Nutritional disorders
“Food for thought is no substitute for the real thing.”

~ Walt Kelly
WARNING:

Reflections in this mirror may be distorted by socially constructed ideas of 'beauty'.
Perfect body?
OTHER PSYCHIATRIC CONDITIONS AFFECTING FOOD INTAKE

- Mood Disorders
- Schizophrenia
- Substance Use Disorders
- Attention Deficit Hyperactivity Disorder
- Psychotropic Medications → Food Intake
Mood Disorders

Accompanied by;

- disturbance in appetite
- thoughts of death or suicide
- feelings of worthlessness or guilt
- changes in sleep patterns
- difficulty in concentrating
- lack of energy
Mood Disorders

Besides depression

adjustment disorders in response to acute stressors and grief reactions

transient anorexia or loss of appetite

weight loss
FOOD & MOOD – Fat

- Low plasma cholesterol associated with depression\(^1\) and anxiety\(^2\)
  - Part of every cell membrane
  - Building block for hormones
  - Statins???

CONCLUSION:

- Fat supports mental health!

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Serotonin-rich foods

- walnuts
- hickory nuts
- pineapple
- bananas
- kiwis
- plums
- tomatoes
Where are those voices coming from?

I Saw Elephants Under My Bed

Maybe I Am Jesus

The Radio Told Me To Free All The Zoo Animals

Aliens are contacting me

They're Following Me!
Symptoms

Benztropine (Cogentin)
“Controlling The Uncontrollable”
Anticholinergic Antiparkinson Drug

- Reduced extrapyramidal effects
- Used in treatment of Parkinson’s disease

Possible side effects:
- Drowsiness
- Dry mouth
- Urinary retention
- Constipation
- Decreased sweating
- GI upset

Note: The voices in my head are telling me to kill you.
Luckily the days are long gone when we just labelled people as "mad".
Substance use disorder

- Marijuana → food intake
- Cannabis withdrawal → food intake
- Alcoholism → Wernicke-Korsakoff
- Cocaine → food intake
# Attention Deficit Hyperactivity Disorder (ADHD)

- **2% to 18% prevalence**

- **Cause - genes and environment (diet)**

- **1922– high-sugar diets worsen ADHD**

- **1970s – food additives deteriorate ADHD**

- **Azo dyes – urticaria-histamine release - ADHD**

- **Tartrazine - urinary zinc excretion - zinc deficiency**
Attention Deficit hyperactivity disorder (ADHD)

- Imaging studies - reduced blood flow to the frontal lobes in children with ADHD
- Omega-3 deficiencies in children with ADHD

Optimal blood flow to the brain depends on

- Omega-3 fatty acids
- Thiamin
- Pyridoxine and
- Folic acid
Several antidepressants, mood stabilizers, and antipsychotics are associated with weight gain.

Stimulant drugs used in the treatment of ADHD tend to reduce appetite and may result in weight loss.
An Eating Disorder Requires Treatment From:

- A Doctor
- A Therapist
- A Nutritionist
“Fuel Your Brain, Feel Your Best”
Nervous System

• Central Nervous System
  – Brain
  – Spinal Cord

• Peripheral Nervous System
Basic Divisions of the Nervous System

CNS
- Brain
  - Forebrain
  - Midbrain
  - Hindbrain
- Spinal Cord

PNS
- Somatic Division
  - Cranial Nerves
  - Spinal Nerves
- Autonomic Division
  - Sympathetic
  - Parasympathetic
Factors Important to Understanding Nervous System Pathology

1. The nervous system consists of highly specialized functional units called neurons. Damage to neurons is irreversible because neurons cannot regenerate. Injury to certain areas of the brain result in loss of function to that particular area. A loss of vision center in the occipital lobe causes blindness. Lesions of the respiratory centers in the medulla oblongata causes death.

2. The central nervous system (CNS) is protected from mechanical injury by the bones of the skull and vertebrae. If the vertebrae were detached from one another or dislocated, the spinal cord may be severed.
Factors Important to Understanding Nervous System Pathology

3. The CNS is separated from the remainder of the body by meninges and by a bloodbrain barrier. The brain is protected from harmful substances in that the blood or cerebral spinal fluid (CSF) acts as filters.

