



Mast Cell Activation Syndrome (MCAS) & Histamine Disorders

What Are Mast Cells?

- Types of white blood cells found in everyone and in most tissue throughout your body.
- Found in tissues in close contact with the environment such as your skin, airways, and gastrointestinal tract and your cardiovascular, nervous, and reproductive systems.
- Release signaling chemicals as part of an immune system stabilizing defense in response against foreign invaders like parasites, fungi, bacteria, or viruses or allergens, and environmental toxins.
- Allergy cells that contain a number of chemicals responsible for immediate allergic reactions.
- Protects from infection, heal wounds, creates new blood cells, and develops immune tolerance.
- Can become dysfunctional or overactive creating more serious health issues.

What Are Mast Cell Mediators?

- Mediators are the granules secreted by mast cells in response to an outside stimulus which include histamine, proteases, leukotrienes, prostaglandins, chemo-kines, and cytokines.
- Release mediators that are either stored inside the mast cell or produced by them. (In the case of an allergic reaction, this release occurs when the allergy antibody IgE is present on the surface of the mast cell and binds to the proteins that cause allergies. These are "allergens.")
- Signal and guide other cells, tissues, and organs to respond to hostile invaders.
- Mediators provoke potent inflammatory responses that can include skin rash and swelling, swelling beneath the skin surface, airway constriction, diarrhea, vomiting, low blood pressure, cardiovascular collapse, and even death all within minutes.

What Is Mast Cell Activation Syndrome (MCAS)?

- A condition triggering mast cells to release inappropriate amounts of chemicals into your body.
- Triggering is referred to as "activation" occurring without awareness creating a myriad of symptoms.

Secondary Mast Cell Activation

- Activated by other substances such as infection, insect bites, vaccinations, and medications as a direct result to external stimuli.
- Normal response by mast cells creating symptoms ranging from itching, scratching and swelling, congestion, sneezing, inflammation, and the overproduction of mucous.
- Mutations in mast cells can produce populations of identical mast cells called clones that result in overproduction and spontaneous release of mediators.
- Abnormal cells can grow uncontrollably and are unusually sensitive to activation creating Mast Cell Activation Syndrome.

Histamine Intolerance is a Subset of MCAS

- Mast Cell Activation Syndrome (MCAS) is sometimes confused with Histamine Intolerance (HIT) and is considered a subset where too much histamine is released due to a flood of histamine taken in by consuming foods containing histamine.
- Occurs when histamine is not broken down in the gut because of Diamine Oxidase (DAO) gut

enzyme deficiency, or Histamine-N-Methyltransferase (HNMT) deficiency and is not properly broken down in the liver.

- Symptoms and conditions are the same as MCAS, with the exception that mast cells secrete many mediators of inflammation with MCAS, not just histamine.
- Histamine serves as a neurotransmitter, helps to produce stomach acid, and is an important immune mediator when not going overboard.
- Mast Cell Activation disorders require the presence of several of symptoms and a proper diagnosis.

Detailed Symptoms of Mast Cell Activation Syndrome

- Causes episodic multi-system symptoms as the result of mast cell mediator release and without causing abnormalities in routine laboratory or radiologic testing.
- Creates chronic and recurrent inflammation, with or without allergic symptoms, as a response to the immune system becoming overactive due to the release of inflammatory chemicals affecting every organ in your body.
- Symptoms come and go over time similar to a flare-up and remission like those found in auto-immune disorders and reoccur over and over again affecting different organs and parts of your body throughout your lifetime.
- Often has a lack of common unifying set of symptoms.
- Is often discovered when there is a lack of an established diagnoses to account for your symptoms.
- Becomes a highly probable diagnosis when various symptoms of an inflammatory nature have occurred throughout your lifetime.
- Subtle becoming more serious with age.

Mast Cell Activation Syndrome Symptoms By Organ System:

Any of these symptoms could indicate an issue with mast cells:

- **Eyes** - Red, irritated, dry, burning eyes, difficulty focusing vision, and conjunctivitis (pink eye).
- **Nose** - Nasal stuffiness, sinusitis, postnasal drip, hoarseness, laryngitis, nose bleeds (epistaxis), and intranasal sores.
- **Ears** - Ringing in ears (tinnitus) and eustachian tube dysfunction (blocked, popping ears).
- **Throat** - Vocal cord dysfunction, throat swelling, sores on tongue/mouth, itchy throat, burning mouth, and difficulty swallowing.
- **Skin** - Hives, angioedema (swelling of the skin), skin flushing, itching, skin rashes, dermatographism (when scratched skin causes a red welt), chronic itching, urticarial pigmentosa (legion/hive-like spots on the skin), flushing, bruising easily, reddish or pale complexion, cherry angiomas (skin growths), patchy red rashes, red face in the morning, cuts that won't heal, fungal skin infections, and lichen planus.
- **Cardiovascular** - Fainting, fainting upon standing, increased pulse rate (tachycardia), palpitations, spikes and drops in blood pressure, high pulse or temperature, high triglycerides, lightheadedness, dizzy, hot flashes, and postural orthostatic hypotension syndrome (POTS).
- **Respiratory** - Wheezing, asthma, shortness of breath, difficulty breathing deeply, air hunger, dry cough, chronic obstructive pulmonary disease (COPD), and chronic interstitial fibrosis.
- **GI Tract** - Left upper abdominal pain, splenomegaly (enlarged spleen), epigastric tenderness, nausea, vomiting, diarrhea and/or constipation, abdominal cramping, bloating, non-cardiac chest pain, malabsorption, GERD/acid reflux, cyclic vomiting syndrome, colonic polyps, and gastric polyps.
- **Liver** - High bilirubin, elevated liver enzymes, and high cholesterol.
- **Neurological** - Numbness and tingling (especially hands and feet), headaches, migraines, tics, tremors, pseudo-seizures, true seizures, waxing and waning brain fog, memory loss, poor concentration, difficulty finding words, and spells of cataplexy (unresponsive or nonreactive).

- **Musculoskeletal** - Muscle pain, fibromyalgia, increased osteopenia, osteoporosis, weakness, and migratory arthritis (joint pain).
- **Coagulation** - History of clots, deep vein thrombosis, increased bruising, heavy menstrual bleeding, bleeding nose, and cuts that won't stop bleeding.
- **Blood disorders** - Anemia, increased white blood cell count, platelets, decreased white blood cell counts, decreased neutrophils, decreased lymphocytes, decreased platelets, reductions in CD4 helper lymphocytes, reductions in CD8 positive suppressor lymphocytes, reductions or excesses of IgA, IgG, IgM, IgE, a known condition called MGUS, myelodysplastic syndrome (reduced red cells, white cells, platelets), and increased MCV (mean corpuscular volume).
- **Psychiatry** - Anxiety, panic, depression, obsessive compulsive disorder (OCD), decreased attention span, attention deficit/hyperactivity disorder (ADHD), forgetfulness, and insomnia.
- **Genitourinary** - Interstitial cystitis, recurrent bladder infections, sterile bladder infections, and frequent urination.
- **Hormones** - Decreased libido, painful periods, heavy periods, infertility, and decreased sperm counts.
- **Dental** - Deteriorating teeth.
- **Anaphylaxis** - Difficulty breathing, itchy hives, flushing or pale skin, feeling warm after exposure, weak and rapid pulse, nausea, vomiting, diarrhea, dizziness, and fainting.

How Are MCAS & HIT Treated?

Stabilize The Immune System & Reduce Inflammation

- **Check & Treat Any Underlying Infections**
H. pylori, Epstein Barr, Candida & Herpes Simplex
- **Correct Gut Dysbiosis**
Certain strains of probiotics that have been shown to help breakdown histamine, including:
Bifidobacterium adolescentis
Bacteroides thetaiotaomicron
Bacteroides fragilis
Lactobacillus rhamnosus
- **Reduce Histamine Levels**
Reduce histamine levels by adopting a low histamine diet.

What Is A Low-Histamine Diet?

Used for the purpose of lowering histamine levels rather than reduce calories for weight-loss.

- Helps to identify food intolerances.
- Eliminates foods high in histamine, including limiting foods that are histamine liberators but includes fresh, whole, organic, nutrient dense foods that are low in histamine.
- Supports a healthy immune system necessary for the development of histamine degrading enzymes, like Diamine Oxidase (DAO) gut enzyme deficiency, or due to Histamine-N-Methyltransferase (HNMT).

