

Food & The Immune System

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What Makes Up the Immune System?

- 2 types: Innate vs. Adaptive immunity



Innate Immunity

Innate immunity is a first-line defense from pathogens that try to enter our bodies, achieved through protective barriers. These barriers include:

- Skin that keeps out the majority of pathogens
- Mucus that traps pathogens
- Stomach acid that destroys pathogens
- Enzymes in our sweat and tears that help create antibacterial compounds
- Immune system cells that attack all foreign cells entering the body

Adaptive Immunity

Adaptive or acquired immunity is a system that learns to recognize a pathogen.

- Regulated by cells and organs in our body like the spleen, thymus, bone marrow, and lymph nodes.
- When a foreign substance enters the body, these cells and organs create antibodies and lead to multiplication of immune cells (including different types of white blood cells) that are specific to that harmful substance and attack and destroy it.
- Our immune system then adapts by remembering the foreign substance so that if it enters again, these antibodies and cells are even more efficient and quick to destroy it.

What Else Can Impact the Immune System?

- Allergens
- Inflammation
- Autoimmune disorders
- Immunodeficiency



How Does Diet Impact the Immune System?

- *Obesity*: Associated with low-grade chronic inflammation. Fat tissue produces adipocytokines that can promote inflammatory processes.
- *Poor diet*: Malnutrition or a diet lacking in one or more nutrients can impair the production and activity of immune cells and antibodies.
- *Chronic diseases*: Autoimmune and immunodeficiency disorders attack and potentially disable immune cells.
 - Most prevalent chronic diseases: heart disease, cancer, type II diabetes



So Does Eating Certain Foods Really Help With Immunity?

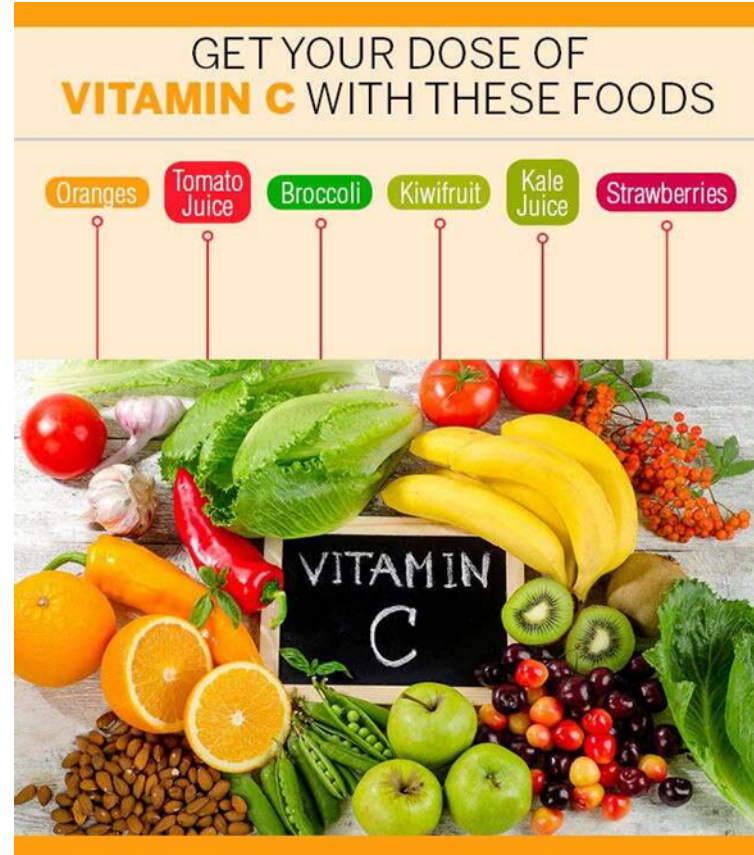
- ***Certain dietary patterns may better prepare the body for microbial attacks and excess inflammation, but it is unlikely that individual foods offer special protection.
- Many micronutrients are needed from a variety of foods to ensure the immune system is functioning optimally.
- Examples of nutrients that have been identified as critical for the growth and function of immune cells include vitamin C, vitamin D, zinc, selenium, iron, probiotics, prebiotics. and protein (including the amino acid glutamine).