Examples:
- Bilirubin does not enter the CNS compartment, even in the most severe forms of jaundice.
- Glucose concentration in the CSF is at a level that is one-half that of the blood concentration.
Factors Important to Understanding Nervous System Pathology

4. The brain and the spinal cord are surrounded by CSF.
   - CSF separates the brain from the meninges and serves as a mechanical buffer (cushion) between the brain and bones of the skull.
   - CSF serves as a venue to remove metabolites and waste products from the brain.
   - CSF remains constant under normal circumstances in regards to rate of production, flow and reabsorption.
Overview of Major Diseases

The nervous system is affected by many diseases such as:

- Developmental and genetic diseases
- Diseases caused by trauma
- Circulatory disorders
- Infectious diseases
- Autoimmune disorders
- Metabolic and nutritional diseases
- Neurodegenerative diseases of unknown etiology
- Brain tumors
Overview of Major Diseases

The nervous system is affected by many diseases such as:

- Developmental and genetic diseases
- Diseases caused by trauma
- Circulatory disorders
- Infectious diseases
- Autoimmune disorders
- Metabolic and nutritional diseases
- Neurodegenerative diseases of unknown etiology
- Brain tumors
• Brain function is unavoidably dependent on a constant dietary supply of appropriate nutrients
According to FAO, nearly 30% (~777 million people) of the world population are malnourished.

Of them, 150 million children worldwide are underweight, and 182 million are physically and cognitively stunted.

Moreover, protein-energy malnutrition contributes to 5 million child deaths per year.
The effects of malnutrition on the nervous system

- isolated involvement of the peripheral nervous system that produces blindness, deafness, paralysis, or
- sensory deficits to complex lesions of the spinal cord and CNS that lead to mental retardation, cognitive dysfunction, and gait limitations
POPULATIONS AT RISK

the poor

the homeless

people addicted to alcohol and substance abusers

some patients with chronic psychiatric conditions

demented elderly persons
Under nutrition

obesity

“the double burden of malnutrition”
NUTRITION AND COGNITIVE FUNCTION

glucose, amino acids, fatty acids, vitamins, and minerals — required for normal brain function
Food is also needed to:

- maintain the integrity of cellular membranes in the brain and
- the production of neurotransmitters
Although the brain represents only 2% of the body mass,

- Children consume twice more glucose than adults do, and the newborn brain requires 60% of the energy provided by the diet and 20% of the oxygen inhaled.
dietary supply of amino acids is needed to synthesize proteins and neurotransmitters in the nervous system
Tryptophan, a precursor of serotonin (5-hydroxytryptamine)—the neurotransmitter involved in appetite and satiety, sleep, blood pressure, pain sensitivity, and mood—cannot cross the blood–brain barrier.
Metabolically active brain sites such as hippocampus, basal ganglia, and hypothalamus are particularly sensitive to the effects of malnutrition, loss of energy, and amino acid supply.
Neurons and glia are formed and begin migration by 22 weeks of gestation; and by late pregnancy, marked axonal and neural proliferation result in substantial brain growth.
Early malnutrition also affects processes involved in brain maturation such as neurogenesis, neuronal and glial migration, number of synapses, and degree of myelination.
Lower IQ and more severe learning difficulties result in
worse school performance
higher school desertion
lower enrollment in higher education institutions
Maternal milk contains lipids that promote brain maturation

The brain is 60% structural lipid and depends on dietary lipids

Lack of both linoleic acid and ω-linolenic acid (ALA) is incompatible with life

Arachidonic acid and docosahexaenoic acid (DHA) are large contributors to non-myelin membranes and must be provided by the diet
Micronutrient deficiencies

- vitamins, fat-soluble as well as water-soluble, and trace elements (minerals)
- Essentially used as cofactors for enzymes engaged in various biochemical reactions
- Iron, vitamin A, zinc and iodine, vitamin C and the vitamin B complex
Micronutrient deficiencies

From the public health viewpoint, iodine is the most important micronutrient for the prevention of brain disorders causing lower intellectual functioning, psychomotor delay, and mental retardation.
Micronutrient deficiencies

Nutritional disorders of nervous system

Iron, Copper, Zinc and selenium

as well as vitamin B12, folate and vitamin A

Iodine
Iodine Deficiency Disorders

endemic cretinism

goiter

short stature

deafness
Iodine Deficiency Disorders

- Moderate dietary iodine deficiency,
- A steady decrease of T4 occurs during gestation,
- TSH increases, resulting in a 20% to 30% enlargement of the thyroid volume,
- Goiter
In areas with moderate iodine deficiency (iodine ingestion 20 to 49 g/day), people have definite abnormalities of Psychomotor and intellectual development including

- lower IQ,
- slower visual-motor performance,
- loss of fine-motor skill,
- Deficits in perceptual and neuromotor abilities,
- apathy,
- and low developmental quotients
Endemic Cretinism and Other Forms of Iodine Deficiency Disorders

Endemic cretinism is different from congenital hypothyroidism, which occurs in 1 in 3500 newborns.

