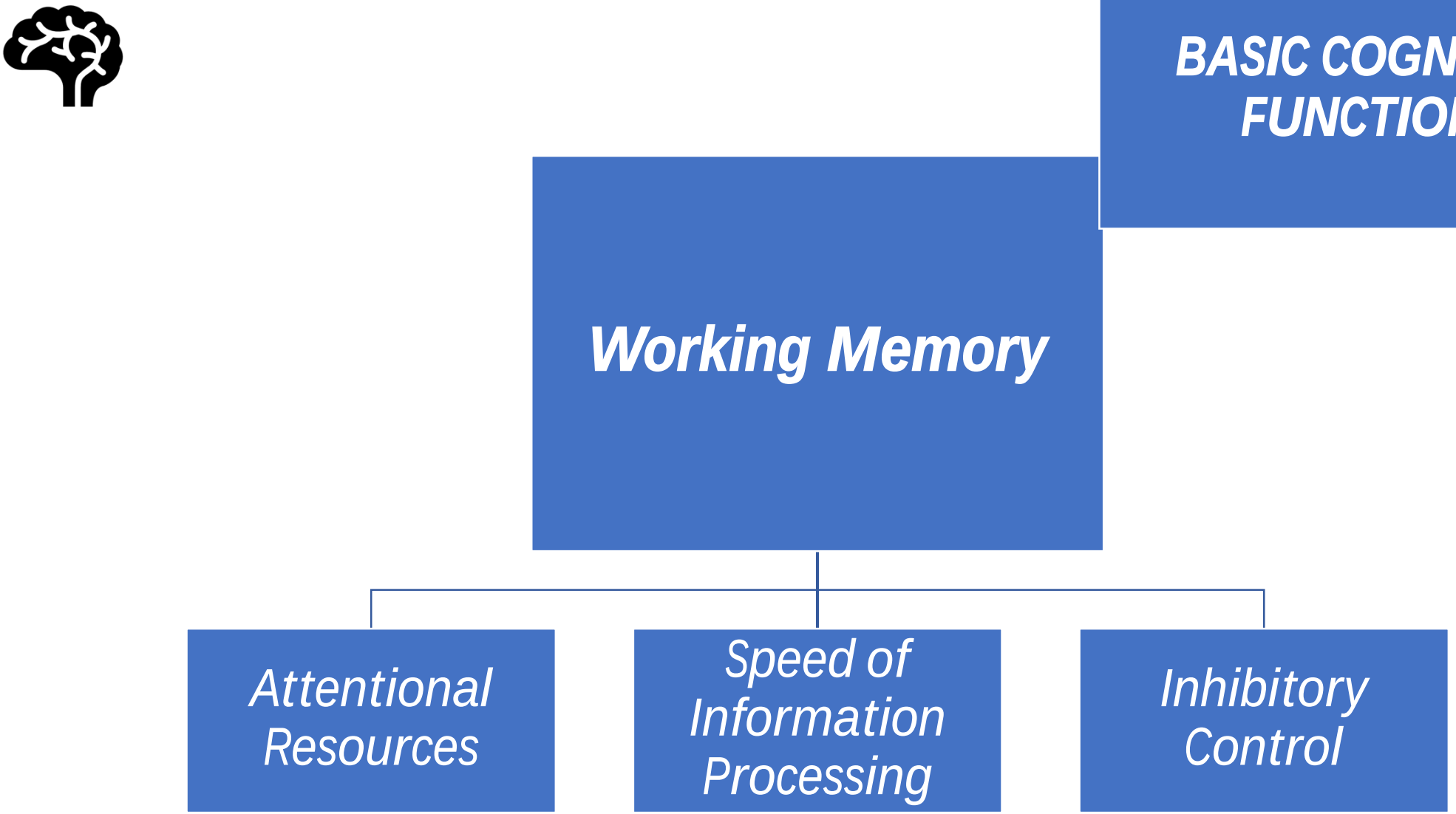


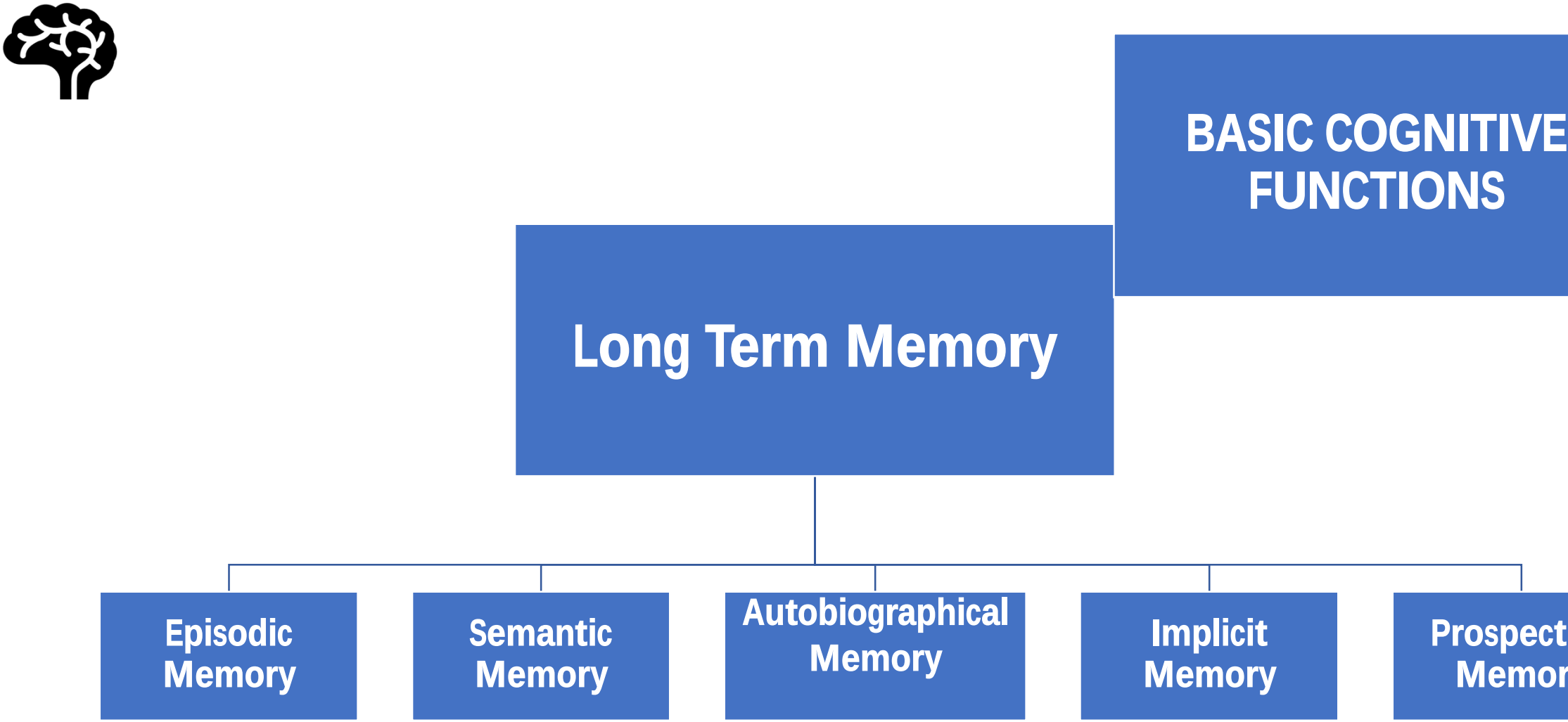
BASIC COGNITIVE FUNCTIONS

Attention

- Selective Attention
- Divided Attention and Attention Switching
- Sustained Attention

BASIC COGNITIVE FUNCTIONS





abeth L. Glisky. Brain Aging: Models, Methods, and Mechanisms. Changes in Cognitive Function in Human Aging

nitive Super Agers: The brains of cognitive super s(80 + years) seem to defy wear and tear better than the age brain.