Vitamin C

- Vitamin C, also known as L-ascorbic acid, is a water-soluble vitamin.
- Vitamin C is required for the biosynthesis of collagen, L-carnitine, and certain neurotransmitters.
 - Collagen is an essential component of connective tissue, which plays a vital role in wound healing.
- Might help prevent or delay the development of certain cancers, cardiovascular disease, and other diseases
 - Reduces oxidative stress by destroying free radicals
- Improves iron absorption

Foods Highest in Vitamin C

- Red bell peppers
- Orange/orange juice (watch sugar)
- Kiwi
- Strawberries
- Broccoli
- Brussel sprouts
- Tomatoes
- Potatoes



Vitamin D

- Vitamin D (also referred to as “calciferol”) is a fat-soluble vitamin that is naturally present in a few foods, added to others, and available as a dietary supplement.
- It is also produced when ultraviolet (UV) rays from sunlight strike the skin to promote vitamin D synthesis.
- Reduces inflammation
- Children who have vitamin D-deficiency rickets are more likely to get respiratory infections, while children exposed to sunlight seem to have fewer respiratory infections.
- Adults who have low vitamin D levels are more likely to report having had a recent cough, cold, or upper respiratory tract infection.

Foods Containing Vitamin D

- Cod liver oil
- Salmon
- Tuna
- Egg yolks
- Fortified cereals
- Dairy/plant milks fortified with vitamin D
- Cheese
- Orange juice fortified with vitamin D
- Beef liver
- Butter
- Mushrooms



Vitamin D and Sun Exposure

- Season, time of day, length of day, cloud cover, smog, skin melanin content, and sunscreen are among the factors that affect UV radiation exposure and vitamin D synthesis.
 - Older people and people with dark skin have more difficulty producing vitamin D from sunlight.
 - Aim for approximately 5–30 minutes of sun exposure, particularly between 10 a.m. and 4 p.m., either daily or at least twice a week to the face, arms, hands, and legs without sunscreen to ensure sufficient vitamin D synthesis.
 - Federal agencies and national organizations advise using sunscreen with a sun protection factor (SPF) of 15 or higher, whenever people are exposed to the sun.

Zinc

- Zinc is involved in numerous aspects of cellular metabolism.
- Needed for enzyme activity
- Synthesizes protein
- Aids in wound healing
- Synthesizes DNA synthesis
- Divides cells
- Supports normal growth and development during pregnancy, childhood, and adolescence
- Required for proper sense of taste and smell
- **Supplements may interact with medications
- **Zinc deficiency more common in vegans.

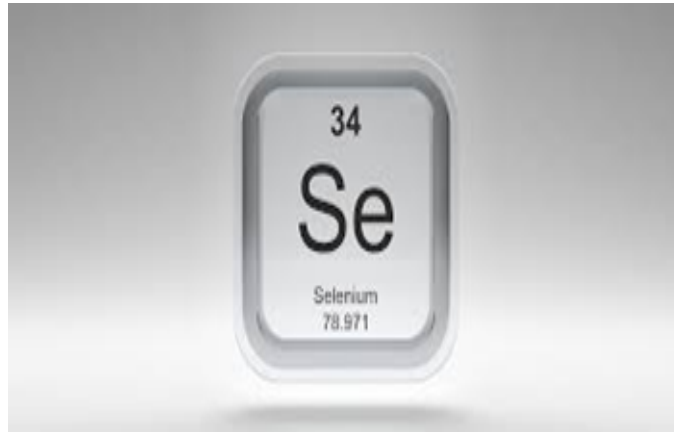
Foods Containing Zinc

- Oysters
- Beef
- Pork
- Beans
- Peas
- Cheese
- Fortified cereal
- Oats
- Cashews
- Milk



Selenium

- Selenium is an essential component of various enzymes and proteins, called selenoproteins, that help to make DNA and protect against cell damage and infections
- Has antioxidant properties that help to break down peroxides, which can damage tissues and DNA, leading to inflammation and other health problems.



