The Microbiome, Prebiotics, and Probiotics

September 18th, 2020
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Objectives

• Define gut microbiome

• Define prebiotics

• Define probiotics

• Identify food sources of prebiotics and probiotics

• Define gut microbiome and how it is impacted by prebiotics and probiotics
Digestive disorders affect the quality of life and overall health of millions of people each year

- Acid reflux
- GERD
- Gallstones
- Vomiting
- Diarrhea
- Constipation
- Hemorrhoids
- Diverticular disease
- Gastritis
- Ulcer

Gut Microbiome

- First recognized in the late 1990s
- The lining of your gut, like every surface of your body, is covered in microscopic creatures, mostly bacteria.
  - Microbiota
  - Microbes
  - Thousands of species
- These organisms create a micro-ecosystem called the microbiome.

- Although we don't really notice it's there, it plays an oversized role in your health and can even affect your mood and behavior.

- What you feed your microbiome may have the biggest impact on its health.

https://www.mayoclinic.org/prebiotics-probiotics-and-your-health/art-20390058
The gut microbial balance is critically important for good health

**BENEFITS OF A HEALTHY GUT MICROBIOTA**

- Retrieves some energy from undigested carbohydrates
- Improves the health of mucosa in the gut
- Synthesizes vitamin K, folate, biotin
- Displaces pathogenic ("bad") bacteria
- Promotes immune system health
- Enhances mineral absorption
- Reduces cancer risk

**Probiotics**: Live microorganisms that provide health benefits when administered in adequate amounts. These microbes may be in foods, pills, or creams. Bacterial strains most commonly accepted as being health promoting are:

- *Bifidobacterium sp.*
- *Lactobacillus sp.*

**PREBIOTICS PROMOTE THE GROWTH OF BENEFICIAL MICROBES IN OUR INTESTINES**

Prebiotics are undigested carbohydrates in our foods that make their way to the large intestine where they can be used by beneficial microbes already present in the gut. Initially, we see a situation with low prebiotic consumption.

As more prebiotic compounds are consumed, beneficial microbes have increased opportunity to use them as an energy source, whereas "bad" microbes cannot effectively use these compounds. This selectively promotes the growth of beneficial microbes.

The continued supply of prebiotics in the diet provides a competitive advantage to beneficial microbes, allowing them to grow and divide more rapidly than those that are undesirable. As a result, good microbes compete for nutrients and attachment sites on the wall of the large intestine, causing "bad" microbes to decrease in number.

Pope/Nizielski, *Nutrition for a Chc*

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[Logo images for Division of Agriculture, University of Arkansas System, and Center for Human Nutrition]
Gut Microbiome

• Each person has an entirely unique network of microbiota that is originally determined by one’s DNA.

• A person is first exposed to microorganisms as an infant, during delivery in the birth canal and through the mother’s breast milk.
  • Exactly which microorganisms the infant is exposed to depends solely on the species found in the mother.

• Later on, environmental exposures and diet can change one’s microbiome to be either beneficial to health or place one at greater risk for disease.

Source: https://www.hsph.harvard.edu/nutritionsource/microbiome/#what-is-microbiome
Gut Microbiome

• The microbiome consists of microbes that are both helpful and potentially harmful

• Most are symbiotic (where both the human body and microbiota benefit)

• Some, in smaller numbers, are pathogenic (promoting disease)

• In a healthy body, pathogenic and symbiotic microbiota coexist without problems.
  • But if there is a disturbance in that balance—brought on by infectious illnesses, certain diets, or the prolonged use of antibiotics or other bacteria-destroying medications—dysbiosis occurs, stopping these normal interactions. As a result, the body may become more susceptible to disease.

Source: https://www.hsph.harvard.edu/nutritionsource/microbiome/#what-is-microbiome
Factors that Influence the Gut Microbiome

Schematic representation of the role of the gut microbiota in health and disease giving some examples of inputs and outputs.

Ana M Valdes et al. BMJ 2018;361:bmj.k2179
The microbiome-gut-brain axis

The brain can influence gut microbiota
- Normal gut microbiota affected by stress-induced changes in gastrointestinal:
  - Epithelial function
  - Mucin production
  - Enteroendocrine cell function
  - Motility
  - Immune responses

The gut microbiota can influence brain and behaviour:
- Activation of neural afferent circuits to the brain
- Activation of mucosal immune responses
- Production of metabolites that directly influence the CNS

Quigley, E. M. M. (2017) Gut microbiome as a clinical tool in gastrointestinal disease management: are we there yet? 