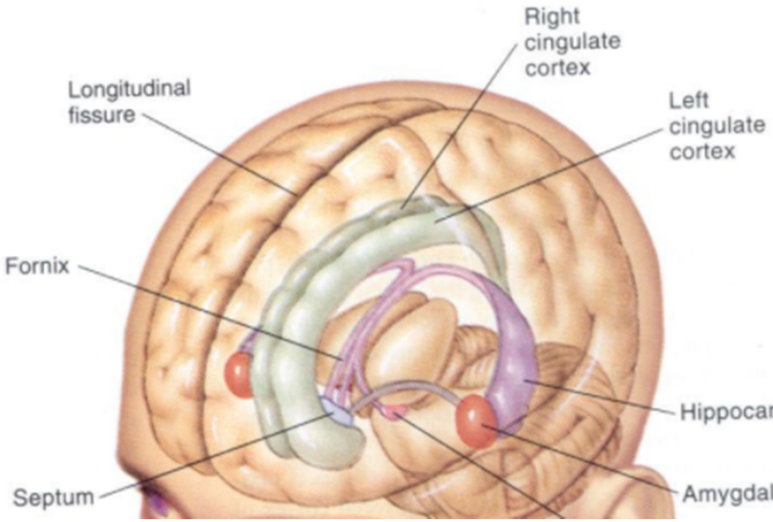
netic resonance imaging (MRI) scans
ognitive super agers
cognitively normal peers
cognitively normal people in the 50- to 65-year age e.

ulate cortex, was thicker in super agers than in their e-age peers
ain region considered important for the integration of mation related to memory, attention, cognitive control ivation

trophy compared with the same brain region of the dle agers.

cific region of the anterior cingulate cortex was ficantly thicker compared to the middle agers' brains.

ers at Northwestern University's Mesulam Center for Cognitive Neurology and r's Disease in Chicago

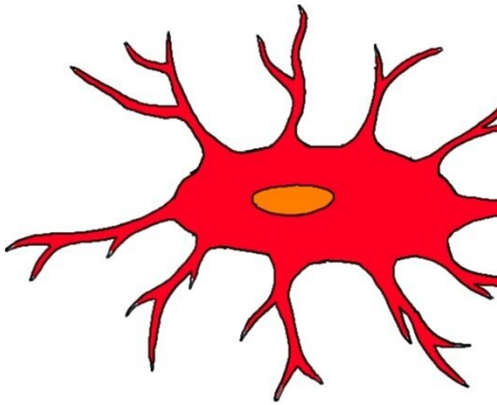


Researchers found that super agers' brains contained a much higher density of von Econo neurons, which are linked to social intelligenc and awareness. Their brains had more of these neurons even than the brains of younger adult

Social factors also could play a role in healthy cognitive aging. Study on psychological well-being among 31 cognitive super agers and 19 cognitively normal peers. The super agers repor more friends and family connections, a finding th builds on past research showing links between psychological well-being and lower risk of Alzhei

AGEING BRAIN AND INFLAMMATION

mmation is a protective response to cell and tissue damage to destroy and remove harmful
s and injured tissues, promoting tissue repair.



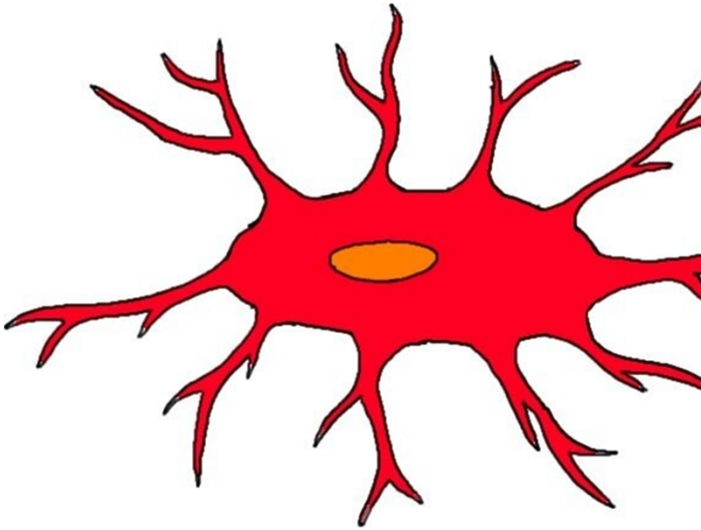
n inflammation is uncontrolled, it can cause excessive damage to cells and tissues,
ately leading to destruction of normal tissue and chronic inflammation.