Selenium-Rich Foods

- Brazil nuts
- Fish
- Beef
- Turkey
- Chicken
- Fortified cereals
- Beans
- Lentils
- Whole-wheat bread



Iron

- Iron is an essential component of hemoglobin, an erythrocyte (red blood cell) protein that transfers oxygen from the lungs to the tissues.
- Iron is also a component of myoglobin, another protein that provides oxygen, iron supports muscle metabolism and healthy connective tissue.
- Iron is also necessary for physical growth, neurological development, cellular functioning, and synthesis of some hormones.



Iron Food Sources

- Fortified breakfast cereals
- Cow's milk
- White beans
- Chicken
- Tuna
- Turkey
- Beef
- Whole eggs
- Dark chocolate
- Tofu
- Nuts
- Peas/legumes
- Spinach



Glutamine

- Glutamine is a protein building block found abundantly in the body.
- It is important for the function of white blood cells.
- The proven roles of glutamine include:
 - Promotion of gut mucosal integrity by acting as an energy source and preventing bacterial translocation;
 - Fuel source for cells of the immune system
 - Improved nitrogen balance in times of stress.

Sources of Protein/Glutamine

- Chicken
- Fish
- Beef
- Pork
- Beans
- Dairy

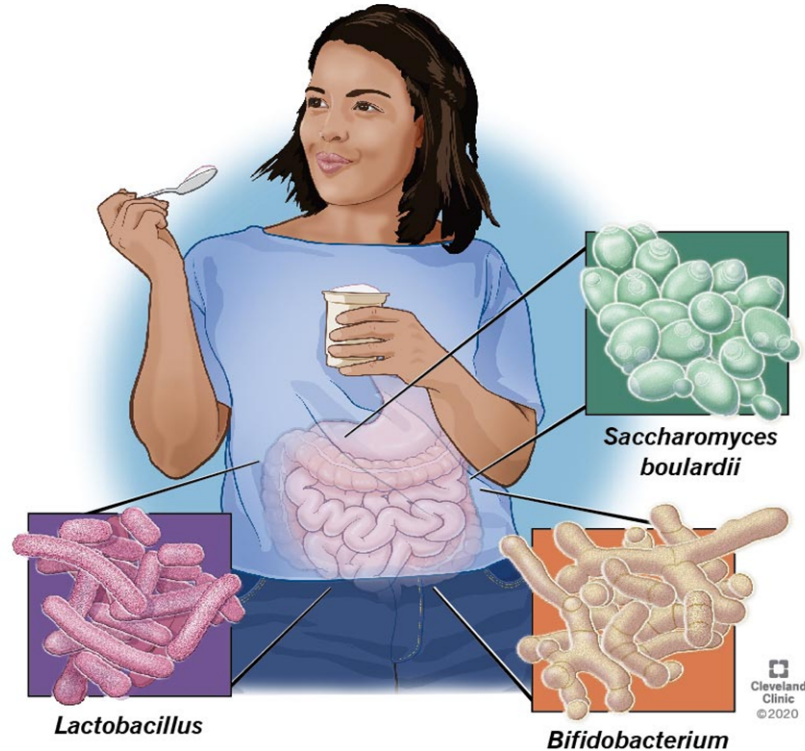


Probiotics

- Probiotics are a combination of live beneficial bacteria and/or yeasts that naturally live in your body.
- Good bacteria keeps you healthy by supporting your immune function and controlling inflammation. Certain types of good bacteria can also:
 - Help your body digest food.
 - Keep bad bacteria from getting out of control and making you sick.
 - Create vitamins.
 - Help support the cells that line your gut to prevent bad bacteria that you may have consumed (through food or drinks) from entering your blood.
 - Breakdown and absorb medications.