Some Individuals May Need To Avoid The Following:

- Lectins
- Oxalates
- Salicylates
- Sulfur
- FODMAPs (Fermentable Oligosaccharides, Disaccharides, Monosaccharides & Polyols, which are short-chain carbohydrates)
- Eliminate all food with histamine potential, including:

Histamine-Rich Foods

Histamine Liberators

Other Biogenic Amines (Substrates that compete for DAO and act similarly to histamine)

Degradation Inhibitors (DAO inhibitors, HNMT inhibitors)

Indirect Influences On Histamine Levels

Histamine Liberators

- Foods that do not directly carry histamine but non-specifically release histamine stored in your mast cells and block enzymes needed to breakdown histamine.
- Anyone can react to histamine liberators if the dose is strong enough.
- Can be difficult to identify.
- Can be consumed a few days in a row before symptoms become more obvious.
- Can slowly build in the body causing subtle symptoms initially such as:
 - Anxiety/Depression
 - Fatigue/Lethargy
 - Sleep Apnea/Insomnia
 - Aches/Pains
 - Increased/Recurring Infections

Examples:

- *Alcohol, Chocolate, Citrus Fruits, Nuts, Tomatoes & Tomato Products, Shellfish, Walnuts, Peanuts, Vinegars, Legumes, Wheat Germ & Additives (benzoate, sulphites, nitrites, glutamate, food dyes)*

Biogenic Amines

- Shares the same degradation pathway as histamine blocking the normal breakdown of histamine.
- Some have similar properties to histamine and cause similar symptoms directly.

Examples:

Bananas, Oranges, Grapefruit, Pears, Raspberries, Kiwis, Pineapple, Papaya, Lentils, Beans, Soy Products & Wheat Germ

Diamine Oxidase Inhibitors (DAO)

- A sensitive molecule that can be inhibited by chemical influences found in certain foods.

Examples:

Specific Medications & Biogenic Amines

Gut Permeability

- Allows macromolecules and other substances from the digestive system to enter the bloodstream increasing the risks for developing allergies.

Examples:

Spices: Chili, Curry, Black Pepper, Cayenne, Habenero & Chipotle

Low-Histamine Foods TO Be Consumed On Low-Histamine Diet

Low-Histamine Vegetables

- Arugula
- Asparagus
- Basil
- Bok choy
- Broccoli/Broccolini
- Brussels Sprouts
- Butter lettuce
- Cabbage, Green & Red
- Carrots
- Celery/Celery Root
- Cauliflower
- Collards

- Dandelion greens
- Endive
- Escarole
- Fennel
- Jicama
- Kale
- Kohlrabi
- Leafy Greens
- Leeks
- Lettuce-Butter, Endive, Red, Iceberg, Radicchio, Romaine
- Mesclun

- Mustard greens
- Napa Cabbage/Chinese Cabbage
- Onions
- Parsnips
- Radishes/Daikon Radishes
- Rutabaga
- Romaine, Red/Green
- Scallions
- Shallots
- Turnips
- Watercress

Low-Histamine Fruits

- Apples
- Apricots
- Blueberries
- Cantaloupe
- Cherries
- Coconut-Meta, Cream, Water, Milk
- Cranberries
- Currants
- Dragonfruit
- Fresh Figs

- Grapes (especially black)
- Green Apples
- Kiwi
- Lemons/Limes (Small amounts)
- Mango
- Nectarine
- Peach
- Pear
- Watermelon

Low-Histamine Proteins

Eat moderate amounts of clean protein from organic, pasture-raised meats:

- Bison
- Lamb
- Liver
- Poultry (Chicken, Duck, Goose, Ostrich, Quail, Turkey)
- Pork
- Rabbit
- Turkey
- Beef (non-aged)
- Nuts/Seeds (Flax, Macadamias, Pistachios, Coconut, Pecan)
- Pasture Raised Eggs-Chicken, Duck, Quail (Not well-tolerated by all and should be tested.)
- Beans-Dried, Soaked & Cooked Fresh (Kidney, Black, Navy, Garbanzo/Chickpeas)

Low-Histamine Healthy Fat Sources

- Grass-fed Butter
- Extra-virgin Olive Oil
- Virgin Coconut Oil
- Corn Oil
- Safflower Oil
- Peanut Oil

Low-Histamine Herbs

- Ginger
- Basil
- Chives
- Cilantro
- Coriander
- Curcumin
- Curry Leaves
- Dill
- Fenugreek
- Garlic
- Ginger
- Lemongrass
- Mint
- Oregano
- Parsley, Flat Italian
- Peppermint
- Rosemary
- Sage
- Saffron
- Shallots
- Tarragon
- Thyme

Low-Histamine Sweeteners

- Coconut Sugar (Used sparingly)
- Inulin
- Maple Syrup
- Monk Fruit
- Stevia

Low-Histamine Additives

- Arrowroot
- Baking Powder
- Brown Rice Flour
- Cocoa Butter (Without Additives)
- Cream of Tartar
- Sweet Potato Starch