oglial macrophages in the brain become chronically activated during ageing, and particularly
r pathological conditions, to promote sustained production of pro-inflammatory cytokines,
ding interleukin-1β, interleukin-6 (IL-6) and tumour necrosis factor-α (TNF-α)

AGEING BRAIN AND INFLAMMATION

creased oxidative stress by excessive release of harmful reactive oxygen and
trogen species (ROS and RNS), further promote neuronal damage
d subsequent inflammation resulting in a feed-forward loop of
eurodegeneration

number of the structural and functional changes observed in the ageing brain can be attributed to
creased brain oxidative stress and progressive imbalance occurs between the intracellular concentration
active oxygen species and the brain's antioxidant defense system



flammation has been strongly associated with the pathogenesis of
zheimer's Disease and some types of frontotemporal dementia

ognitive decline. Aging Cell. 2007 Jun;6(3):361-70. doi: 10.1111/j.1474-9726.2007.00294.x.
17517043; PMCID: PMC1974775.röge W, Schipper HM. Oxidative stress and aberrant
g in aging

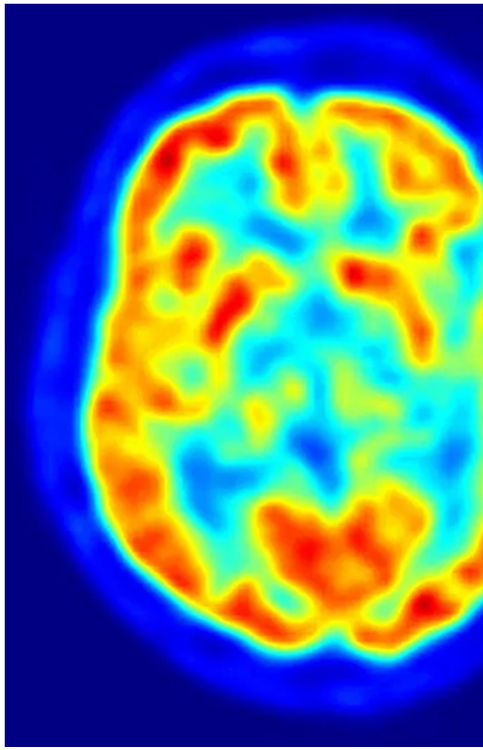
Inflammation and Cognition in the Elderly

uroinflammation , Inflammation in the brain has been recognized and linked to
ny disorders including

- Depression
- Psychosis
- Multiple sclerosis

ealthy older adults, peripheral inflammation has been related to cognitive
cline and to greater structural change .

middle-aged adults, chronic peripheral inflammation correlates with higher
idence of dementia.



rain-derived neurotrophic factor (BDNF) is one of the most
died neurotrophies' in the healthy and diseased brain.

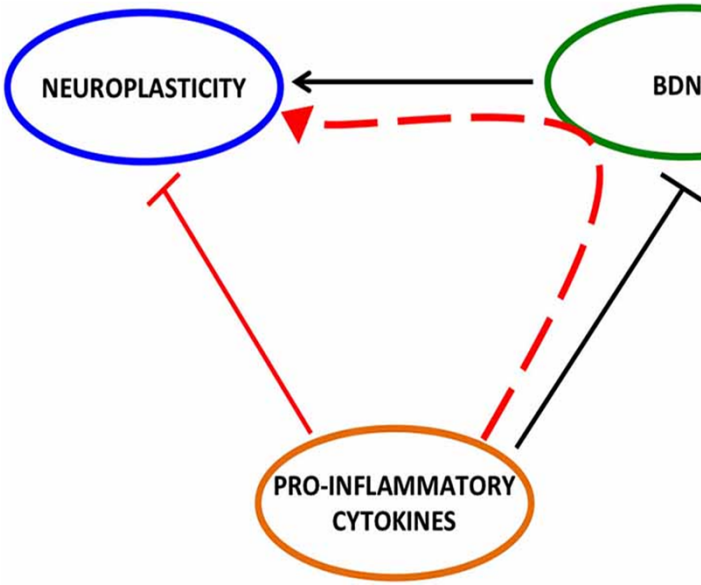
here is a large body of evidence that associates BDNF with neuronal
intenance, neuronal survival, plasticity, and neurotransmitter regulation.

tients with psychiatric and neurodegenerative disorders often have
luced BDNF concentrations in their blood and brain.

w studies have investigated the link between BDNF and
uroinflammation.

e negative impact of inflammation on BDNF has important implications
a number of pathological conditions.

is known that pro-inflammatory cytokines compromise hippocampus-
pendent memory
atial memory
crease apoptosis in the brain, features that are involved in many aging-
ociated pathologies and neurodegenerative diseases.



