

Role of Nutrition in Central Nervous System Disorders

Essay

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Neurology & Psychiatry*

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بسم الله الرحمن الرحيم



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List of Abbreviation

AB	Amyloid Beta.
AD	Alzheimer Disease.
AED	Anti Epileptic Drugs.
ALS	Amyotrophic Lateral Sclerosis.
AMCI	Amnestic Cognitive Impairment.
CA	Carnosic Acid.
CHO	Carbohydrate.
CNS	Central Nervous System.
CoQ10	Coenzyme Q10.
CSF	Cerebro - Spinal Fluid.
CT	Computer Tomography.
CVA	Cerebrovascular Accident.
DBS	Deep Brain Stimulation.
EAE	Experimental Autoimmune Encephalomyelitis.
EDSS	Expanded Disability Status Scale.
EEG	Electro Encephalo Gram.
EGCG	Epigallocatechin Gallate.
EPIDOS	Epidemiologie de l'osteoporose Study.
FAO	Food Agriculture Organization of the United Nation.
FDA	Food and Drug Administration.
FTD	FrontoTemporal Dementia.
GBD	Global Burden of Disease.
Hcy	Homocystine.

IgG	Immunoglobulin G
INR	International Normalization Ratio.
KD	Ketogenic Diet.
LRRK2	Leucine – Rich Repeat Kinase2.
MND	Motor Neuron Disease.
MOG	Myelin Oligo dendrocyte Glycoproteine.
MRI	Magnetic Resonance Image.
MS	Multiple Sclerosis.
NAC	N – Acetyl Cystine.
NHANES3	Third National Health and Nutrition Examination Survey.
PD	Parkinson Disease.
PET	Positron Emission Tomography.
PINK1	PTEN – induced putative kinase1.
PRKN	Parkin.
RD	Registered Dietitian.
RDA	Recommended Daily Allowances.
RNS	Neurostimulation system.
SNCA	Alpha – Synuclein.
SPECT	Single Photon Emission Computer Tomography.
TIA	Temporary Ischemic Attack.
VEP	Visual Evoked Potential.
WKS	Wernicke – Korsakoff Syndrome.

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In low income countries, inadequate amounts of food (causing conditions such as child malnutrition and retarded growth) and inadequate diversity of food (causing deficiency of vital nutrients such as vitamins, minerals or trace elements) continue to be priority health problems. Malnutrition in all its forms increases the risk of disease and early death (*FAO, 2000*).

Nearly 800 million people in the world do not have enough to eat. Malnutrition affects all age groups, but it is especially common among poor people and those with inadequate access to health education, clean water and good sanitation.

Most of the malnutrition-related neurological disorders are preventable (*FAO, 2000*).

Chronic food deficits affect about 792 million people in the world. Malnutrition directly or indirectly affects a variety of organ systems including the central nervous system (CNS), (*FAO, 2000*).

A number of nutritional conditions are included in the Global Burden of Disease (GBD) study, such as protein–

energy malnutrition, vitamin A deficiency, and iron deficiency anaemia (**FAO, 2000**).

Over 15% of the disability adjusted life years (DALYs) lost globally are estimated to be from malnutrition (**FAO, 2000**).

The major dietary nutrients needed by living organisms, especially human beings, can be grouped into macronutrients and micronutrients. The macronutrients are the energy-yielding nutrients-proteins, carbohydrates and fat, and micronutrients are the vitamins and minerals. The macronutrients have a double function, being both “fi rewood” and “building blocks” for the body, whereas the micronutrients are special building items, mostly for enzymes to function well. The term “malnutrition” is used for both macronutrient and micronutrient deficiencies. Macronutrient and micronutrient problems often occur together, so that the results in humans are often confounded and impossible to separate out (**FAO, 2000**).

Table (1) outlines which of the nutrients may contribute to neurological disorders if not provided in sufficient amounts, together with their recommended daily allowances (RDA) for an adult (**WHO, 2006**)

Table1. Neurological disorders caused by nutrient deficiency (WHO, 2001):

Nutrient	RDA	Neurological disorder
Macronutrient total energy	2200 Kcal	In children it make long term mental deficient.
Micronutrient: Vitamins		
Vitamin B1Thiamine	1.1 mg	Beri-beri, polyneuropathy, Wernicke's encephalopathy
Vitamin B3 Niacin	15 mg NE	Pellagra including dementia and depression.
Vitamin B6 Pyridoxine	1.6 mg	Polyneuropathy
Vitamin B9 Folate	180 µg	Neural tube defects (myelomeningocele) of the fetus, cognitive dysfunction in children and elderly.
Vitamin B12 Cobalamine	2.0 µg	Progressive myelopathy with sensory disturbances in the legs.
Micronutrient: Minerals		
Iodine	150 µg	Iodine defi ciency disorders.
Iron	15mg	Delayed mental development in children.
Zinc	12mg	Delayed motor development in children, depression.
Selenium	55mg	Adverse mood states.

The nervous system develops in utero and during infancy and childhood, and in these periods it is vulnerable to macronutrient deficiencies. As a rule, general

The percentage of wasted children in low income countries is 8%. This presents a disturbing picture of malnutrition among children under 5 years of age in underprivileged populations. These children should be an important target group for any kind of nutritional intervention to be undertaken in these countries (*Onis, 1993*).

Stunting is also widespread among children in low income countries. The global average for stunting among children in low income countries is 32%. Increasing evidence shows that stunting is associated with poor developmental achievement in young children and poor school achievement or intelligence levels in older children (Onis, 1993).

Apart from the risk of developing coronary heart disease, diabetes and high blood pressure later in life owing to malnutrition in early life, there is now accumulating evidence of long-term adverse effects on the intellectual capacity of previously malnourished children. It is methodologically difficult, however, to differentiate the

biological effects of general malnutrition and those of the deprived environment on a child's cognitive abilities. It is also methodologically difficult to differentiate the effect of general malnutrition from the effect of Micronutrient deficiencies, such as iodine deficiency during pregnancy and iron deficiency childhood, which also cause mental and physical impairments (*Grantham-McGregor & Ani, 2003*).

Malnourished children lack energy, so they become less curious and playful and communicate less with the people around them, which impairs their physical mental and cognitive development (*Grantham-McGregor & Baker-Henningham, 2005*).

Two recent reviews highlight the evidence of general malnutrition per se causing long-term neurological deficits. An increasing number of studies consistently show that stunting at a young age leads to a long-term deficit in cognitive development and school achievement up to adolescence. Such studies include a wide range of tests including IQ, reading, arithmetic, reasoning, vocabulary, verbal analogies, visual-spatial working memory, simple and complex auditory working memory, sustained attention and information processing (*Grantham-McGregor & Ani, 2003*).

Introduction

Episodes in young childhood of acute malnutrition (wasting) also seem to lead to similar impairments. The studies also indicate that the period in utero and up to two years of age represents a particularly vulnerable time for general malnutrition. In addition to food supplementation, it has been nicely demonstrated that stimulation of the child has long-term beneficial effects on later performance (*Grantham-McGregor & Baker-Henningham, 2005*).

The aim of the work is to discuss the role of nutrition in developing, protecting, and management of central nervous system disorders.