Non-Drug Therapies
Balancing the Brain and Body

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Educational Series
Disclosure

All Faculty, CME Planning Committee Members, and the CME Office Reviewer have disclosed that they have no financial relationships with commercial interests that would constitute a conflict of interest concerning this CME activity.
Learning Objectives

1. Recognize non-drug therapies that improve health and wellness for psychiatric and medical conditions

2. Discuss the importance of assessing nutrition, sleep, exercise, stress reduction, drug-drug interactions, deficiency states, supplements, and substance use in patient care

3. Implement strategies for promoting non-drug therapies in clinical practice
The Brain is a Dynamic Ecosystem

- Regular intake of protein (i.e., essential amino acids) and complex carbohydrates are important for mood, sleep, energy and appetite regulation
- Exercise is important to release neurotransmitters
- Sleep is important to make and store neurotransmitters for the next day
- Hormones important for mood regulation (thyroid, estradiol, testosterone, vitamin D, etc.)
What Makes Us Happy?

Regular intake of protein (i.e., essential amino acids) and complex carbohydrates are important for mood, sleep, energy, and appetite regulation.

- Every 3-5 hours interval
- Do not skip meals, particularly breakfast
- Eat slow to allow food to be digested, absorbed, and amino acids/glucose to enter the brain (30 minutes)
  - Serotonin – important for appetite regulation
- Drink water
Nutrition

- **Protein**
  - Complete proteins: all essential amino acids
    - Meat, poultry, fish, eggs, dairy
    - Soy ≠ diary
  - “Incomplete” proteins
    - Grains + legumes
    - Grains + nuts/seeds
    - Legumes + nuts/seeds

- **Essential fatty acids**: 80% of mammalian brain is lipid (long-chain polyunsaturated fatty acids)

- **Cholesterol**: Essential component of cell membrane development and the production of bile acids, adrenal steroids, vitamin D, and sex hormones

- **Complex carbohydrates** (low glycemic index)
  - Fruits, vegetables, nuts, legumes, grains

- **Vitamin and mineral supplements**

- **Water**
Protein-Rich Foods

- Animal Proteins (muscle meat or by-products from an animal) = complete protein
  - Beef
  - Venison, buffalo, other game
  - Pork
  - Poultry
  - Fish
  - Cottage cheese
  - Cheese
  - Milk
  - Yogurt
  - Egg
Incomplete Proteins

- Does not contain all of the essential amino acids
  - Vegetable proteins: grains, legumes, nuts, seeds, and other vegetables
- Must combine “incomplete” proteins to create “complete” proteins
  - Grains + legumes
  - Grains + nuts/seeds
  - Legumes + nuts/seeds
- By adding a small amount of animal protein (meat, eggs, milk, or cheese) to the above groups, you can create a complete protein
Omega 3,6 Fatty Acids

- Omega-3 fatty acids (cold water fish)
  - EPA/DHA
  - Walnuts & flaxseeds contain alpha-linolenic acid (ALA) that is converted to EPA/DHA
  - Fish oil supplements and omega 3 fortified eggs
  - Fewer inflammatory effects than omega-6

- Omega-6 fatty acids (meat/nuts/seeds/oils)
  - Corn, sunflower, safflower, soy, and cottonseed oil
  - More inflammatory effects
    - An important component of the immune response, blood clotting, cell proliferation
Vitamin/Mineral Deficiency States

- Vitamin A (retinol)
- Vitamin B complex
  - B-1 (thiamine)
  - B-2 (riboflavin)
  - B-3 (niacin or nicotinic acid)
  - B-5 (pantothenic acid)
  - B-6 (pyridoxine)
  - B-7 or H (biotin)
  - B-9 (folate)
  - B-12 (cobalamin)
- Vitamin C (ascorbic acid)
- Vitamin D
- Vitamin E (tocopherol)
- Vitamin K
- Boron
- Calcium
- Chloride
- Chromium
- Copper
- Iodine
- Iron
- Magnesium
- Manganese
- Molybdenum
- Nickel
- Phosphorus
- Potassium
- Selenium
- Silicon
- Vanadium
- Zinc
Vitamin/Mineral Deficiency States

- **Vitamin B$_{12}$ (cobalamin)**
  - Macrocytic anemia (↑ MCHC)
  - Causes: lack of animal products, strict vegetarianism, impaired absorption, gastrectomy