**Detrimental effect of pro-inflamm
cytokines on neuroplasticity ma
mediated by BDNF.**

Calabrese Francesca etal.Brain-derived neuro
factor: a bridge between inflammation and
neuroplasticity.Frontiers in Cellular
Neuroscience.VOL8,2014,430
DOI=10.3389/fncel.2014.00430

Role of Diets on NeuroInflammation

et is known to modulate the immune system and several nutrients and oactive components can influence neuroinflammatory processes, For example, lyphenols, unsaturated fats and antioxidant vitamins inhibit oxidative stress d neuroinflammation.

he synergistic effects of nutrients and foods when consumed together s a usual dietary pattern are likely to exert greater effects on inflammatory ocesses and neurodegeneration during ageing.

Nutrition in Cognitive Function and Brain Ageing

ition likely influences trajectories of cognitive and neurobiological change in older adults

thy diets appear to ‘tip the balance’ in favour of healthy ageing, and decrease risk of neurodegenerative ologies such as AD and other forms of dementia

ary patterns recognize that foods and nutrients are biologically interactive, acting together rather than in tion

Three dietary patterns that have been associated with cognitive outcomes:

(1) The Mediterranean diet (MeDi)

(2) The Dietary Approaches to Stop Hypertension (DASH) diet

(3) the Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet

a L. Gardener& Stephanie R. Rainey-Smith. The Role of Nutrition in Cognitive Function and Brain Ageing in the Elderly. Current Nutrition Reports- 2018

The Mediterranean Diet(MD)

aditional dietary pattern consumed in editerranean countries and is characterized by