Congenital hypothyroidism results from deficient thyroid function in the fetus and the newborn, resulting from endocrine factors unrelated to dietary iodine deficiency.
Endemic Cretinism and Other Forms of Iodine Deficiency Disorders

Both forms of endemic cretinism (neurologic and myxedematous) represent the most severe degree of brain damage from in utero maternal and fetal hypothyroidism.

Thiocyanate toxicity from cassava consumption plays a role in myxedematous endemic cretinism.
Thiocyanate Toxicity

- cassava, Spanish yam, sweet potato, corn, millet, bamboo shoots, and beans
- Tobacco smoke

Foods containing large amounts of cyanogenic glycosides include
Cassava is goitrogenic. It inhibits thyroid peroxidase and prevents the incorporation of iodine into thyroglobulin. Thiocyanate may also form thiourea. These mechanisms explain the damaging neurologic effects of cyanide, diets poor in sulfur-containing amino acids, and low dietary iodine intake.
Selenium

- glutathione peroxidase
- superoxide dismutase,
- normal thyroid
- deiodinase,
Pathogenesis of Brain Lesions Induced by Iodine Deficiency

Thyroid hormones affect neuronal differentiation, migration, neural networking, and synaptogenesis.

Through binding of T3 to nuclear receptors regulating gene expression in different brain regions.
Treatment and Prevention

iodized oil

iodized salt
Cognitive Effects of Iron Deficiency

Both iron deficiency anemia and excessive iron accumulation in the brain are associated with neurologic disturbances.
Cognitive Effects of Iron Deficiency

anemic children usually have poor cognition and lower school achievement than non-anemic children.

With aging, there is accumulation of iron-containing molecules in the brain, particularly in Alzheimer and Parkinson diseases, perhaps caused by enhanced generation of reactive oxygen species (ROS) and higher neuronal vulnerability.
Cognitive Effects of Zinc Deficiency

Zinc treatment of deficient children improves growth, immunity, and motor development in infants and toddlers.

Zinc deprivation during periods of rapid growth impairs brain and sexual development.
Copper is an essential cofactor for numerous enzymes, including:

- Copper-zinc superoxide dismutase,
- Ceruloplasmin ferroxidase,
- Cytochrome oxidase.
Neurologic Effects of Copper

Menkes disease
- MNK
  - ATP7A
  - Low Cu

Wilson disease
- WND
  - ATP7B
  - High Cu
Alcohol play a secondary neurotoxic role, but it also displaces food in the diet, increases the metabolic demands for B-group vitamins, and decreases absorption of thiamin, folic acid, and liposoluble vitamins because of impaired pancreatic function.
Cuban Epidemic Neuropathy

caused by nutritional deficiencies produced by

• poor diets resulting from political and economic problems
• Deficit of B vitamins (B12) + lack of essential sulfur containing amino acids and carotenoids such as lycopene in the diet
• Cigar smoking and alcohol
<table>
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<tr>
<th>CLINICAL MANIFESTATIONS</th>
<th>POSSIBLE CAUSE</th>
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<tr>
<td>Optic neuropathy</td>
<td>Folate-vitamin B₁₂ deficiency and methanol</td>
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<tr>
<td></td>
<td>Cyanide</td>
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<tr>
<td>Cecocentral scotoma</td>
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<td>Dyschromatopsia</td>
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<tr>
<td>Dorsolateral myelopathy</td>
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<td>Proprioceptive loss</td>
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<td>Sensorineural deafness</td>
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<td>High-frequency (4–8 kHz) loss</td>
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<td>Areflexia</td>
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<tr>
<td>Burning feet</td>
<td>Deficiencies of niacin, pantothenic acid, thiamin, and pyridoxine</td>
</tr>
<tr>
<td>Myeloneuropathy</td>
<td>Multivitamin deficiency including vitamin E</td>
</tr>
</tbody>
</table>
NEUROLOGIC DISORDERS ASSOCIATED WITH SPECIFIC VITAMINS

