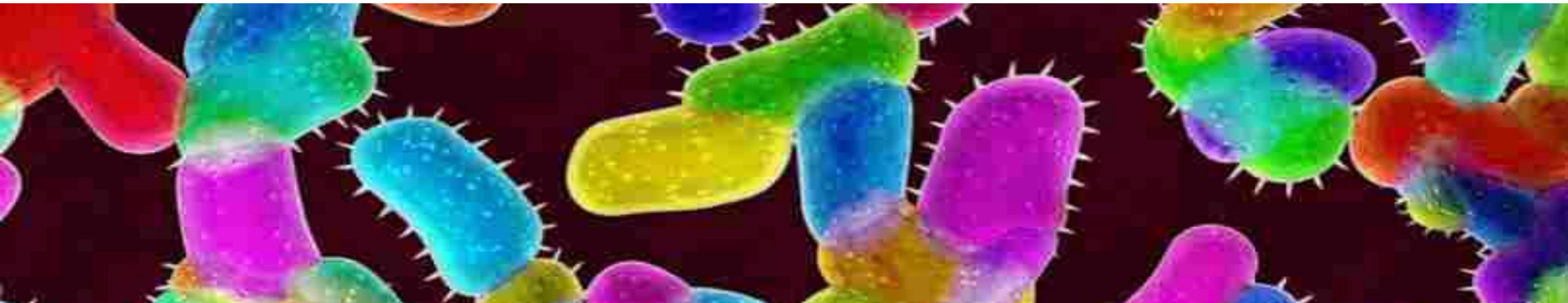
Pre and Probiotics

Jessica Luong, Rahyana Shahsamand & Payton Harmon



Importance of the Gut Microbiota

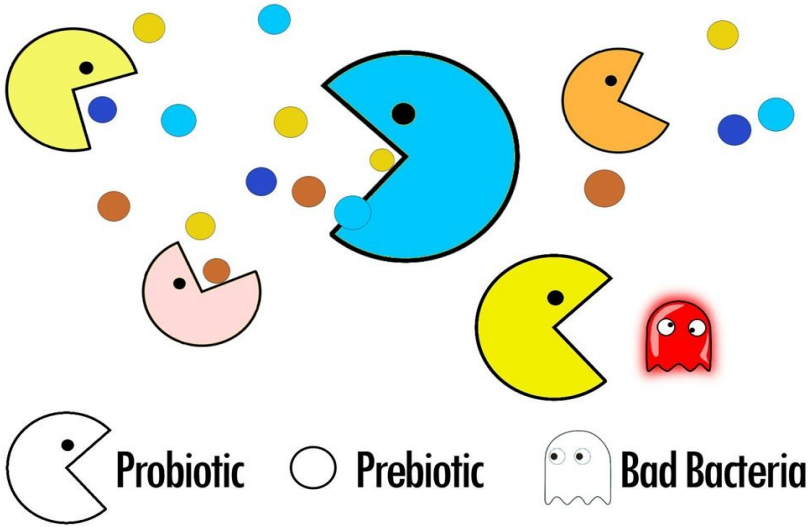
- Human gut microbiota is comprised of 2 major phyla:
  - Bacteroidetes- "good" bacteria
  - Firmicutes- "bad" bacteria
- A healthy microbiota is essential for overall good health
  - Studies have shown an increase in firmicutes v. bacteroidetes is linked to obesity, colorectal cancer, Irritable Bowel Syndrome, Irritable Bowel Disease, Diabetes, Rheumatoid arthritis
- Plays an important role in maintaining good health by providing energy, nutrients and immunological protection.
- Pre and probiotics have a symbiotic relationship with the microbiota
  - Synbiotics were developed to overcome the possible survival difficulties for probiotics (pH, H_2O_2, organic acids, oxygen, moisture stress etc.)

Jandhyala, Sai Manasa, et al. 7 Aug. 2015

Koliada, Alexander, et al. 2017

What are prebiotics?

- *"Nonviable food component that confer health benefit(s) on the host associated with modulation of the microbiota"* -FAO and WHO
- Non-digestible food ingredient that stimulates the growth and activity of bifidobacteria and lactobacilli in the GI tract.
  - Prebiotics selectively stimulate the growth and/or activity of some genera of microorganism in the colon
- "Good" bacteria promoters
- Types of prebiotics:
  - Dietary fibers
  - Fructo-oligosaccharides
  - Galacto-oligosaccharides
  - Inulin
  - Lactulose
  - Lactitol