gh intake of fruits, vegetables

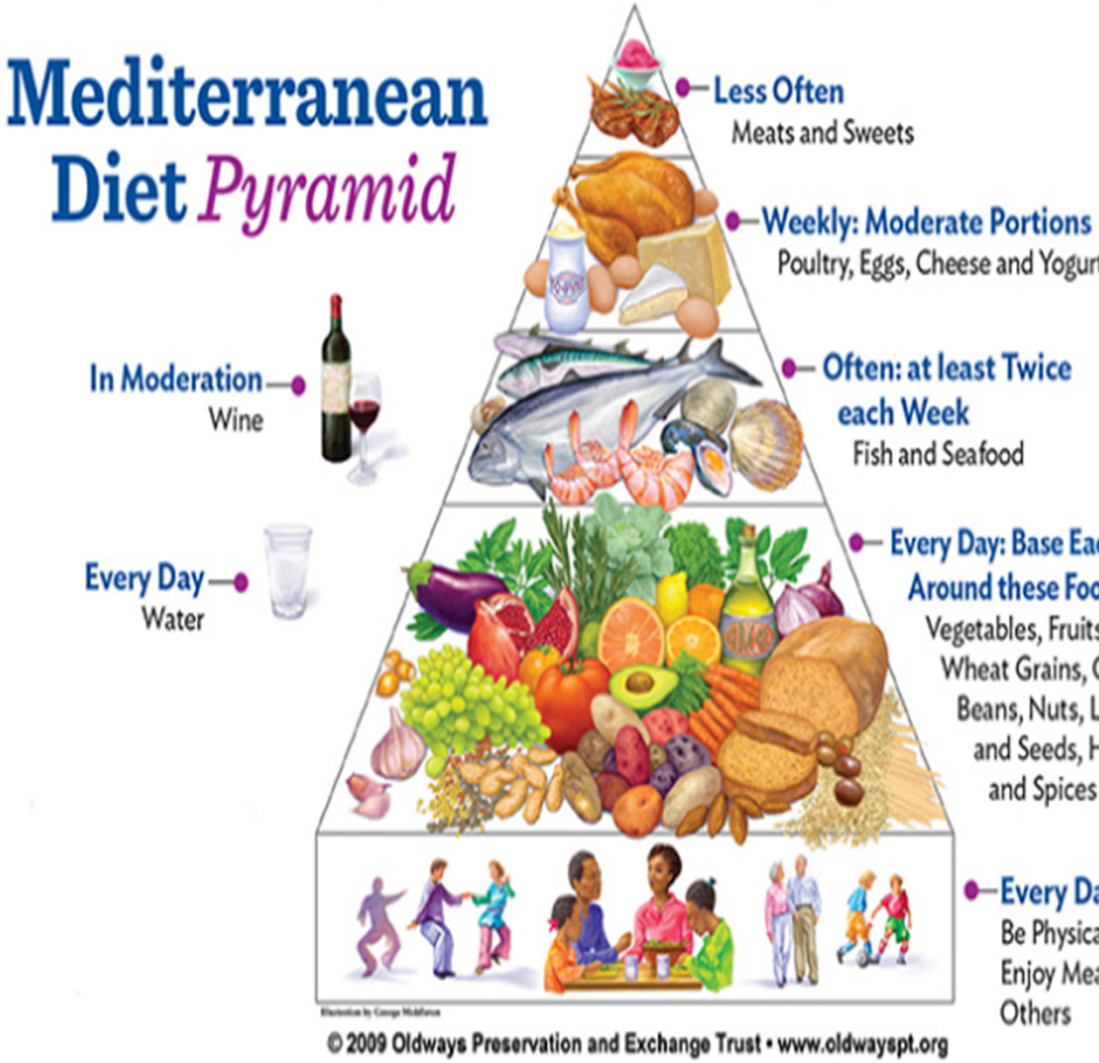
holegrains

ts and legumes

oderate intake of fish, poultry and alcohol rticularly red wine, with meals)

w intake of red and processed meats

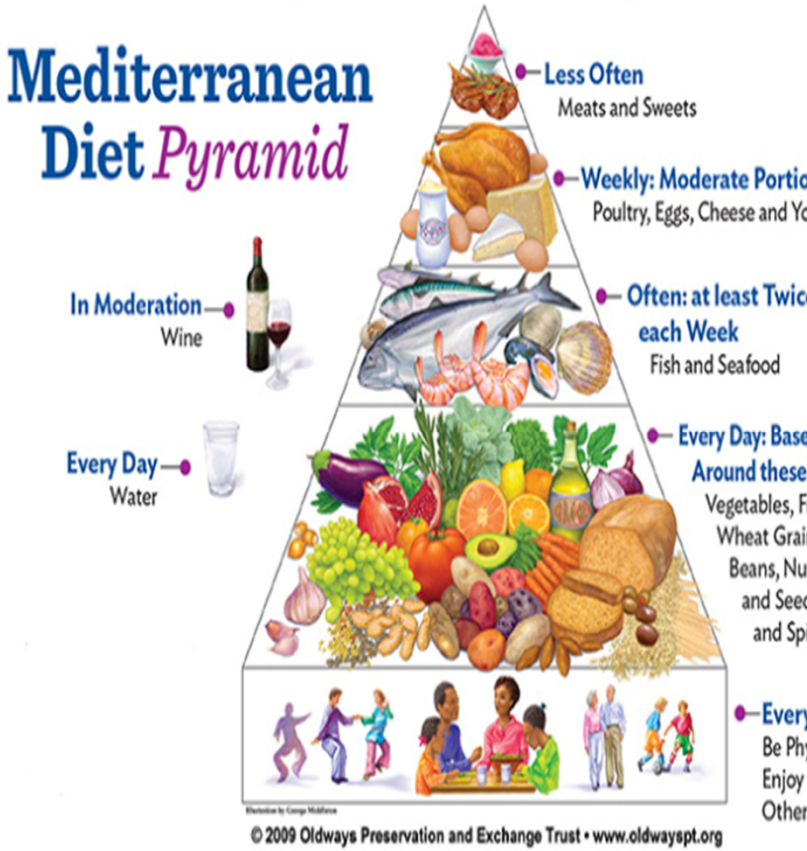
ve oil used as the main fat source.



