GI Health and Hormones

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Learning Objectives

- At the conclusion of this activity, the participant will be able to:
  - Explain the role of lifestyle modification and its impact on hormone status.
  - Discuss nutrients that impact hormone mediated conditions.
  - Describe how nutritional support through supplementation and food will affect BHRT protocols used in pharmacy and medical practice.

You Are What You Eat!

References

- From work of Jonathan Wright, Sidney Baker, Sherry Rogers, and D. Lindsey Berkson
- Good book for your patients:
Intestinal Health

- In the GI tract is the largest blood supply in the body using 1/3 of the blood flow from the heart.
- Transit time in the intestine from mouth to rectum should be 24-30 hours. In the U.S. it is about 48 hours.
- 80% of the lymph nodes in the body are around the GI tract. The GI tract has immune function.

Gut Flora

- 100,000 bacterial count
- 400 different microbial species
- Bacteroides, Lactobacillus, Clostridum, Fusobacterium, Bifidobacterium, Eubacterium, Peptococcus, Peptostreptococcus, Escherichia, and Vellonella

Host-Flora Interactions

- The gut has a massive amount of influence on your metabolism
  - 10x the number of cells
  - 100x the genomic material
  - Metabolic activity greater than the liver
  - THE HIDDEN ORGAN!!!
- The cells of the intestinal trace are shed and replaced every 3-6 days. Therefore they are very sensitive to nutrition and lifestyle choices.
Intestinal Dysfunction

- Being low in B vitamins can promote maldigestion
- Excess alcohol intake stresses the body’s ability to digest
- Emotional trauma can affect digestion negatively
- Almost half of the adults in the U.S. experience intestinal illness at sometime in their lives.

Signs of Poor Digestion

- Less than one bowel movement a day
- Undigested food in stools
- Foul smelling stools
- Feel better if don’t eat
- Chronic indigestion after eating
- Poor sleeping habits/waking up tired
- Frequently cold for no reason

Signs of Poor Digestion (Cont.)

- Depressed with no reason
- Frequent burping, passing gas, and/or bloated stomach
- Feeling stress with without a cause
- Need to loosen belt after eating even though overeating has not occurred
- Increase in pulse of 20-25 beats within 15 minutes after eating
- Chronically coated tongue
Signs of Optimal Digestion

- Two bowel movements a day
- No undigested food in stools
- Stools do not smell
- Feel good after eating and several hours later
- Sleep well and wake up rested
- Warm extremities

Signs of Optimal Digestion (Cont.)

- Good energy level throughout the day
- No extreme food cravings
- Feel better after exercising
- Do not have frequent mood swings, shakiness, anxiety, depression without reason

Nutrients of the Gut

- B complex (especially B1, B6, folic acid)
- Vitamins A, C, D, E
- Zinc
- Selenium
- Manganese
- Molybdenum
- Magnesium
- Arginine
Inflammatory Disease of The Gut

- Dysbiosis
  - Imbalance of intestinal bacteria
- IBS (irritable bowel syndrome)
- Crohn's disease
- Ulcerative colitis

Symptoms Associated With Dysbiosis

- Nausea
- Belching, bloating
- Heartburn
- Abdominal pain
- Cramping and abdominal distention
- Depression and anxiety
- Altered bowel function (constipation and/or diarrhea)

Symptoms Associated With Dysbiosis (Cont.)

- Cramps and spasms
- Hypersecretion of colonic mucus
- Flatulence
- Halitosis
Extra-Intestinal Symptoms Linked to Dysbiosis

- Arthralgias
- Anxiety
- Brain fog
- Cognitive and memory deficit
- Depression
- Fatigue
- Fever of unknown origin
- Frequent urination

Extra-intestinal Symptoms Linked to Dysbiosis (Cont.)

- Malaise
- Myalgias
- Palpitations
- Phlebitis
- Pruritis
- Skin rashes
- Seizures
- Vasculitis

Causes of Dysbiosis

- Injurious agents
- Antacids
- Poor nutrition/SAD
- Free radical production
- Stress
- Alcohol
- Drugs
  - NSAID
  - Antibiotics
- Viruses
Causes of Dysbiosis (Cont.)

- Diminished HCL
- Decreased enzymes
- Diminished bile
- Food allergies
- Travel (food, water, bacteria)
- Hypoxia/exposure to extreme altitude
- Yeast infections
- Lectins

How NSAIDs Breakdown The Intestinal Wall

- Mechanisms of action
  - Damage to the mucosal lining
  - Damage to the mitochondria
  - Breakdown of intercellular integrity
  - Recirculation of waste products from the liver
  - Activation of neutrophils caused by the escape of bacteria and large molecules of undigested food through the compromised intestinal barrier

Viruses

- Viruses like rotaviruses have proteins on their outer surfaces that can open the cellular spaces between the tight junctions between the GI mucous cells.
Lectins

- Lectins are protein fragments of foods that are not completely digested that bind with specific sugars on the surface cells throughout the body.
- They stick to the lining of the GI tract which causes inflammation and can destroy cell membranes.
- Lectins flatten the intestinal villi and consequently decrease the absorption of nutrients.