- **Vitamin B$_{9}$ (folate)**
  - Macrocytic anemia (↑ MCHC)
  - Causes: lack of vegetables in diet, alcoholism, impaired absorption, increased requirements (pregnancy, infancy, hypothyroidism)

- **Iron**
  - Microcytic anemia (□ MCHC)
  - Most prevalent worldwide cause of anemia
  - Causes: dietary inadequacy, malabsorption, increased iron loss (bleeding)
Vitamin B12 Deficiency

- Common Symptoms
  - Feel weak, tired, and lightheaded
  - Have pale skin
  - Have a sore, red tongue or bleeding gums
  - Feel sick to your stomach and lose weight
  - Have diarrhea or constipation

- If the level of vitamin B12 stays low for a long time, it can damage nerve cells:
  - Numbness or tingling in your fingers and toes
  - A poor sense of balance
  - Depression
  - Dementia, a loss of mental abilities
Folate Deficiency

- **Folic acid → folate (active)**
- **Common Symptoms**
  - Diarrhea, loss of appetite, weight loss
  - Headaches, heart palpitations
  - Irritability
  - Abnormal paleness or lack of color in the skin
  - Lack of energy or tiring easily (fatigue)
  - Smooth and tender tongue
  - High homocysteine levels = multiple health problems
- **Pregnant women with folate deficiency**
  - Low birth weight, premature infants, neural tube defects; infants and children with folate deficiency: slow growth rate, language delay, autism spectrum disorder
Iron Deficiency

• Common Symptoms
  ◦ Pale skin color, brittle nails, sore tongue
  ◦ Fatigue, weakness, shortness of breath
  ◦ Decreased appetite (especially in children)
  ◦ Headache – frontal
  ◦ Unusual food cravings (called pica)
  ◦ Restless legs syndrome (uncomfortable feeling in legs, sensations of pulling, tingling, crawling, accompanied by a need to move the legs)
Neurotransmitter Synthesis

• Requirement of active folate, vitamin B12, vitamin D for the synthesis of major neurotransmitters in the body and brain
  ◦ Serotonin
    • Involved in appetite, mood, sleep, migraines, bleeding
  ◦ Norepinephrine
    • Involved in alert system, blood pressure, energy, motor action
  ◦ Dopamine
    • Involved in pleasure, movement, focusing
Essential Amino Acids

- Histidine
- Isoleucine
- Leucine
- Lysine
- Methionine
- Phenylalanine
- Tyrosine
- Dopamine
- Norepinephrine
- Epinephrine
- Threonine
- Tryptophan
- Serotonin
- Melatonin
- Valine
Amino Acid Deficiency States

- **History**
  - Weight control by severe diet restrictions
  - Uninformed vegetarianism or vegan
  - Antacid use
  - Any digestive impairment
  - Alcohol or substance abuse disorders (poor nutrition)

- **Symptoms**
  - Failure to thrive
  - Rapid weight loss
  - Obsessive-compulsive spectrum disorders
    - Anorexia, binge eating, autism
  - Behavioral disorders: aggression, anxiety, depression, insomnia
  - Chronic fatigue
  - Earlier onset of menopause
Synthesis of Serotonin

- L-tryptophan (essential amino acid) □ serotonin □ melatonin (darkness)
  - L-tryptophan must cross the blood brain barrier and requires an energy pump

- Primary sources are from animal proteins and by-products (complete proteins)
  - Meat, poultry, fish
  - Eggs, dairy products
  - Soy (whole bean) – incomplete protein
  - Incomplete proteins: grains, nuts, legumes, seeds
Synthesis of Serotonin

Tryptophan → 5-hydroxytryptophan (5-HTP) → Serotonin (5HT)

- Tryptophan hydroxylase
- Aromatic amino acid decarboxylase
Serotonin Deficiency States

- Anxiety, panic attacks, obsessive-compulsive behaviors
- Irritability, agitation, impulsivity, aggression
- Insomnia and sleep disruption
  - Serotonin □ melatonin (under darkness)
- Depression
- Increased appetite
  - Aggression to kill animals for food
  - Over-eating and binge-eating behavior
  - Obesity
Serotonin Deficiency States