The Mediterranean Diet(MD)

oss-sectionally:
tter global cognitive function
tter performance on measures of attention processing speed, and
rking memory
duced likelihood of major cognitive Impairment at age 70

ngitudinal studies:
eDi adherence associated with less decline in executive function
wer decline in episodic memory, semantic memory,
orking memory, and global cognition
ne Less likelihood of incident cognitive impairment



ardman, R. J., Kennedy, G., Macpherson, H., Scholey, A. B., & Pipingas, A. (2016). Adherence to a Mediterranean-Style Diet and Effects on Cognition in Adults: A ualitative Evaluation and Systematic Review of Longitudinal and Prospective Trials. Frontiers in nutrition, 3, 22. https://doi.org/10.3389/fnut.2016.00022

Dietary Approaches to Stop Hypertension (DASH)

DASH diet is an accepted non-pharmacological treatment for ertension and, like the MD, recommends a high intake of s, vegetables, nuts and wholegrain products

ontrast to a MD, DASH places greater emphasis on low fat y foods, low dietary sodium and does not recommend alcohol

Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Bray GA, Vogt TM, Windhauser MM, Lin PH, Karanja N. A dietary approach to prevent hypertension: f the Dietary Approaches to Stop Hypertension (DASH) Study. Clin Cardiol. 1999 ppl):III6-10. doi: 10.1002/clc.4960221503. PMID: 10410299.

Smith, Patrick J. et al. 'Metabolic and Neurocognitive Chang Following Lifestyle Modification: Examination of Biomarker the ENLIGHTEN Randomized Clinical Trial'. 1 Jan. 2020 : 179 1803

er adults, higher DASH scores have been associated with

r cognitive function
er cognitive decline

oved **cognitive funct**ion in response to a calorie restricted DASH
mong **overweight adults with hypertension**

ovement in **executive function** among those consuming DASH
ined with **aerobic exercise**

ges in neurocognition after lifestyle modification are associated
mproved metabolic function.

Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Bray GA, Vogt TM, Windhauser MM, Lin PH, Karanja N. A dietary approach to prevent hypertension: f the Dietary Approaches to Stop Hypertension (DASH) Study. Clin Cardiol. 1999 ppl):III6-10. doi: 10.1002/clc.4960221503. PMID: 10410299.

Smith, Patrick J. et al. 'Metabolic and Neurocognitive Chang Following Lifestyle Modification: Examination of Biomarker the ENLIGHTEN Randomized Clinical Trial'. 1 Jan. 2020 : 179 1803

editerranean-DASH Intervention for Neurodegenerative Delay (MIND) diet

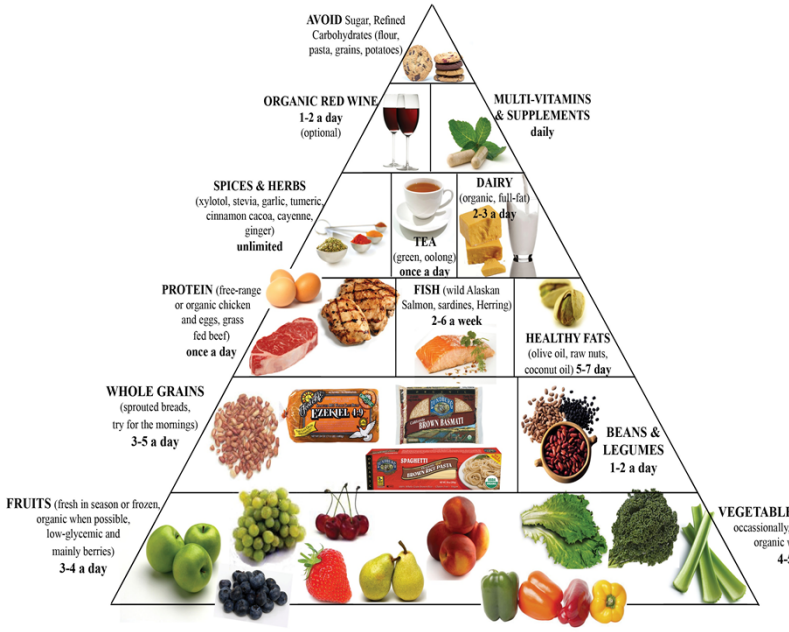
e MIND diet, a fusion of Mediterranean and DASH diets, was developed based on an scientific data to ntify the nutrients, foods and dietary patterns related to brain health and dementia.