Low-Histamine Beverages

- Coconut Water
- Dandelion Root Tea
- Herbal Teas (Except Black Green, White, & Rooibos)
- Mineral Water/Water

Low-Histamine Dairy

- Milk (Grass-Fed Goat, Sheep)
- Butter (Grass-Fed)
- Cream Cheese (Grass-Fed)
- Ricotta Cheese (Grass-Fed)

High-Histamine Foods To Avoid

High-Histamine Herbs

- Anise
- Allspice
- Cayenne
- Cinnamon
- Chili Powder
- Cloves
- Curry Powder
- Mace
- Monosodium Glutamate (MSG)
- Mustard
- Nutmeg
- Paprika
- Peppercorns (Black & Green)

High-Histamine Vegetables

- Avocado
- Eggplant
- Green Beans
- Mushrooms
- Peas
- Peas
- Pumpkin
- Sauerkraut
- Soybeans
- Spinach
- Squash
- Tomato/Tomato Product

High-Histamine Fruits

- Avocado
- Banana
- Dates
- Dried Fruit
- Grapefruit
- Jams/Jellies/Preserves
- Loganberry
- Oranges (All Citrus)
- Papaya
- Pineapple
- Plums
- Prunes
- Raisins
- Strawberries

High-Histamine Protein/Meat

- Aged Beef/Bison
- Cured Meats-Bacon, Salami, Pepperoni, Luncheon Meats, Hot Dogs
- Fish
- Ground Meats
- Leftover Cooked Meats
- Raw Egg White (ex. Hollandaise)
- Shellfish

High-Histamine Dairy

- Buttermilk
- Cheese
- Kefir
- Yogurt

High-Histamine Legumes

- Canned Beans
- Canned Lentils
- Edamame
- Peanuts
- Seitan
- Soybeans
- Tofu

High-Histamine Nuts/Seeds

- Cashews
- Coconut
- Coconut Butter
- Peanuts
- Pecans
- Walnuts

High-Histamine Sweeteners

- Artificial Sweeteners
- Candy
- Corn Syrup
- Dessert Fillings
- Honey
- Icing
- Molasses
- Sugar

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- Artificial Sweeteners
- Candy
- Corn Syrup
- Dessert Fillings
- Honey
- Icing
- Molasses
- Sugar

High-Histamine Processed Foods & Additives

Avoid packaged and processed foods of any kind even if it says it is "healthy" or "organic".

- Artificial Colors
- Artificial Flavors
- Bragg's Liquid Aminos
- Bone Broth
- Calcium Chloride
- Carrageenan
- Carob
- Chocolate/Cocoa
- Citric Acid
- Coconut Aminos
- Collagen
- Food Coloring
- Gherkin Pickles
- Hydrolyzed Lecithin-BHA/BHT
- Ketchup
- Lecithin
- Maltodextrin
- Monosodium Glutamate (MSG)
- Mincemeat
- Miso
- Nutritional Yeast
- Olives
- Potassium Sorbate
- Potassium Trip-phosphate
- Relishes
- Smoke Flavoring
- Sodium Benzoate
- Sodium Nitrite
- Sodium Triphosphate
- Soy Sauce
- Tamari
- Vinegars-ACV, Balsamic, Champagne, White, Red
- Xanthan Gum
- Yeast /Yeast Extract

High-Histamine Beverages

- Beer
- Bourbon
- Carbonated Drinks
- Cider
- Cocoa
- Coconut Water (Packaged)
- Flavored Alcohols
- Quality top-shelf alcohol is tolerated in small amounts by some individuals. These include: Gin, Silver Tequila, Vodka, White Rum.
- Alcohol of any kind should not be consumed during the restriction phase of the low-histamine diet.
- Flavored Milks
- Fruit Juices (Concentrated/Cocktails)
- Kombucha
- Scotch
- Tea-Black, White, Roiboos
- Wine

The Important Food Handling, Shopping & Storage Information

Shopping

- Foods must be fresh; freshest foods can be found at the back of the shelf. Check expiration dates.
- Purchase perishable items last when shopping.
- Transport perishables from the grocery in a cooler or insulated tote with ice.
- Choose organic meats in vacuum-sealed packaging which helps reduce bacterial growth and reduces rancidification. (Germs do not thrive in the absence of air.)

Food Handling

- Warmth increases bacterial growth in perishable items but kills it once it reach 165 F or higher.
- Perishable items must remain cold at 40 F or lower until ready to cook.