- Anxiety disorders: OCD
- Mood disorders: depression, mood swings
- Impulsivity: aggression, suicide
- Insomnia
- Eating disorders
- Premenstrual dysphoric disorder (PMDD)
- Decreased pain threshold
- Migraines
## Serotonin-Deficiency Disorders

- **Depressive Disorders**
  - Depression with anxiety (mixed)
  - Bipolar disorder
  - Menstrual cycle depression (PMDD) and perimenopausal depression

- **Anxiety Disorders**
  - Generalized anxiety disorder (GAD)
  - Panic disorder
  - Phobias
  - Post-traumatic stress disorder
  - Obsession-compulsive disorder
  - Social phobia

- **Impulse-Control Disorders**
  - Attention deficit/hyperactivity disorder
  - Alcoholism/drug dependency
  - Aggression and violence
  - Hypersexual activity
  - Accidents
  - Suicidal behavior

- **Eating Disorders**
  - Anorexia
  - Binge eating
  - Bulimia
  - Obesity

- **Sleep Disorders**
  - Insomnia
    - ↓ serotonin → ↓ melatonin

- **OCD Spectrum Disorders**
  - Autism and Asperger’s disorder
  - Body dysmorphic disorder
  - Paraphilia
  - Trichotillomania

- **Migraine**
  - Lack of serotonin at 1B/1D receptor = vasodilation

- **Bleeding**
  - Lack of serotonin in platelets = no vasoconstriction
Drugs that Increase Serotonin Activity

- **Serootonin Reuptake Inhibitors** – block the reuptake of serotonin into the presynaptic neuron and less is taken up and restored for future release
  - Deficiency of serotonin may occur if the person does not eat foods that contain L-tryptophan
  - Less serotonin reuptake into the platelet will cause increased risk of bleeding

- **Monoamine Oxidase Inhibitors** – block the metabolism of neurotransmitters
Serotonin Reuptake Inhibitor (SRI)

- Clomipramine (Anafranil®) + NRI = SNRI
- Citalopram (Celexa®)
- Desvenlafaxine (Pristiq®) + NRI = SNRI
- Duloxetine (Cymbalta®) + NRI = SNRI
- Escitalopram (Lexapro®)
- Fluoxetine (Prozac®, Sarafem®)
- Fluvoxamine (Luvox®)
- Levomilnacipran (Fetima®) + NRI = SNRI
- Milnacipran (Savella®) + NRI = SNRI
- Paroxetine (Paxil®)
- Sertraline (Zoloft®)
- Venlafaxine (Effexor®) + NRI = SNRI
<table>
<thead>
<tr>
<th>↓ activity (receptor antagonist)</th>
<th>↑ activity (e.g., reuptake inhibitor, MAOI)</th>
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<tbody>
<tr>
<td>Buspirone (if high 5-HT)</td>
<td>Buspirone (if low 5-HT)</td>
</tr>
<tr>
<td>Cyproheptadine (2A, 2C)</td>
<td>Clomipramine (+NE)</td>
</tr>
<tr>
<td>Mirtazapine (2A,2C,3)</td>
<td>Citalopram</td>
</tr>
<tr>
<td>Nefazodone (2A)</td>
<td>Duloxetine (+NE)</td>
</tr>
<tr>
<td>Trazodone (2A)</td>
<td>Escitalopram</td>
</tr>
<tr>
<td>Aripiprazole (2A)</td>
<td>Fluoxetine (+NE)</td>
</tr>
<tr>
<td>Asenapine (2A)</td>
<td>Fluvoxamine (+ NE)</td>
</tr>
<tr>
<td>Clozapine (2A)</td>
<td>Milnacipran (+NE)</td>
</tr>
<tr>
<td>Iloperidone (2A)</td>
<td>Paroxetine (+NE, anticholinergic)</td>
</tr>
<tr>
<td>Lurasidone (2A)</td>
<td>Sertraline (+DA)</td>
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<tr>
<td>Olanzapine (2A, 2C)</td>
<td>Venlafaxine (+ NE &amp;DA)</td>
</tr>
<tr>
<td>Paliperidone (2A)</td>
<td>Vilazodone (+5-HT1A)</td>
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<tr>
<td>Quetiapine (2A)</td>
<td>MAOIs (+ NE &amp; DA)</td>
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<tr>
<td>Risperidone (2A)</td>
<td>L-Tryptophan</td>
</tr>
<tr>
<td>Ziprasidone (2A)</td>
<td></td>
</tr>
</tbody>
</table>
Synthesis of DA and NE