Excessive Alcohol Use

- Ethanol and acetaldehyde (one of the breakdown products of ethanol) disrupt the tight junctions in the cells lining the intestines which increases membrane permeability.

Consequences of Dysbiosis

- Loss of good bacteria
- Loss of vitamin production
- Loss of detoxification
- Loss of chemical and antibiotic protection
- Overgrowth with harmful species
Dysbiosis Will Lead To Leaky Gut Syndrome

- Leaky gut syndrome occurs when there is damage to the lining of the bowel which results in increased permeability.
  - Toxins will reenter blood stream
  - Can get medication twice

Common Conditions Associated With Leaky Gut Syndrome

- Acne
- Aging
- AIDS
- Alcoholism
- Allergies/food sensitivities
- Ankylosing spondylitis
- Arthritis
- Asthma
- Autism

Common Conditions Associated With Leaky Gut Syndrome (Cont.)

- Burns
- Candida infections
- Celiac disease
- Chemical sensitivities
- Chemotherapy
- Chronic fatigue syndrome
- Crohn’s disease
- Cystic fibrosis
- Eczema
Common Conditions Associated With Leaky Gut Syndrome (Cont.)

- Environmental illness
- Fibromyalgia
- Hyperactivity
- Intestinal infections
- IBS
- Liver dysfunction
- Lupus
- Malabsorption

Common Conditions Associated With Leaky Gut Syndrome (Cont.)

- Malnutrition
- Psoriasis
- Reiter’s syndrome
- Rheumatoid arthritis
- Schizophrenia
- Trauma
- Ulcerative colitis

Diagnosing Leaky Gut Syndrome

- Administer mannitol and lactulose
- Mannitol is a small sugar molecule and is taken up quickly into the intestinal cells
- Lactulose is a larger molecule that should not be taken up by the intestinal cells
- If gut is leaky lactulose will be absorbed
- Mannitol is the marker for general absorption and lactulose is the indicator of increased intestinal permeability
Diagnosing Leaky Gut Syndrome

- Normally the percentage of mannitol that is recovered is between 5% to 25% and the percentage of lactulose that is recovered is 0.1% to 0.8%.
- If the levels of lactulose and mannitol are both increased, it indicates general increased intestinal permeability.
- If the levels of mannitol and lactulose are both decreased, it reflects malabsorption.

If the level of lactulose is increased and the level of mannitol is decreased or the ratio of lactulose to mannitol is increased, it may indicate damage to absorptive surfaces similar to the damage caused by celiac disease.

Nutrients For Leaky Gut Syndrome

- Probiotics
- Glutamine: 500 mg TID
- Vitamin A: 5,000 IU
- Vitamin C: 1,000 mg BID
- Vitamin B complex
- NAC: 50 mg
- EPA/DHA: 2,000-3,000 mg
- Zinc: 20 mg
- Eat foods rich in flavonoids, fiber, carotenoids, and lycopenes
4 R Program/Gut Restoration

- Remove
- Replace
- Repopulate
- Repair

The 4-R Program

- Remove
  - Pathogenic organisms
  - Allergic foods
  - Removing the source of the imbalance is the critical first step, but the anti-aging/functional medicine approach does not stop here....

- Replace
  - Hydrochloric acid
  - Digestive enzymes
  - Herbal support
Functions of Gastric Acid

- Many in the body, but two major ones
  - HCL sterilizes the food
  - HCL increases the denaturing of proteins
    - Prepares the protein for breakdown by gastric and pancreatic enzymes

Antacid Use

- Half of American adults have used antacids
- Third most common OTC medication
- 75% of antacid consumption is by heavy users
- Median duration of use by heavy users is 20 years
- Averaged 2-6 doses per day, concentrated through the work weeks
- Often self medication for heartburn and reflux-like symptoms

Reference

Gastric Acidity Changes With Age

- Studies have shown that as one ages the body produces less gastric acid.
- Low stomach acid was found in more than 50% of people over the age of 60.