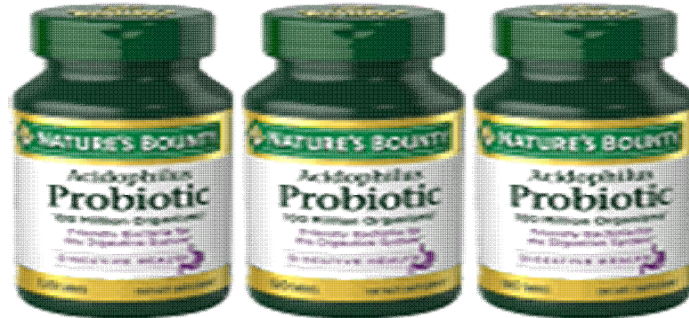
Probiotic-Containing Foods

- Yogurt
- Cottage cheese
- Fermented sauerkraut
- Kombucha tea
- Keifer
- Tempeh
- Miso
- Kimchi
- Buttermilk
- Sourdough bread



Probiotic Supplements

- Probiotics have over 1 billion strains. Be sure to pick the right probiotic supplement for you!
- Store probiotic in refrigerator.
- Take probiotic before first meal of the day or before bed if eating several hours before bedtime.
 - Probiotics work best when stomach acidity is at its lowest, or when it is not working to digest food.



Prebiotics

- Prebiotics are naturally occurring, non-digestible food components that are linked to promoting the growth of helpful bacteria in your gut.
- Prebiotics may improve gastrointestinal health as well as potentially enhance calcium absorption.



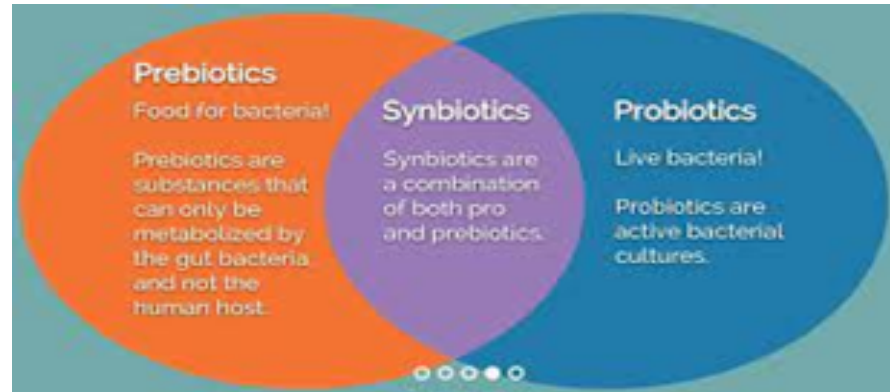
Foods With Prebiotic Functions

- **Fruits**
 - Bananas
- **Vegetables**
 - Garlic
 - Onions
 - Leeks
 - Asparagus
 - Artichokes
 - Beans
- **Whole grains**
 - Oats



Synbiotics

- Prebiotics are fuel for probiotics, which restore and improve GI health.
- Products that combine these together are called synbiotics.
- Try pairing prebiotic and probiotic-containing foods together for best results:
 - Ex; Salsa with garlic and onions, bananas and yogurt. Stir-fried asparagus with tempeh



How Can You Ensure Optimal Immunity?

1. Eat a balanced diet with whole fruits, vegetables, lean proteins, whole grains, and plenty of water.
2. If a balanced diet is not readily accessible, taking a multivitamin containing the RDA for several nutrients may be used.
3. Don't smoke (or stop smoking if you do).
4. Drink alcohol in moderation.
5. Perform moderate regular exercise. (~150 min/wk)
6. Aim for 7-9 hours of sleep nightly. Try to keep a sleep schedule, waking up and going to bed around the same time each day.
7. Aim to manage stress.
8. Wash hands throughout the day: when coming in from outdoors, before and after preparing and eating food, after using the toilet, after coughing or blowing your nose.

Resources

1. <https://www.hsph.harvard.edu/nutritionsource/nutrition-and-immunity/>
2. <https://ods.od.nih.gov/factsheets/VitaminC-HealthProfessional/>
3. <https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/>
4. <https://ods.od.nih.gov/factsheets/Zinc-HealthProfessional/#en4>
5. <https://www.hsph.harvard.edu/nutritionsource/selenium/>
6. <https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/>
7. <https://badgut.org/information-centre/health-nutrition/glutamine/>
8. <https://my.clevelandclinic.org/health/articles/14598-probiotics>
9. <https://www.healthline.com/nutrition/best-probiotic-supplement>
10. <https://www.eatright.org/food/vitamins-and-supplements/nutrient-rich-foods/prebiotics-and-probiotics-creating-a-healthier-you>