- Phenylalanine (essential amino acid)
  - Tyrosine
  - Dopamine (DA)
  - Norepinephrine (NE)
    - Phenylalanine is in aspartame (Equal)

- Food sources
  - Complete proteins
    - Meats, Poultry, Fish, Eggs, Dairy
  - Incomplete proteins
    - Nuts, Grains, Beans, Legumes, Soy
Synthesis of DA/NE/E

Phenylalanine → Tyrosine

Tyrosine hydroxylase

DOPA

Dopamine (DA)

Norepinephrine (NE)

Epinephrine (E)
Drugs that Increase NE and/or DA Activity

- Caffeine
- Nicotine
- Cocaine
- Amphetamines/dextroamphetamine
- Methamphetamine
- Methylphenidate (Ritalin)
- Atomoxetine (Strattera)
- Bupropion (Wellbutrin, Zyban)
- Desipramine (Norpramin)
- Modafinil (Provigil)
- Armodafinil (Nuvigil)
- Parkinson’s Disease medications: dopamine precursors and agonists, MAO inhibitors, COMT inhibitors
Norepinephrine

• \downarrow \text{activity}
  • Beta-Blockers
    • Atenolol
    • Nadolol
    • Propranolol
  • Alpha-2 Agonists
    • Clonidine
    • Guanfacine
  • Alpha-1 Antagonists
    • Tricyclic antidepressants
    • Antipsychotics
    • Trazodone
    • Prazosin

• \uparrow \text{activity}
  • Reuptake Inhibitors
    • Amphetamines
    • Atomoxetine
    • Bupropion (+DA)
    • Desipramine
    • Duloxetine (+5-HT)
    • Milnacipran (+5-HT)
    • Venlafaxine (+5-HT & DA)
  • NE Releasing Agents
    • Amphetamines
  • MAOIs (+5-HT & DA)
  • Alpha-2 Antagonists
    • Yohimbine
    • Mirtazapine
  • NE Precursor:
    PA/Tyrosine
Dopamine

- ↓ activity
  - DA Antagonists
    - Antipsychotics
      - D1
      - D2
      - D3
      - D4
    - Metoclopramide
      - Antiemetics
  - ↑ 5-HT2A activity
    - SRI’s

- ↑ activity
  - 5-HT2A Antagonists
  - DA Precursor
    - Levodopa, Tyrosine, Phenylalanine
  - DA Agonist
    - Apomorphine, Bromocriptine, Pramipexole, Ropinirole
  - DA Releasing
    - Amphetamine
  - DA Reuptake Inhibitor
    - Methylphenidate,
      - Bupropion (+ NE)
  - MAOIs and COMT Inhibitors
  - Nicotine and caffeine
Caffeine

- 80-85% of US adults consume caffeine
  - Most cultures use < 50 mg/d compared to 400 mg/d for US and European countries
- Stimulates norepinephrine and dopamine
- Use of > 250 mg (e.g. more than 2-3 cups of brewed caffeine)
  - Causes anxiety/panic, agitation/irritability, psychosis, insomnia, tachycardia, tremors, decreased tone of esophageal sphincter, gastritis
  - Causes vasoconstriction and lowers the seizure threshold
- Withdrawal reactions
  - Causes migraines
- Half-life elimination = 5-8 hours
Nicotine and Neurodevelopment

- Nicotine = neuroteratogen / neurotoxin
- In humans, associated with:
  - Low birth weight and preterm birth
  - Infant respiratory illness
  - Sudden death syndrome
  - Attention-deficit hyperactivity (inattention)
  - Impulse control / conduct disorders
  - Psychosis / psychotic disorders
  - Depression
  - Dementia
Nicotine

- Stimulates dopamine and opioid activity
- Causes anxiety, insomnia, dizziness, headache, nausea, increased heart rate
- Withdrawal reactions (irritability, aggression, depression)
- Smoking increases liver enzymes and lowers blood levels of many medications and hormones (e.g., antipsychotics, antidepressants, caffeine, estradiol, testosterone)
Side Effects of CNS Stimulants

- Decreased appetite and nausea (weight loss and decreased growth)
- Increased heart rate and blood pressure
- Headache
- Insomnia
- Irritability, anxiety, mood swings
- Mania
- Psychosis
- Tremors
- Tics
What Makes Us Happy?