e MIND diet is composed brain-healthy components: green leafy getables, other vegetables, nuts, berries, beans, whole grains, fish, ultry, olive oil, and wine

ne MIND diet score was more predictive of cognitive decline han either the MeDi or DASH diet

e MIND and Mediterranean diets had comparable protective ations to AD suggesting that the MIND diet is not specific to the derlying pathology of Alzheimer disease.

ross-sectional association between higher MIND diet score and etter composite test scores of global cognitive function



C., Tangney, C.C., Wang, Y., Sacks, F.M., Bennett, D.A. and Aggarwal, N.T. (2015), MIND diet associated with 11: 1007-1014. https://doi.org/10.1016/j.jalz.2014.11.009

late for the day' represents proportions of different food
os for meeting ~2000 Kcal

Regular consumption of foods in proportions as per the model plate

- improves immunity and resistance to infections
- maintains good microbial flora (beneficial bacteria in the intestine)
- prevents Diabetes Mellitus, Cardiovascular Diseases (CVDs) such as heart attack, stroke and many other diseases
- maintains appropriate alkalinity and thereby reduces inflammation and decreases chances of kidney stone formation
- prevents insulin resistance and maintains appropriate insulin sensitivity and glycaemic index
- ensures adequate intake of fibre and therefore prevents constipation
- prevents adverse effects of environmental pollution and toxins such as heavy metals and pesticides by working as a detoxifying diet

Risk Factors

Overweight/Obesity
Hypertension
High Cholesterol
Dyslipidaemia
Type II Diabetes
Poor mental or Social Stimulation
Sedentary lifestyle
Smoking

Protective Factors

✓Healthy eating

✓Regular exercise

✓Keeping your brain active

✓Social connections

✓Getting enough sleep

Dementia - Impact, prevention, and challenges

arge increase in the burden of dementias and cognitive decline associated with aging.

ne care of dementia patients is extremely time and cost intensive (600bn).
here is a dearth of information on economic costs and social burden of dementia in the Indian
pulation.

mary Prevention: The modifiable factors such as cardiovascular risk factors (type 2 diabetes, hypertension,
sity, and hypercholesterolemia), lifestyle factors (smoking, alcoholism, unhealthy diet, and physical inactivity),
ression, and head injury are to be targeted for intervention

ondary Prevention: It focuses on early detection before the emergence of overt dementia and halts the progression.
ly intervention also enhances the quality of life of the demented patient and is known to cause less severe behavioral
psychological symptoms of dementia

tiary prevention: focuses on timely diagnosis and treatment of cognitive, behavioral, and psychological symptoms
ng with decreasing caregiver burden and improving quality of life.

Moving Forward…

Understanding the nature of the epidemic: Dementia is a syndrome of multiple etiologies, predominantly degenerative in nature. The focus should be primary prevention of risk factors from a young age

Steps for early identification and management: Programs to raise awareness to reduce stigma, and wide screening using a reliable tool should be considered.

Handling the caregiver burden: Considering the increasing dependency ratio, the caregiver burden is going to be huge.

Research focus: Research should focus on understanding the neuropathological changes of disease and its correlation to clinical features. It helps in finding appropriate screening and diagnostic tool along with strategies for drugs to halt or reverse the progression of disease

Health policy focus: Policies should address health determinants' right from birth and enhance cognitive reserve for populations by promoting education and thereby economic well-being. Budget spending on health and education should rise significantly in upcoming years to halt the epidemic of dementia.

Ganguli, R., & Kantipudi, S. J. (2018). The dementia epidemic: Impact, prevention, and challenges for India. Indian journal of psychiatry, 60(2), 165–167. https://doi.org/10.4103/psychiatry.IndianJPsychiatry_261_18

Thank you