Digestive Acid/Hypochlorhydria

- Consequences:
  - Small bowel overgrowth
  - Dysbiosis
  - Chronic candida infections
  - Mineral deficiencies
    - Calcium, magnesium, zinc, iron, chromium, manganese, copper, molybdenum
    - B12 deficiency

Common Signs and Symptoms of Low Gastric Acidity

- Bloating, belching, burning, and flatulence immediately after meals
- A sense of “fullness” after eating
- Indigestion, diarrhea, or constipation
- Multiple food allergies
- Nausea after taking supplements
- Itching around the rectum
- Weak, peeling, and cracked fingernails
- Using herbs but not improving from them
- Vitiligo
Common Signs and Symptoms of Low Gastric Acidity (Cont.)
- Dilated blood vessels in the cheeks/nose
- Muscle cramps and spasms
- Acne
- Iron deficiency
- Chronic intestinal parasites or abnormal flora
- Undigested food in stool
- Chronic Candida infections
- Upper digestive tract gassiness
- Rosacea

Diseases Associated With Low Gastric Acidity
- Addison’s disease
- Asthma
- Auto-immune diseases
- Celiac disease
- Dermatitis herpetiformis
- Diabetes mellitus
- Eczema
- Gallbladder disease

Diseases Associated With Low Gastric Acidity (Cont.)
- Hepatitis
- Chronic hives
- Lupus erythematosus
- Myasthenia gravis
- Osteoporosis
- Pernicious anemia
- Psoriasis
- Rheumatoid arthritis
Diseases Associated With Low Gastric Acidity (Cont.)

- Rosacea
- Sjogren's syndrome
- Thyrotoxicosis
- Hyper- and hypothyroidism
- Vitiligo

Heidelberg pH Capsule Gastric Analysis

- Developed to measure the pH of the digestive system
- Developed more than 50 years ago in Heidelberg, Germany
- Over 100 studies have been done
- Two techniques
  - Tethered capsule repeat challenge
  - Flow-through capsule

Results

- Normal: patient reacidifies after four challenges
- Hypochlorhydria: patient requires more than 20 minutes to reacidify
- Achlorhydria: patient shows little or no acid secretion and is not able to bring the pH below 4
- Hyperchlorhydria: gastrogram shows rapid reacidification within 5 minutes after each challenge
Natural remedies to increase stomach acid
- See handout
Give betaine (HCL)
- Digest protein
- Helps calcium and iron get dissolved
- Kills unfriendly bacteria and parasites
- Increases digestion in SI
- Contributes to GB, liver, and digestive health
  - If you have trouble with betaine try glutamic HCL
    - Protocol of J. Wright and M. Murray follows

Protocol For HCL Acid Supplementation

- Begin by taking one tablet or capsule containing 10 grains (600 mg) of HCL at your large next meal. If this does not aggravate your symptoms, at every meal after that of the same size take one more tablet or capsule. (One at the next meal, two at the meal after that, then three at the next meal.)

- Continue to increase the dose until you reach seven tablets or when you feel a warmth in your stomach whichever occurs first. A feeling of warmth in the stomach means that you have taken too many tablets for that meal, and you need to take one less tablet for that meal size. It is a good idea to try the larger dose again at another meal to make sure that it was the HCL that caused the warmth and not something else.
Protocol For HCL Acid Supplementation

- After you have found the largest dose that you can take at your large meals without feeling any warmth, maintain that dose at all of meals of similar size. You will need to take less at smaller meals.
- When taking a number of tablets or capsules it is best to take them throughout the meal.

- As your stomach begins to regain the ability to produce the amount of HCL needed to properly digest your food, you will notice the warm feeling again and will have to cut down the dosage. HCL may be used indefinitely.

Gastric Enzymes (Pepsin)

- Pepsin breaks down proteins
- Low pepsin levels delays the breakdown of proteins and results in symptoms of protein maldigestion.
**Pancreatic Insufficiency**

- Every day the pancreas secretes about 1.5 quarts of pancreatic juice in the small intestine.
- Secreted are lipases (digests fats), proteases (breaks down protein) and amylases (breaks down starch).
- The proteases secreted are trypsin, chymotrypsin and carboxypeptidase.

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**Incomplete Digestion Of Proteins**

- Formation of toxic substances produced during putrefaction.
- Development of allergies

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**Allergies**

- At least 60% of Americans have food allergies
- Cyclic allergies account for 80% to 90% of food allergies. The sensitivity is developed slowly by repetitive eating of a food. The food may be reintroduced if avoided for a while (about four months) and the allergy may have resolved.
- Many people crave foods they are allergic to.
Signs of Food Allergies

- Dark circles under the eyes
- Puffiness under the eyes
- Horizontal creases in the lower lid
- Chronic noncyclic fluid retention
- Chronic swollen glands

Symptoms and Diseases Associated With Food Allergies

- Gastrointestinal
  - Canker sores
  - Celiac disease
  - Diarrhea
  - Stomach ulcers
  - Duodenal ulcers
  - Mouth ulcers
  - Ulcerative colitis
  - Nausea and vomiting

- Constipation
- Gas
- Gastritis
- IBS
- Malabsorption
- Indigestion
- Gallstones

- Genitourinary
  - Bed wetting
  - Chronic bladder infections
  - Nephrotic syndrome
  - Frequency