- Exercise/movement is important to release neurotransmitters and improves mood, concentration, and energy.
- Exercise increases dopamine, norepinephrine, and serotonin activity.
- Outdoor exercise increases sun exposure and the synthesis of vitamin D.
Movement and Activity

Improves brain (cerebellar) functioning
- Increases growth of new receptors in the brain
- Improves the tone of the locus ceruleus
- Improves attention by activating the basal ganglia
- Helps regulate the amygdala
- Increases the volume of the prefrontal cortex

Touch/Movement/Exercise and the Brain

- **Touch**
  - Repetitive movements = neurotransmitter release
  - Sexual activity = release of dopamine, oxytocin, vasopressin
  - Acupuncture/ Acupressure = neurotransmitter release

- **Movement/Exercise**
  - Weight training, running, walking, yoga, Pilates
  - Decreases anxiety and depressive symptoms
  - Improves stress tolerance, energy, and memory/concentration
  - Improves health and well-being
  - Lowers insulin levels and body fat
Exercise for the Brain

- Physical exercise protects and enhances the brain
- Moderate exercise improves blood flow to the brain, which increases oxygen and glucose delivery
- Exercise stimulates neurogenesis, the ability of the brain to make new neurons
- Improves sleep
- Reduces the risk of depression
- An active sex life leads to a longer life, better heart health, and better brain function
What Makes Us Happy?

- Sleep is important to make and store neurotransmitters for the next day.

- Maximum REM sleep = 8 hours
  - REM is when serotonin and norepinephrine are synthesized and stored.
  - Need 10-12 hours per day for children and adolescents

- Naps (REM sleep) make more neurotransmitters
Sleep Stages During a Night

The diagram illustrates the sleep stages during a night of sleep. It shows the progression of stages from awake to different stages of sleep, including REM sleep, across the hours of sleep. The stages are differentiated by color and position on the graph.
Sleep Deprivation

- < 8 hrs./day (75% of adults in US)
- Increased accidents
- Impaired work performance
- Impaired physical and mental health
  - Increased stress, aggression, anxiety, depression and weight gain
  - Increased disease states
    - Cardiovascular disease and stroke
    - Diabetes and obesity
    - Cancer risk
  - Rapid/accelerated aging
**Sleep Deprivation (sleep-debt)**

- Carbohydrate metabolism
  - Increased glucose levels
  - Decreased glucose tolerance
- Thyroid function
  - Decreased thyrotropin at night
- Hypothalamic-pituitary-adrenal axis
  - Increased cortisol levels in afternoon and evening
  - Increased sympathetic nervous system activity
- Immune function
  - Decreased interleukin-7 levels

REM sleep deprivation = weight gain
Adolescents and Sleep Disturbances

- 20-30% of children and adolescents have complaints or difficulties related to sleep
  - 17% have non-restorative sleep
  - 6% have difficulty initiating sleep
  - 7% have daytime fatigue
  - 5% have daytime sleepiness almost every day

- Issues
  - Pubertal phase delayed sleep affects sleep quantity, sleep/wake schedule, and daytime behavior
  - Late-night activities, jobs, and early-morning school demands
Risk Factors of Poor Sleep

- Using caffeinated products in the afternoon or evening
- Drinking alcohol in the evening
- Taking stimulating medications or drugs in the late afternoon or evening
  - CNS stimulants impact on sleep
- Eating a large meal near bedtime, particularly with gastroesophageal reflux disease or delayed gastric emptying
- Exercising close to bedtime
- Sleep apnea
- Restless leg syndrome
Risk Factors of Poor Sleep

- Following an irregular morning and nighttime schedule or working evening shifts or traveling to different time zones
- Having acute stress, anxiety, depression, and chronic pain
- Aging adults may have more sleep disruptions during the night (sleep apnea, restless leg syndrome, hot flashes)
- Being overweight increases the risk of sleep apnea
Treatment for Insomnia