Modified, with permission, from Elsevier © Collins, S. M. & Bercik P. 
How microbiota benefit the body

- Microbiota stimulate the [immune system](https://www.hsph.harvard.edu/nutritionsource/microbiome/#what-is-microbiome), break down potentially toxic food compounds

- Synthesize certain vitamins and amino acids, including the B vitamins and vitamin K. For example, the key enzymes needed to form vitamin B12 are only found in bacteria, not in plants and animals.

- Complex carbohydrates like starches and fibers are not as easily digested and may travel lower to the large intestine. There, the microbiota help to break down these compounds with their digestive enzymes.
  - The fermentation of indigestible fibers causes the production of short chain fatty acids (SCFA) that can be used by the body as a nutrient source
  - SCFA Play an important role in muscle function
  - SCFA possibly play a role in the prevention of chronic diseases, including certain cancers and bowel disorders. Clinical studies have shown that SCFA may be useful in the treatment of ulcerative colitis, Crohn’s disease, and antibiotic-associated diarrhea
How microbiota benefit the body

• The microbiota of a healthy person will also provide protection from pathogenic organisms that enter the body such as through drinking or eating contaminated water or food.

• Large families of bacteria found in the human gut include *Prevotella*, *Ruminococcus*, *Bacteroides*, and *Firmicutes*.

• In the colon, a low oxygen environment, you will find the anaerobic bacteria *Peptostreptococcus*, *Bifidobacterium*, *Lactobacillus*, and *Clostridium*.
  • These microbes are believed to prevent the overgrowth of harmful bacteria by competing for nutrients and attachment sites to the mucus membranes of the gut, a major site of immune activity and production of antimicrobial proteins.

Source:
https://www.hsph.harvard.edu/nutritionsource/microbiome/#what-is-microbiome
2 ways to help your gut microbiome grow

- There are two ways to maintain this balance:
  - Helping the microbes already there to grow by giving them the foods they like (prebiotic)
  - Adding living microbes directly to your system (probiotic).

https://www.mayoclinic.org/prebiotics-probiotics-and-your-health/art-20390058

Prebiotics

• Prebiotics are fibers that feed and maintain bacteria in the gut.
  • Food for the bacteria
  • Nonliving
  • Naturally occurring
  • Non-digestible

• Prebiotic fiber moves through the GI tract untouched until it reaches the colon where it is fermented.

• The fermentation process produces short-chain fatty acids, which feed and increase the colonies of beneficial bacteria already present in the gut.

• Found in plant foods.

Source: https://www.umassmed.edu/nutrition/blog/blog-posts/2019/4/probiotics-vs-prebiotics/
# Good Sources of Prebiotics

## Foods
- Steel cut oats
- Bananas
- Ground flax seeds
- Chia seeds
- Chicory root
- Asparagus
- Onions
- Jerusalem artichokes
- Dandelion greens
- Apples
- Leeks
- Legumes/beans
- Garlic

## Ingredient Label
- Inulin
- Fructo-oligosaccharides (FOS)
- Trans galacto-oligosaccharides (TOS)
- Resistant starch
- Gums
- Pectin

[http://thecandidaguide.com/probiotics-prebiotics/prebiotics/]
Most Americans do not eat enough fiber

• We need to consume 25-35 grams of fiber in order for the gut bacteria to survive and replicate.

Probiotics

• Probiotics are live microorganisms considered to be the “good bacteria”.

• These microorganisms are normally present in the intestines and have many essential functions such as to aid digestion and nutrient absorption, fight disease-causing bacteria, and contribute to immune function.

• An estimated one hundred trillion microorganisms including more than five hundred different species inhabit every healthy bowel, and do not generally make us sick.

• Probiotic supplement sales exceeded $35 billion in 2015, with a projected increase to $65 billion by 2024.