- HEENT
  - Serous otitis media
  - Migraine headaches
Symptoms and Diseases Associated With Food Allergies

- Mental/Emotional
  - ADD
  - Depression
  - Anxiety
  - Memory loss
  - Epileptic seizures
  - Schizophrenia
- Musculoskeletal
  - Joint pain
  - Myalgias
  - RA

- Respiratory
  - Asthma
  - Chronic or allergic sinusitis
  - Constant runny or congested nose
  - Nasal polyps
- Skin
  - Eczema
  - Psoriasis
  - Urticaria
  - Red itchy eyes
  - Itchy skin
  - Acne

- Cardiovascular
  - Irregular heart rhythm
  - Vasculitis
  - Inflammation of the veins producing purpura
  - Spontaneous bruising
  - Urticaria
  - Edema
    - Textbook of Functional Medicine
As you age, normal digestion slows down which inhibits your ability to process nutrients.

Digestion decrease with age because digestive enzyme production declines.


Common signs and symptoms
- Post-prandial bloating, pain, or nausea ½ hour to several hours after eating (low stomach acid give pain immediately after eating)
- Loose or watery stools
- Undigested food in stool
- Hypochlorhydria
- Food intolerances
- Gastroesophageal reflux
- Fat soluble vitamin deficiencies
- No improvement in health when eating a good diet and taking supplements
Methods of Testing For Pancreatic Insufficiency

- Lab study—pancreatic elastase
- Provides the most accurate non-invasive measure of the exocrine pancreas
- Measures minerals to evaluate absorption
  - Calcium, magnesium, copper, chromium, zinc, potassium, and selenium

Pancreatic Elastase (PE)

- PE is a proteolytic enzyme secreted exclusively by the human pancreas
- Reflects overall enzyme production (amylase, lipase, and protease)
- It is not affected by gut transit time, not enzymatically degraded, and not affected by digestive enzyme supplementation

Pancreatic Elastase (Cont.)

- Healthy patients
  - PE1 >500 mcg/g
- Mild to moderate dysfunction
  - PE1 100-200 mcg/g
- Moderate to severe dysfunction
  - PE1 <100 mcg/g
Fecal Fat Analysis

- Causes of steatorrhea
  - Digestive disorders
  - Failure of the pancreas secretion system
  - Dysfunction of the biliary secretion system
  - Absorption problems
  - Transport of fat across the mucosal membrane of the intestine
  - Normal fecal excretion of fat is less than 6 g/d
  - Test does not distinguish between fat maldigestion from fat malabsorption

Fecal Fat Analysis (Cont.)

- Test of fecal triglycerides and long-chain free fatty acids help differentiate between fat maldigestion and malabsorption.
- Elevated levels of fecal triglyceride indicate maldigestion.
- Can be due to low pancreatic secretion or activation of pancreatic lipase

Fecal Steroids

- Come from dietary cholesterol, intestinal mucosal sloughing, and bile acids and cholesterol contained in bile
Fecal Fibers

- An increase in meat and vegetable fibers reveals an impaired digestion due to insufficient pancreatic enzymes or low HCL levels.

Digestive Enzymes

- Enhance digestive health
- Reduces autoimmunity
- Decreases post-surgery recovery time by decreasing need for pain relievers and reducing edema
- Used in place of NSAIDs in Europe to treat arthritis—acts as an anti-inflammatory
- Reduces effects caused by radiation and chemotherapy in cancer patients

Digestive Enzymes (Cont.)

- Do not take if has ulcers or any kind of active inflammatory bowel condition.
- May not want to use if patient is on coumadin if product contains papain.
- Use 2-3 just before or at the beginning of a meal
- Example of formula to use:
  - Protease 100,000 USP units
  - Lipase 20,000 USP units
  - Amylase 100,000 USP units
  - May also contain papain from papaya to assist with protein digestion
Causes of Enzyme Depletion

- Pesticides
- Hybridization and genetic engineering of plants
- Bovine growth hormone used in livestock
- Pasteurization
- Irradiation of food
- Large intake of unsaturated and hydrogenated fats

Causes of Enzyme Depletion (Cont.)

- Cooking at high temperatures
- Microwaving
- Radiation and electromagnetic fields
- Fluoridation of water
- Heavy metals
- Mercury amalgam dental fillings
- Root canals and hidden dental infections

Conditions That Enzymatic Therapy Is Effective

- Maldigestion
- Malabsorption
- Pancreatic insufficiency
- Steatorrhea
- Celiac disease
- Lactose intolerance
- Arterial obstruction
Conditions That Enzymatic Therapy Is Effective (Cont.)