- Nonpharmacologic treatments for chronic insomnia are effective in 70-80% of patients
  - Complete protein + complex carbohydrate prior to bedtime (e.g., dairy + fruit)
    - L-tryptophan □ serotonin □ melatonin
  - Dawn to dusk simulation
  - Dark, cool room
  - Decrease noise (ear plugs, white noise)
  - Progressive muscle relaxation/biofeedback/cognitive therapy
  - Avoid caffeine 8-10 hours prior to bedtime
  - Avoid alcohol prior to bedtime
  - Avoid exercising within 2-3 hours of bedtime

- Power napping (15-30 minutes) = “siesta” = REM sleep
What Makes Us Happy?

- Hormones are important for mood regulation and whole body health
  - Thyroid functioning
  - Gonadal hormone functioning
    - DHEA □ testosterone □ estradiol
  - Vitamin D is synthesized from UV light
    - Less sun exposure, sun block, and protective clothing = deficiency states
**Vitamin D Deficiency**

- Rickets, osteopenia, osteoporosis, osteomalacia
  - Must have calcium + vitamin D
- Cancer
  - Colon, prostate, breast, ovarian, pancreatic
- Cardiovascular diseases
  - Hypertension
- Autoimmune diseases
  - Multiple sclerosis and Type 1 diabetes
- CNS disorders
  - Neurodevelopmental disorders, neurological disorders, mood disorders
Vitamin D

- Improves bone density, muscle strength, and skin
  - Lower risk of osteopenia, osteoporosis, osteomalacia, fibromyalgia, and wrinkling
- Improves mood
  - Lower rates of depression, seasonal affective disorder, and bipolar disorder
- Improves immune functioning
  - Lower rates of influenza, autoimmune disorders, asthma, and cancer
- Improves metabolic functioning
  - Lower rates of diabetes
- Improves cardiac functioning
  - Lower rates of hypertension
- Improves gastrointestinal functioning
- Improves neurodegenerative disorders
  - Lower rates of dementia, Parkinson’s disease, multiple sclerosis, schizophrenia, autism spectrum disorder

Vitamin D Council: http://www.vitamindcouncil.org
Risk of Vitamin D Deficiency

- Darker skin
- Winter months / lack of sunlight (UV radiation)
- SPF $>30$ sunscreen and protective clothing
- Lack of fortified foods or supplements
- Elderly
- Infants and children
- Pregnant or lactating women
- Hospitalized/institutionalized patients
- Chronic renal and/or liver disease
- Gastrointestinal diseases or gastric bypass
- Obesity
- Drug interactions
Sources: Dietary

- **Dietary vitamin D sources**: Cod liver oil, cold water fish (salmon, mackerel, herring), egg yolks, fortified milk, butter, cereals, and orange juice
  - Fatty fish such as salmon, cooked, 3.5 oz, 360 IU
  - Mackerel, cooked, 3.5 oz, 345 IU
  - Sardines, canned in oil, drained, 3.5 oz, 270 IU
  - Eel, cooked, 3.5 oz, 200 IU
  - Fish oils such as cod liver oil, 1 Tbs, 1,360 IU
  - Egg yolk - one whole yolk, 20-25 IU
<table>
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<tr>
<th>Serum Levels (ng/mL)</th>
<th>Health Status</th>
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<tbody>
<tr>
<td>&lt; 10</td>
<td>Deficiency: associated with vitamin D deficiency and rickets in infants and young children</td>
</tr>
<tr>
<td>10-20</td>
<td>Generally considered inadequate for bone and overall health in healthy adults</td>
</tr>
<tr>
<td>20-30</td>
<td>Sufficient for bone health but insufficient for whole body health</td>
</tr>
<tr>
<td>≥ 30-100</td>
<td>Proposed as desirable for overall health and disease prevention: 50-70 ng/mL target levels</td>
</tr>
<tr>
<td>&gt; 150-200</td>
<td>Considered potentially toxic, leading to hypercalcemia and hyperphosphatemia</td>
</tr>
</tbody>
</table>
• **Vitamin D2 (ergocalciferol)**
  - Produced from ergosterol in a variety of plants and yeast by UVR
  - Lower levels of 25[OH]D than vitamin D3