Storage

- Maintain refrigerator temperature between 38-40 degrees. (This is slightly lower than usual temperatures.)
- Frozen foods should be stored no longer than two weeks. Freezing slows bacterial growth but doesn't stop them entirely. The longer food is frozen the more bacterial growth.

Food Preparation

- Meats and fish should go from refrigerator to pan immediately and not be allowed to sit out for any amount of time. This allows histamine to grow.
- Never re-freeze foods that have been defrosted.
- Quick-defrost meat in the microwave or cold water bath then cook immediately.

Mealtime

- Eat smaller meals to allow for proper digestion and for your body to properly breakdown histamine.
- The more food consumed, the more histamine ingested.

Leftovers

- Cook only what is to be eaten for that meal avoiding leftovers.
- Any leftovers should be frozen and stored for no more than 24 hours.

Beginning Your Low-Histamine Diet

Phase One: The Elimination Phase

- Create a symptom-free environment to determine how specific foods are tolerated.
- Eat only foods on the low-histamine food list. This includes eliminating histamine liberators.
- Maintain a food diary that includes amounts of foods eaten and any symptoms experienced. (This is a very important component to the success in determining your personal tolerated food list.)
- Follow for four to six weeks. (Two weeks minimum for individuals with few or mild symptoms.)
- Symptoms such as changes in mood and brain fog can occur due to the body detoxing.

Phase Two: The Reintroduction Phase

- Reintroduction is important to determine intolerances and should not be skipped because the elimination phase has you feeling better.
- Reintroduce poorly tolerated foods (foods that are not on the low-histamine food list including additives and histamine liberators) one-at-a-time to determine if they are tolerated. If you experience a reaction, the offending food should remain off "your" food list. (Intolerances are indications you have HIT or Histamine Intolerance.)
- Once an offending food has caused a reaction, wait 24-72 hours before reintroducing another food to allow your body to recalibrate. (You may have to allow for a longer period of time if symptoms persist. Do not reintroduce a new food until all symptoms have subsided.)
- You may discover a number of foods which are moderately tolerated which can possibly be enjoyed from time-to-time as long as they are not consumed back-to-back. (There are varying factors as discussed.)

Phase Three: Building Your Food List

- The elimination phase has helped to determine those foods which are well tolerated and moderately tolerated. You can still try to reintroduce poorly tolerated foods during this phase. You may find they are tolerated in smaller amounts.
- Reliable retesting required you to be symptom-free after consumption and without taking anti-histamines. Only consume the food for two days and return to your food list of non-offending foods. (Some foods can cause delayed reactions.)
- This process is an on-going process and will continue for the duration of your life.
- Your list will likely change over time adding and subtracting from currently tolerated foods.
- Remember tolerance thresholds develop slowly and even moderately tolerated foods can become better tolerated.
- Be mindful that histamine liberators and biogenic amines both have indirect and delayed effects making it difficult to determine if a food is truly poorly tolerated.

Lifestyle Changes to Lower Histamine & Have You Feeling Better

Varying Factors Involved in Food Tolerance

Tolerance of certain foods is subject to large variation and have numerous factors that contribute. Symptoms and intensity of symptoms are dose dependent due to varying levels of histamine in your system at any given time.

Avoid The following Triggers (non-food items):

- Anesthetics
- Chemicals-Airborne/Cleaning/Lawn/Personal Products
- Emotional Stress
- Heavy Metals
- Insect Bites
- Medications Liberators (Blocking DAO)
- Mold
- Smoke
- Temperature Extremes

** It is vital to reduce toxic burden.*

Create Better Gut Health

- Eliminate inflammatory foods by adopting an Anti-inflammatory Diet/Protocol.
- Take probiotics & DAO enzyme.

Stabilize Mast Cell Release of Mediators

- Take Quercetin & Vitamin C.

Use An Antihistamine

- Try using one (Claritin, Zyrtec or Allegra) 3 times daily.
(You might need to experiment with which one works best for you, but try each for 2-3 weeks.)

Block & Reduce Nighttime Histamine Release

- Get a proper and quality night's sleep by taking 0.25-1 mg ketotifen or zaditen before bedtime.
(Speak to your healthcare provider if you are having difficulties.)

Treat Existing Infections

- Treat any existing infections to help your body heal and reduce mast cell triggers including skin infections, candida or fungal infections.
(Speak to your provider for thorough testing for any pathogens.)