- Ischemic disease
- Thrombotic disease
- Inflammatory disorders
- Rheumatoid arthritis


Source of Enzymes

- Animal-derived
  - Require pH conditions that may not be present in an ill patient in order to work
    - Pepsin (active only below pH of 4.5)
    - Pancreatin (active in alkaline medium)
      - If acidic medium need large doses since much is destroyed
      - High dose can cause hyperuricosuria and renal damage due to high purine content

Source of Enzymes (Cont.)

- Animal-derived (cont.)
  - Pancreatin (cont.)
    - Enteric coated tablets/capsules help protect against gastric acidity but not acid in the upper SI which occurs due to decreased bicarbonate secretion and therefore may not dissolve
  - Trypsin
  - Chymotrypsin
  - Pancrelipase
  - Pancreatic amylase

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Source of Enzymes (Cont.)

- Microbial-derived
  - Active over a broad range of pH
    - Aspergillus oryzae
    - Rhizopus arrhizus
  - Resistant to inactivation in pH ranging from 2-10

Studies On Microbial Enzyme Therapy

- Studies have shown that microbial enzyme therapy is very effective
  - Malabsorption and steatorrhea
  - Study compared microbial enzyme therapy to enteric coated pancreatin and convention pancreatic enzymes
    - Study revealed that all of the treatments worked but it took 33% larger doses of enteric-coated pancreatin, and 380% larger doses of conventional pancreatin, to achieve the same results as normal doses of microbial enzymes.
    - Ibid., Schneider.

Studies On Microbial Enzyme Therapy (Cont.)

- Numerous studies show the efficacy of treating chronically obstructed arteries in humans with A. oryzae.
  - Studies showed that IV A. oryzae was more effective than anticoagulant therapy at recanalizing arteries that are obstructed and improving blood flow through arterial segments that are stenosed.
References


Studies On Microbial Enzyme Therapy (Cont.)

- Studies have shown that fungal protease is effective in the treatment of arterial obstruction in patients with gangrene and severe ischemic disease.
  - Ibid., Verhaeghe.

Studies On Microbial Enzyme Therapy (Cont.)

- Celiac disease
  - The carbohydrate component is the source of gluten’s GI toxicity in celiac disease and not the protein fraction.
Studies On Microbial Enzyme Therapy (Cont.)

- Celiac disease (cont.)
  - Fungal carbohydrazide preparations render grains like wheat and rye harmless to patients with gluten enteropathy.
  - Ibid., McCarthy.

Full Spectrum Digestive Enzyme

- Amylase 3,000 to 9,000 DU
- Lipase 150-450 LU
- Cellulase 200-600 CU
- Lactase 75-225 ALU
- Invertase 75-300 SU
- Peptidase 1,000-3,000 HUT+
- Alpha galactosidase 10-30 GAJU
- Glucoamylase 2-12 AGU
- Malt diastase 75-300 DP
- Pectinase, xylanase, hemicellulase, phytase, and/or beta-glucanase

Digestive Enzymes

- Digestive enzymes if taken with food they improve digestion and help heal leaky gut syndrome.
- Digestive enzymes if taken on an empty stomach they have anti-inflammatory action.
**Bitters**

- Trigger the release of digestive enzymes in the mouth
- Increase the release of HCL in the stomach
- Enhance the production of bile
- Increase the production of saliva and gastric juices which accelerates the stomach emptying causing the pancreas to release digestive enzymes.

**Bitters (Cont.)**

- Bitter herbs have been used to treat the following conditions
  - Sluggish digestion
  - Flatulence
  - Bloating
  - Dyspepsia
  - Bowel tension

**Bitters (Cont.)**

- Excellent herbal combination of bitters are extracts of the following:
  - Ginger root
  - Cardamon seed
  - Centaury
  - Astragalus root
  - Fennel seed
  - Rosemary leaf
  - Gentian root
    - Ibid, Kamhi, p. 159.
Bitters (Cont.)

- Bitters salad
  - Dandelion leaves
  - Escarole
  - Endive
  - Other bitter salad greens
  - Can be combined with romaine lettuce
- Commercially available formulations
- Alcoholic bitters
  - Fernet Branca
  - Angostura

Bile Salts

- Help digest fats, fat-soluble vitamins and essential oils
- Carries waste products from the liver
- Is alkaline
- Help to maintain adequate bowel flora
- Low bile salts leads to poor absorption of iron and calcium

Symptoms of Low Bile Salts

- Stools that are consistently pale brown, yellowish, or grayish
- Bloating, gas, abdominal discomfort—especially after fatty meals
- Heartburn
- Vague and intermittent abdominal pains
- Dull right-sided fullness several hours after eating
- Chronic constipation
- Fat soluble vitamin deficiency
Replacement of Bile Salts