• **Vitamin D3 (cholecalciferol)**
  - Animal/fish sources, supplementation or fortification of dairy
  - Produced from 7-dehydrocholesterol in the skin under the influence of UVB radiation (UVR)
  - Stable to heat, light, and storage
  - More active than vitamin D2
Vitamin D3 Supplementation

- Higher daily doses may be needed based on 25-OH-D Levels and risk factors
  - Low risk deficiency: 400 IU/d □ 1000 IU/d
    - Adequate sun exposure for synthesis
  - High risk deficiency: 800 IU/d □ 10,000 IU/d
  - Pregnancy and lactation: 1000 IU/d □ 4000 IU/d
  - Winter months or higher altitudes: 1000 IU/d □ 4000 IU/d
  - Non-hispanic blacks and Mexican-Americans may needed higher doses: 1000-2000 IU/d □ 4000 IU/d
First-Line Approaches

- **Nutrition**
  - Complete protein (EAA) / low fat foods and dairy
  - B12 and iron (meat)
  - Methionine
  - Vegetables (green leafy) and fruits
  - B6 and folate
  - Enriched foods such as bread, cereals, milk

- **Supplements**
  - Multiple vitamin + minerals
  - Calcium + vitamin D3
    - Don’t take too much calcium: calcium-rich foods
  - B vitamins (B2, B6, B12)
  - L-methylfolate vs. folic acid
    - Adults > 19 yrs: RDA 400 µg/d dietary folate
    - Pregnancy: + additional 100-200 µg/d dietary folate

- **Stop smoking, alcohol, and caffeine**
Treatment Refractory

- Skipping meals or poor nutrition = □ neurotransmitter synthesis, storage and release
  - Deficiency in vitamins, minerals, essential amino acids, and fatty acids
  - Hypoglycemia = stress reaction
- Not sleeping (e.g., < 8 hrs./day) = □ 5-HT or NE neurotransmitter synthesis and storage during REM sleep or circadian rhythm disorders
- Not exercising or physical touch = □ neurotransmitter release
Treatment Refractory

- High stress (with poor coping skills) = □ stress hormones and depletion of neurotransmitters

- Use of alcohol, caffeine, nicotine, opiates, CNS stimulants, CNS depressants, marijuana, etc. = imbalances of neurotransmitters and activity
Treatment Refractory

• A recent significant increase in polypharmacy involving antidepressants, antipsychotics, and sedative-hypnotics
  – Minimal evidence to show efficacy with combinations
  – May have poorer clinical outcome
  – Increased off-label prescribing
  – Increased risk of drug-drug interactions and adverse effects
  – Significant impact on cost of care
How to Take Better Care of Your Brain and Body

- Nutrition
- Sleep
- Exercise
- Hormonal balance
- Minimizing substances and drugs that impact on mental and physical health
- Sun exposure or vitamin D supplements
- Vitamin and mineral supplements, omega 3 fatty acids, etc.
- Stress reduction
References: Psychiatry Web Sites

- National Institute of Mental Health
  www.nimh.nih.gov/
- National Alliance for the Mentally Ill
  www.nami.org/
- American Psychiatric Association
  http://www.psych.org/
- Fact sheets form the APA
  http://www.healthyminds.org/
  http://www.psychiatry.org/mental-health/
- Mental Health America
  http://www.mentalhealthamerica.net/
- National Mental Health Information Center
  http://mentalhealth.samhsa.gov/
References: Nutrition & Health

- http://www.fitness.gov/federal_pubs.htm
  - Action Guide for Health Eating
  - Bulking Up Fiber’s Healthful Reputation
  - Dietary Guidelines for Americans 2000
  - Eat Right to Help Lower Your High Blood Pressure
  - Food Guide Pyramid
  - Fruits & Vegetables: Eating Your Way to 5/day
  - Growing Older, Eating Better
  - Making Health Food Choices
  - Recipes and Tips for Healthy, Thrifty Meals
  - Using the Dietary Guidelines for Americans
The Million Hearts initiative announces the launch of a new Healthy Eating and Lifestyle Resource Center, developed in partnership with the Centers for Disease Control and Prevention and Eating Well magazine. The resource center features lower sodium, heart-healthy recipes and family-friendly meal plans, with an emphasis on managing sodium intake, a major contributor to high blood pressure and heart disease.

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