- Vitamin A
- Vitamin B1
- Vitamin B2
- Vitamin B3
- Vitamin B6
- Vitamin B12
- Folic Acid
Vitamin A Deficiency

- night blindness
- conjunctival xerosis
- Bitot spots
- corneal xerosis that may lead to corneal ulceration and keratomalacia
Vitamin A Intoxication

cleft palate, harelip, macroglossia, eye abnormalities, hydrocephalus.
Vitamin B1 (Thiamin)

The main manifestations of thiamin deficiency are a sensorimotor axonal peripheral neuropathy (dry beriberi) and a cardiac form (Shoshin beriberi) also called wet beriberi because of edema secondary to congestive heart failure.
Vitamin B2 (Riboflavin)

- angular cheilosis
- glossitis (beefy-red tongue)
- scaling dermatitis
- normochromic normocytic anemia
- superficial interstitial keratitis
Niacin Deficiency

Pellagra occurs among patients with:

- Alcoholism
- Malabsorption syndromes
- Chronic diseases

Malnourished populations that consume corn (maize) as staple food.
Vitamin B6

• pyridoxol
• Pyridoxal
• pyridoxamine
Vitamin B6 Deficiency

Dietary deficiency is unlikely

Increased requirements occur in:
- Pregnancy and lactation
- Estrogen use
- Hyperthyroidism
- High-protein diets
- Elderly persons
Vitamin B6 Deficiency

Vitamin B6 deficiency → impaired tryptophan metabolism → niacin deficiency
Vitamin B6 Deficiency

- Infantile seizures
  - Faulty preparation of formula
- Neonatal seizures
  - Mothers deficient in vitamin B
The clinical manifestations of pyridoxine deficiency resulting from use of the antagonist desoxypyridoxine include:

- seborrheic dermatitis
- angular cheilosis
- glossitis
- peripheral neuropathy
- convulsions.
Vitamin B6 Deficiency

- seborrheic dermatitis
- angular cheilosis
- glossitis
- peripheral neuropathy
- convulsions
Vitamin B6 Intoxication

Pyridoxine >200 mg/day have been associated with

- sensory neuropathy and
- severe ataxia,
- but without weakness
Vitamin B6 Intoxication

Histologic examination revealed neuronal degeneration.

- dorsal root ganglia
- Gasserian ganglia
- sensory nerve fibers in peripheral nerves
- the dorsal columns of the spinal cord
- descending spinal tract of the trigeminal nerve
Vitamin B12 (Cobalamin)

Cobalamin absorption involves at least five separate

- cobalamin-binding molecules,
- receptors, and
- transporters
Vitamin B12 (Cobalamin)

- **Mouth**: haptocorrin in saliva
- **Stomach**: intrinsic factor (IF) - parietal cells
- **Distal ileum**: high-affinity IF receptors on ileal epithelial cells
- **Distal small intestine**: absorbed and released for subsequent binding to transcobalamin-II (TcII)
- **Cell**: TcII-cobalamin complex released into the circulation
- **Plasma**: 90% of the cobalamin is protein bound to TcI and TcIII, probably as storage forms
Pathogenesis of Cobalamin Deficiency

Cobalamin deficiency impairs conversion of

- L-methylmalonyl CoA to succinyl CoA
- Methylmalonic acid (MMA)
- Impairs methylation reactions,
- No synthesis of methionine,
- Synthesis of S-adenosyl methionine (SAM)
- Synthesis of neurotransmitters
  - Norepinephrine
  - Glutamate,
- Myelin synthesis
intramuscular injections of 1000 g of vitamin B12 daily for 5 days to replenish the stores,

followed by monthly injections of 500 to 1000 g indefinitely

A sublingual form of vitamin B12 is also available.