- Take for only two months—if symptoms return, go back on them for another two months and then stop them
- Excessive replacement can lead to greenish-tinged diarrhea with unpleasant odor
- Come from animal sources so people can have allergic reactions
  - Abdominal pain
  - Dark circles under eyes
  - Severe fatigue
  - Red eyes
  - Burping up tablet
  - Feeling worse

The 4-R Program

- Repopulate
  - Lactobacilli
  - Bifidobacteria
  - Saccharomyces if using antibiotics

Restoring Gut Microflora

- Probiotics
  - Microbial food supplements that beneficially affect the host by improving the intestinal microbial balance
- Prebiotics
  - Agents that support the growth and integrity of probiotics
Supplements

- Probiotics
  - Bifidobacteria
  - L. acidophilus
- Prebiotics
  - FOS
  - Arabinogalactans
  - Active immunoglobulins from whey
  - Lactoferrin
  - Lactoperoxidase

Fructo-Oligosaccharides (FOS)

- FOS helps the growth of friendly bacteria.
- FOS also increases production of beneficial short-chain fatty acids, such as butyrate
- Improves liver function
- Reduces serum cholesterol
- Lowers blood pressure
- Improves elimination of toxic compounds

FOS (Cont.)

- Natural food sources of FOS include Jerusalem artichokes, onions, asparagus, and garlic.
- Average recommendation for pure FOS is 2,000 to 3,000 mg a day. Average daily ingestion of FOS from food is about 800 mg—may need to supplement.
Probiotics

- Make short-chain fatty acids
- Produce digestive enzymes
- Act like natural antibiotics
- Maintain optimal pH of intestine
- Help digest fats
- Make B vitamins
- Help with detoxification
- Produce lignins to protect against cancer
- Protect against parasites
- Help maintain good intestinal lining which protects against food allergies

Dosage of Probiotics

- Dosage of L. acidophilus and B. lactis
  - 60 billion to 120 billion CFU daily for 12-16 weeks
  - Side effects: a mild increase in gas and flatulence may occur in some patients following initiation of probiotic therapy. Usually resolves within 3-14 days.

Probiotics

- People with severely compromised immune system should not use live probiotics since the organisms may cross the lining and be absorbed. Use non-live forms of probiotics.
The 4-R Program

- Repair
  - SI: glutamine, gamma oryzanol, duodenum glandular, n-acetylglucosamine
  - LI: fiber, butyrate
  - Boswellia geranium, licorice, quercetin, hydrastis,cheledonium, artemisia, aloe
  - Okra, cabbage, rice protein, GLA, EPA
  - Fasting

Functions of Glutamine

- Functions of glutamine
  - Stimulates intestinal mucosal growth and protects from mucosal atrophy
  - Plays an important role in acid-base homeostasis

Functions of Glutamine (Cont.)

- Functions of glutamine (cont.)
  - Glutathione repletion
  - Protein sparing
    - Is a regulator of muscle proteolysis and supplementation can help prevent loss of protein in the muscle
Functions of Glutamine (Cont.)

- Functions of glutamine (cont.)
  - Immune support
    - Glutamine has an immune-modulating effect by increasing IL-6 levels and lymphocyte function

Fasting

- Fasting has been shown to be helpful in treating leaky gut syndrome.
- During fasting the WBC activity increases which more effectively removes circulating immune complexes (CICs) from the body which decreases inflammation and leaky gut.

Other Herbs and Nutrients To Treat Leaky Gut Syndrome

- Quercetin
  - Is a bioflavanoid
  - Found in onions, blue-green algae
  - Is an antioxidant and an anti-inflammatory
  - Works by decreasing mast cell and basophil production
Other Herbs and Nutrients To Treat Leaky Gut Syndrome (Cont.)

- Antioxidants
  - Decrease oxidative stress which is one of the main causes of intestinal damage
  - Vitamin A
  - Vitamin C
  - Vitamin E
  - NAC
  - Zinc
  - Selenium
  - Carotenes


Other Herbs and Nutrients To Treat Leaky Gut Syndrome (Cont.)

- N-acetyl-D-glucosamine (NAG)
  - Important in the formation of glycocalyx which is a specialized mucus that coats intestinal tissues and acts as a first line of defense against fungi, viruses, and pathologic bacteria
  - Also functions as a decoy sugar which attracts and binds dietary lectins preventing them from attaching to the gut
  - Promotes the growth of friendly bacteria
  - Digested by healthy bacteria in the intestine

Other Herbs and Nutrients To Treat Leaky Gut Syndrome (Cont.)

- Essential fatty acids
  - Anti-inflammatory action
Other Herbs and Nutrients To Treat Leaky Gut Syndrome (Cont.)