Source: https://www.umassmed.edu/nutrition/blog-blog-posts/2019/4/probiotics-vs-prebiotics/
Fermented Foods

• Fermented foods are a great source of probiotics because they contain live bacteria within them
  • Kefir
  • Plain Yogurt
  • Aged Cheese
  • Fermented Vegetables
  • Miso
  • Microalgae
  • Pickles
  • Raw Honey
  • Sauerkraut
  • Kimchi
  • Kombucha

https://time.com/5236659/best-probiotic-foods/
Example: Kefir & Yogurt

Kefir: a fermented milk drink

Nutrition Facts
- Serving Size: 1 Container (150g)
- Servings Per Container: 4

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<td>Vitamin D</td>
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Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Ingredients:
- Cultured Grade A non-fat milk, sugar, water, contains less than 1% of modified food starch, natural flavors, malic acid, sodium citrate, vitamin B12.
- Contains live cultures: L. bulgaricus and S. thermophilus
- Contains live and active probiotic: B. lactis DN 173-010/CNCM I-2494
- Contains billions of live and active probiotics per serving
- Keep refrigerated
- With room for toppings
- Grade A Kosher K
- Partially produced with genetic engineering

LifeWay Kefir contains seven to ten billion CFUs (colony forming units) per serving.
Example: Kombucha

• A fermented, sweetened black or green tea drink commonly consumed for its supposed health benefits.

• Produced by fermenting sugared tea using a symbiotic culture of bacteria and yeast (SCOBY) commonly called a "mother" or "mushroom".

• The living bacteria are said to be probiotic, one of the reasons for the popularity of the drink.
RAW CHIA - RAW ENERGY. Often called "runner's food", chia is a nutrient-rich superfood that provides sustained energy for your body. Packed with more than 8 times the omega 3s found in salmon, this small seed has big nutritional value. With more antioxidants than blueberries and more fiber than oatmeal, see for yourself how chia brings new life to our GT's Kombucha.

Ingredients: G.T.'s organic raw kombucha*, raw chia seeds*, black currant juice* and 100% pure love!!

Organically produced. Gluten-free • Vegan • Non-GMO
This product contains a trace amount of alcohol.

KEEP REFRIGERATED HIGHLY PERISHABLE SHAKE GENTLY
5% REF. ME & H. PLEASE RECYLE

Nutrition Facts
Serving Size 8 fl. oz.
Servings Per Container 2

Amount Per Serving
Calories 73
Calories from Fat 0
% Daily Value
Total Fat 0g 0%
Saturated Fat 0g 0%
Trans Fat 0g 0%
Cholesterol 0mg 0%
Sodium 10mg 0%
Total Carbohydrate 8g 2%
Dietary Fiber 4g 16%
Sugars 4g 9%
Protein 2g 4%

Additional Nutrients (per bottle):
Omega-3 (Alpha-Linolenic Acid) 4200 mg
Omega-6 (Linoleic Acid) 1400 mg

ProBIOTIC ORGANISM CONTENT:
Bacillus coagulans G01-32 6086: 1 billion
S. Boulardii: 1 billion

Antioxidants & Organic Acids:
EGCG 100mg - Glucoronic Acid 10mg
L (+) Lactic Acid 25mg - Acetic Acid 30mg

G.T. Dave began bottling Kombucha in 1995 from his mother's kitchen. He had no business plan, just a desire to share this gift with anybody who could benefit from it. Although G.T.'s Kombucha has grown from its humble beginnings, he remains committed to expanding the company gradually and organically, never sacrificing quality for the sake of profits.

Words of Enlightenment
"To reawaken is to reawaken your life and that allows you to redefine or repurpose your destiny."

Jeffrey Joy
Customer of 10 years
Portland, OR

Want to see YOUR quote on OUR Label?
We invite you to Enlighten us at
facebook.com/GTsKombucha

GT's
BLACK CHIA
16 oz 95% G.T.'s Kombucha 480 mL

©2016 GT's Kombucha. All Rights Reserved. Our products are made with amazing care. We aim to provide safe and fresh products. Our bottles may have minor imperfections. We strive to provide the best possible product. Please report any issues to us. We will do our best to resolve any issues.

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Certified Organic by Organic Certifiers, Inc.
Synbiotics

• Ultimately, prebiotics, or "good" bacteria promoters, and probiotics, the "good" bacteria, work together synergistically.

• In other words, prebiotics are breakfast, lunch and dinner for probiotics, which restores and can improve GI health.

• Products that combine these together are called synbiotics.

Summary

Consuming a variety of foods providing prebiotics and probiotics promotes a healthy balance of “friendly” bacteria

Photo credit (all photos): Scimat/Science Source
Next Week -
The Science of Dietary Fat: The
Latest Research from UAMS

Dr. Elisabet Borsheim
Questions?