For preventive treatment, oral preparations of vitamin B12 appear to be adequate
Folic Acid

5-methyltetrahydrofolate (5MH4F) enters the circulation

Acceptors of one-carbon fragments for the synthesis of purines and methionine

Deoxythymidine monophosphate for the synthesis of DNA
Neurologic Manifestations of Folate Deficiency

- Neurologic syndrome in children
- Idiopathic cerebral folate deficiency
- Low CSF levels of 5MH4F
- Normal folate metabolism outside the nervous system
Onset is at about 4 months of age, with:
- restlessness
- irritability
- altered sleep

followed by:
- psychomotor retardation,
- cerebellar ataxia
- spastic paraplegia
- dyskinesias
- visual and hearing loss

one third of the children have seizures
Numerous neurologic conditions, ranging from migraine, stroke, and hepatic encephalopathy to rare metabolic disturbances respond to dietary treatment or to specific vitamins.
Migraine

Avoid

- ice-cold foods
- hypoglycemia
- nitrates,
- monosodium glutamate,
- biogenic amines, in particular tyramine and phenylethylamine
Mediterranean Diet

The generic name of the typical diet of people living in the olive-growing areas of the Mediterranean basin.
Mediterranean Diet

TABLE 95.3  GENERAL CHARACTERISTICS OF THE MEDITERRANEAN DIETS

1. Abundant plant foods (fruits, vegetables, breads, other forms of cereals, beans, nuts, and seeds)
2. Minimally processed, seasonally fresh, and locally grown foods
3. Fresh fruits as the typical daily dessert; sweets based on nuts, olive oil, and concentrated sugars or honey consumed during festive days
4. Olive oil as the principal source of dietary lipids
5. Dairy products (mainly cheese and yogurt) consumed in low to moderate amounts
6. Fewer than four eggs consumed per week
7. Red meat consumed in low frequency and amounts; fish consumption changing according to region
8. Wine consumed in low to moderate amounts, generally with meals

Mediterranean Diet

lowers risk for
• cardiovascular disease,
• myocardial and cardiovascular mortality
• stroke,
• obesity,
• arthritis,
• cancer,
• Alzheimer disease

useful public health approach to prevent
• Stroke
• cognitive dysfunction
**Stroke**

**Decrease the intake of**
- saturated animal fats
- *trans*-fats
- *sodium* (to control hypertension, hyperlipidemia, and body mass index)

**The DASH diet (Dietary Approaches to Stop Hypertension diet)**
- lowering the dietary intake to 150, 100, or 50 mmol/day of sodium, according to the severity of hypertension and to increase consumption of fruits, juices and vegetables

**Mediterranean diet**
- excellent dietary approach to stroke prevention
Orthostatic Hypotension

To increase the circulating volume:

- Increase their sodium intake to 150 to 250 mEq/day of sodium (10 to 20 g of salt).
- Raise their oral fluid intake to 20 oz/day,
- Along with high potassium supplementation when they are taking fludrocortisone.
SUMMARISE
Thank You
A pound of body fat is equal to 3500 calories. If you eat 100 calories more than you expend every day, you will gain more than 10 pounds in a year.
Wellness Tip

Research shows that some protein-rich foods can give you a quick mental boost, which can be helpful before an exam.
Wellness Tip

Certain carbohydrate-rich foods, such as a bagel or a plain baked potato, can have a temporary calming effect on some people during stressful situations.
Wellness Tip

To avoid intestinal discomfort, add fiber to your diet slowly so you can build a tolerance to it.
Fitness Tip

Drink plenty of water before, during, and after workouts, especially when the weather is warm. Proper hydration helps you avoid cramps and heat-related problems such as heat stroke.
Wellness Tip

If you take a supplement, *never* take more than the recommended dosage unless your doctor tells you to.
Wellness Tip

About a dozen major American cities, and the entire state of California, have enacted laws restricting the use of trans fats in commercially prepared foods.
Wellness Tip

To get produce as clean as possible, rub it with a soft brush while holding it under running water.
Fitness Tip

Consumption of red meats, sweets, eggs, and butter is greatly reduced or eliminated entirely in most forms of the Mediterranean diet.
Red Meat and Butter
USE SPARINGLY

Dairy or Calcium Supplement

Fish, Poultry, and Eggs
0–2 SERVINGS

Nuts and Legumes
1–3 SERVINGS

Vegetables
IN ABUNDANCE

Whole-Grain Foods AT MOST MEALS

White Rice, White Bread, Potatoes, Pasta, and Sweets
USE SPARINGLY

Alcohol
IN MODERATION UNLESS CONTRAINDICATED

Multiple Vitamins
FOR MOST

Fruit
2–3 SERVINGS

Plant Oils (olive, canola, soy, corn, sunflower, peanut, and other vegetable oils) AT MOST MEALS

Daily exercise and weight control
Be happy and stay blessed!

"I have chosen to be HAPPY because it is good for my health."
-Voltaire-