- Arabinogalactans
  - Kiwi
  - Proliferates epithelial cells
  - Larch
  - Benefits immunologic, metabolic, and growth factors

- Fiber
  - Soluble
    - Improves short-chain fatty acid production which aids in the promotion of probiotic growth
  - Insoluble
    - Aids with bulk formation and the elimination of waste

- Ginkgo biloba
  - Studies have shown that it protects the integrity of the mucosal lining of the intestines by reducing oxidative damage.
Chinese skullcap (Scutellaria baicalensis)
- Contains baicalin and wogonin have anti-inflammatory action by blocking the arachidonic acid cascade
- Heals gastric mucosa

Licorice root (Glycyrrhiza glabra)
- Contains flavonoids called saponin glycosides which have a protective effect on the gut
- Has also been shown to decrease GI bleeding secondary to NSAIDs

Meadowsweet (Filipendula ulmaria)
- Contains anti-inflammatory glycosides, tannins, mucilage, and flavonoids
- Aids in treatment of inflammatory conditions of the GI tract
- Helps strengthen the bonds of the CT between cells which helps protect the intestinal barrier
- Free radical scavenger
Other Herbs and Nutrients To Treat Leaky Gut Syndrome (Cont.)

- Chamomile (Matricaria chamomilla)
  - Name means “mother of the gut”
  - In Germany is an OTC licensed drug for treatment of GI spasms and inflammatory diseases of the gut
  - Anti-inflammatory action is due to azulene and bisabolone which are two chemicals in chamomile

Other Herbs and Nutrients To Treat Leaky Gut Syndrome (Cont.)

- Goldenseal (Hydrastis canadensis)
  - Stimulates immune response
  - Destroys germs since it contains berberine
  - Has astringent effects that aid in digestive problems
  - Used to treat peptic ulcers and colitis
  - Promotes the production and secretion of digestive juices
  - Helps to reestablish healthy gut mucosa
  - Can also use barberry or Oregon grape root which are berberine-rich substitutes

Reference

Demulcent Herbs and Foods

- Demulcents are herbs or foods that have a protective effect on the mucous membranes of the body.
- They contain a large amount of mucilaginous materials that have a direct affect on the lining of the intestines to soothe them.
- They reduce the sensitivity of the digestive system to gastric acids, relax spasms, decrease leaky gut, and inflammation and ulceration.

Demulcent Herbs and Foods (Cont.)

- Marshmallow (Althea officinalis)
- Slippery elm bark (Ulmus fulva)
  - Ulcers
  - Ulcerative colitis
  - IBS
  - Diarrhea
- Cabbage juice
- Okra (Hibiscus esculentus)
- Fenugreek (Trigonella foenum-graecum)

Absorption Is Affected By Energy Balance

- Anything that affects ATPase activity can affect absorption
  - Magnesium deficiency
  - Insulin resistance
  - Hypothyroidism
  - Catecholamine production
  - Adrenal insufficiency by altering glucocorticoid metabolism
Gas and belching that occur during, immediately after, or within a ½ hour of eating suggest a stomach-acid deficiency or food allergy.

Gas, belching, and bloating that occur several hours after eating suggest pancreatic enzyme deficiency, food allergies, and/or lactose intolerance.

Gas within 1 to 1½ hours after eating may suggest small-bowel overgrowth or unfriendly bacteria.

Optimal function of the thyroid gland is essential for normal GI function.

For example: one of the symptoms of hypothyroidism is constipation.
Melatonin

- One study showed that melatonin supplementation was helpful to improve symptoms of IBS.
  

Adrenal Hormones

- Abnormal levels of adrenal hormones have long been shown to be a component of IBS.
  

Female Hormones

- Study showed the positive effect of supplementation of female hormones on GI transit time.
  
Neurotransmitter Function

- In order for the patient to have enough serotonin, their GI tract needs to be healthy.
- 70% of serotonin is made in the GI tract.

Serotonin

- Serotonin is a neurotransmitter found in the GI tract, platelets, CNS, and eyes.
- It contributes to feelings of well-being and happiness.
- 90% of serotonin is made in the enterochromaffin cells in the GI tract.
- Serotonin is metabolized mostly into 5HIAA by the liver using monoamine oxidase.
There are many serotonin receptors.

- 5-HT1 A-F
- 5-HT2 A-C
- 5-HT3
- 5-HT4
- 5-HT5 A
- 5-HT6
- 5-HT7

Cofactors: vitamins B6 and magnesium.

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Serotonin

Tryptophan

\[ \text{Tryptophan} \rightarrow \text{5-HTP} \]

\[ \text{5-HTP} \rightarrow \text{SEROTONIN} \]

\[ \text{SEROTONIN} \rightarrow \text{Melatonin} \]

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Functions of Serotonin

- Neuroendocrine homeostasis
- Regulates sleep cycles
- Controls appetite and carbohydrate cravings
- Improves mood and relieves depression
- Social engagement
- Calms anxiety
- Regulates sexual behavior
- Regulates body temperature
- Regulates intestinal movements
Symptoms of Serotonin Deficiency

- Depression
- Anxiety
- Obsessions and compulsions
- Pain sensitivity
- Aggression
- Rarely feels relaxed
- Difficulty with falling asleep or sleep maintenance
- Musculoskeletal pain or fibromyalgia
- Experiences excessive worry
- Has low self-esteem

Symptoms of Serotonin Deficiency (Cont.)