Keep A Regular Routine

- Maintain a regular schedule to stabilize mast cells; they have a circadian rhythm pattern.
- Wake-up and go to sleep at the same time daily.
- Avoid electronics two hours before bedtime or wear blue-blocking glasses for better hormone regulation.

Reduce Stress

- Stress activates mast cells and causes them to release histamine.
- Incorporate breathing exercises, meditation, Emotional Freedom Tapping (EFT) technique, yoga, and other stress-reducing techniques.

Protocol For Stabilizing Mast Cells

These therapies work by inhibiting the inflammatory mediators mast cells release:

- Histamine-1 or H-1 blocker (Claritin, Zyrtec, Allegra) - 3 daily if tolerated
 - One of these typically works better than the others.
 - Try each out for 2-3 weeks to determine which is best for you.
- Histamine-2 or H-2 blocker, Pepcid 20mg twice daily
- Mast cell stabilizer (cromolyn, quercetin, ketotifen, Singulair, Low Dose Naltrexone-LDN)
- Probiotics daily
- Vitamin C 1000mg daily
- Vitamin D3 5000-10,000 iu daily
- B-Complex daily
- Selenium 100mcg daily
- Zinc 15-30mg daily
- Magnesium 400mg daily
- Diamine Oxidase enzymes (DAO), 2 with meals

Further Information About Products Suggested For This Protocol

Quercetin

- Down-regulates the enzyme that converts the protein histidine to histamine—histidine decarboxylase.
- Inhibits the release of histamine, prostaglandins, and leukotrienes— three of the most common inflammatory mediators found in MCAS.
- Decreases the production and release of inflammatory cytokines—the inflammatory mediators responsible for many of the inflammation symptoms related to MCAS.
- Treats allergies, contact dermatitis, photosensitivity, and inflammation.

Antihistamines

- Used for lowering histamine levels and relieving symptoms of allergies such as hay fever, redness and swelling due to inflammation, hives, itching, and reactions to insects bites and stings.

Selenium

- Found to have antioxidant properties and protects against cell damage.

Pepcid

- Pepcid is a Histamine-2 or H-2 blocker that works by decreasing the amount of acid produced in the stomach.

Magnesium

- Magnesium plays many crucial roles in the body, such as supporting muscle and nerve function and energy production.

Vitamin D3

- Vitamin D regulates many other cellular functions in your body. Its anti-inflammatory, antioxidant, and neuroprotective properties support immune health, muscle function, and brain cell activity.

Diamine Oxidase - DAO

- Involved in the metabolism, oxidation, and inactivation of histamine.
- The highest levels of DAO expression are observed in the digestive tract.
- A shortage of diamine oxidase in the body it may appear as allergy or histamine intolerance.

Vitamin C

- Research has shown that when Vitamin C levels in the blood fall, histamine levels increase exponentially. When Vitamin C is reintroduced, histamine levels fall exponentially.
- It is frequently combined with Quercetin in supplements.

B-Complex

B-complex vitamins usually contain the following:

- B1 (thiamine): Essential for metabolism by converting nutrients into energy.
- B2 (riboflavin): Converts food into energy and acts as an antioxidant.
- B3 (niacin): Role in cellular signaling, metabolism, and DNA production and repair.
- B5 (pantothenic acid): Helps your body obtain energy from food and is involved in hormone and cholesterol production.
- B6 (pyridoxine): Involved in amino acid metabolism, red blood cell production, and the creation of neurotransmitters.
- B7 (biotin): Essential for carbohydrate and fat metabolism and regulates gene expression.
- B9 (folate): Needed for cell growth, amino acid metabolism, the formation of red and white blood cells, and proper cell division.
- B12 (cobalamin): Vital for neurological function, DNA production, and red blood cell development.

Although these vitamins share some characteristics, they all have unique functions and are needed in different amounts.

Probiotics

- Probiotics are live microorganisms that are intended to have health benefits when consumed or applied to the body.
- Some bacteria help digest food, destroy disease-causing cells, or produce vitamins.
- Many of the microorganisms in probiotic products are the same as or similar to microorganisms that naturally live in our bodies.
- Different types of probiotics may have different effects.
- Prebiotics aren't the same as probiotics but are non-digestible food components that selectively stimulate the growth or activity of desirable microorganisms.
- Probiotics may contain a variety of microorganisms such as Lactobacillus and Bifidobacterium.

Zinc

- Zinc, a nutrient found throughout your body, helps your immune system, metabolism function, and is important to wound healing and your sense of taste and smell.