- Has experienced a prolonged period of stress
- Reduced appetite
- Feelings of guilt
- Difficulty with change
- Episodes of panic attacks
- Symptoms of irritable bowel
- Loss of interest in pleasurable activities
- Experiences winter blues
- Cries easily
- Feelings of dread or impending doom

Causes of Low Serotonin

- HPA axis dysfunction (sustained levels of high stress)
- GI dysfunction
- Lack of sleep
- Poor nutrition
- Chronic inflammation
- Genetic mutations
- Prescription drugs
- Ecstasy use
- ETOH abuse
- Defects in serotonin transporter
Defects in Serotonin Transporter

- Defects in the serotonin transporter correlate with high levels of cortisol!
- If there is dysfunction of the HPA axis the serotonin activity is reduced.

Diseases Associated With Serotonin Imbalance

- Major depression
- PTSD
- Panic attacks
- OCD
- Autism
- Schizophrenia

Ways to Raise Serotonin

- Eat serotonin boosting foods via tryptophan (has only modest effect)
- Carbohydrates increase the release of serotonin.
- Increase exercise
- Regulate tryptophan hydroxylase
- Nutrients
  - 5-HTP
  - MTHF
  - DHEA
  - Vitamin D
  - Melatonin
  - Magnesium
  - B6
  - SAM-e
  - St. John's Wort
  - Alpha-lactalbumin
Serotonin Boosting Foods via Tryptophan

- Avocado
- Cheese
- Chicken
- Chocolate
- Cottage cheese
- Duck
- Egg
- Granola
- Luncheon meat
- Oat flakes
- Port
- Ricotta cheese
- Sausage meat
- Turkey
- Wheat germ
- Whole milk
- Wild game
- Yogurt

Tryptophan Hydroxylase

- Tryptophan hydroxylase is an enzyme involved in the synthesis of serotonin.
- Positive modulation
  - Oxygen
  - Folic acid
  - Sulfhydryl groups
  - SSRI's
- Negative modulation
  - Nitric oxide
  - L-dopa
  - PCB's
  - Nicotine
  - Ibid., Willner

Reference

5-Hydroxytryptophan (5-HTP)

- 5-HTP is a by-product of tryptophan and is a nonessential amino acid that increases the body’s production of serotonin.
- Dose: 50-300 mg qd in divided doses.
- Magnesium prolongs the benefits of 5-HTP.
- Side effects and C/I
  - Use with caution or do not use in patients on: SSRIs, dextromethorphan, demerol, triptans, carbidopa.
  - Use with caution in patients with: hypertension, diabetes, heart disease or autoimmune disorder.
  - Do not use in patients that are pregnant or have scleroderma.

Vitamin B6

- Vitamin B6 is needed for the metabolism of tryptophan to serotonin.

Vitamin D

- Vitamin D regulates serotonin synthesis by activating transcription of serotonin-synthesizing gene, tryptophan hydroxylase, in the brain.
- Vitamin D also regulates the synthesis of oxytocin and vasopressin.
Folate (5-MTHF)

- Folate a cofactor in serotonin synthesis.
- The rate limiting step in serotonin synthesis is tryptophan hydroxylase which is folate dependent.
- Decreased blood folate levels correlate with decreased CSF 5HIAA levels which are a marker of brain serotonin metabolism.
- Low folate levels are also associated with depression and a decreased response to treatment with antidepressants.

5-MTHF

- Study showed that patients with depression that were taking an antidepressant improved more if they also took 5-MTHF with their anti-depressant.

DHEA

- DHEA increases hippocampal neuron serotonin firing.
St. John’s Wort

- St. John’s wort contains hypericin, which increases the body’s level of dopamine.
- St. John’s wort contains hyperforin, which increases dopamine, GABA, glutamate, NE and serotonin levels.
- It has antibacterial properties.
- It is an anti-inflammatory.
- It may inhibit viral infection.
- Dose: 900-1,200 in split into BID to TID for mild depression.
- It takes 2-6 weeks to be effective.

St. John’s Wort (Cont.)

- Possible side effects and contraindications
  - Anxiety
  - Dry mouth
  - Dizziness
  - Headache
  - Mild palpitations
  - Sexual dysfunction
  - Stomach ache
  - May reduce effectiveness of medications such as anticoagulants, antidepressants, and oral contraceptives

Conclusion

- Eat to live, not live to eat.
Obtaining CME

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