Pandey, Kavita R, et al. 2015

Prebiotic	Medical/clinical benefits	Mechanisms of action	Reference
Inulin	Crohn's disease	Enhancement of immune response	Emilia et al. (162)
	Colitis	Effect on innate immunity	Macfarlane et al. (163), Ramirez-Farias et al. (164)
	Obesity	Modification of microbiota and increase in *Bifidobacteria*	Hopping et al. (165)
	Diabetes type 2		Costabile et al. (166)
	Colon cancer		Ramnani et al. (167)
	Constipation		
FOS (Fructo-oligosaccharides)	Crohn's disease	Increase in *Bifidobacteria*	Scholtens et al. (168)
	Colitis,	Decrease in colon pH	Benjamin et al. (169)
	Obesity	Reduction in lipid accumulation	de Luis et al. (170)
	Constipation	Secretion of anti-inflammatory substances	Cummings et al. (171)
	Travelers' diarrhea	Local induction of reactive oxygen species (ROS)	Arslanoglu et al. (172)
	Colon cancer		Boutron-Ruault et al. (173)
GOS (Galacto-oligosaccharides)	Crohn's disease	Improvement of growth performance and immune responses	Saavedra and Tschernia (174)
	Colitis	Diminishment of intestinal bacterial overgrowth	Macfarlane et al. (163)
	Obesity		Drakoularakou et al. (175)
Soluble fiber (Guar gum, pectin)	Crohn's disease	Enhancement of short-chain fatty acid production, and mainly acetate	Peng et al. (176)
	Celiac disease	Normalization of intestinal microbiota	Slavin (177)
	Colitis	Effects on epithelial permeability	Chen et al. (178)
	Colon cancer	Trophic effects on enterocytes	Hu et al. (179)
	Metabolic syndrome	Anti-inflammatory effects	Cao et al. (180)
	Arthritis	Enhancement of immune response	Slavin (181)
	Cardiovascular diseases	Reduction of blood pressure and reduction of LDL serum concentrations	

Vieira, Angelica, et al..2013

What are probiotics?

- Pro- "for" Bio- "life"
- *"Live microorganism which when administered in adequate amounts confer a health benefit to the host."* - FDA and WHO
- "Good" bacteria and yeasts that improves intestinal microbial balance.
- GI tract is the best "home" for probiotics to live and flourish
    - Small amounts are found in the stomach and small intestine but majority are found in the colon.

Pandey, Kavita R, et al. 2015

Probiotic strains

- Effects of probiotics are strain specific- a single strain can exhibit different benefits when used individually and in combination.
  - Studies have shown greater efficacy with multistrain probiotics.
  - Benefits of probiotic formulation also differ with the patient group
- 27 infants with atopic eczema were given formula substituted with B. lactis (Isolauri, E, et al)
  - Started with a SCORAD of 16 after 2 months the SCORAD decreased to 0
- 16 adults with IBS were given doses of B. infantis (Brenner, D M, et al. 2009)
  - 11 of the individuals showed none to a significant reduction in symptoms
- 37 colon cancer patients were administered fructo-oligosaccharides, L. rhamnosus GG and B. lactis, after 12 wks
  - Increased lactobacilli & bifidobacteria
  - Significant decrease in colorectal cancer cell proliferation
  - Decreased exposure to genotoxins
  - Increased interferon gamma

Lactobacilli	Bifidobacteria	Others
L. casei Shirota	*B. longum*	*Escherichia coli* Nissle
L. rhamnosus GG	*B. bifidum*	*Saccharomyces boulardii*
L. johnsonii	*B. infantis*	*Enterococcus faecalis*
L. acidophilus	*B. lactis*	*Lactococcus lactis*
L. gasseri	*B. breve*	Propionibacteria
L. reuteri	*B. animalis*	
L. casei	*B, adolescentis*	
L. fermentum		
L. crispatus		

Mechanism of action: prebiotics

- Act as food for your microbiome.
  - Can digest the polymers that humans cannot
- The most ‘beneficial’ bacteria are saccharolytic, benefit from availability of starches and complex carbohydrates.
  - *Bifidobacteria* and *Lactobacilli*
  - Prebiotics encourage the growth of these bacteria, allowing them to dominate the endotoxin producing bacteria
- Bacteria ferment prebiotics to produce SCFAs, the preferred substrates for colonic epithelial cells.
- Enhances health of intestinal wall cells
  - Creates tighter junctions between cells and reduces leaking of toxins into the plasma

Slavin J. (2013).

Mechanism of action: probiotics

- 2 General Mechanisms:
  - Colonizing the intestine when they enter your digestive tract
  - OR influencing and remodeling the existing populations while passing through the GI tract
- Certain strains will colonize and exert benefits by attaching to the intestinal mucosa
- Other strains will provide helpful metabolites to preexisting species and help the "good" bacteria become more dominant in the intestine.

K Gogineni, V., & Morrow, L. (2013).
Bermudez-Brito, M., Plaza-Díaz, J., Muñoz-Quezada, S., Gómez-Llorente, C., & Gil, A. (2012).

Fun Fact(s)!

There are 10x more microbial cells in your intestine than there are human cells in your body

Pathogenic bacteria like E. coli and Enterococci live in your gut but it's fine because they're not in your blood

killing you!!!!!! :)

What are they found in?

Prebiotics

- Garlic
- Onions
- Asparagus
- Bananas
- Jerusalem artichoke
- Apples

Probiotics

- Yogurt (containing live bacteria cultures)
- Kefir
- Sauerkraut
- Tempeh
- Kimchi
- Miso
- Kombucha
- Cheese (not baked)
- Pickled foods

Target Populations

- Probiotics are commonly used to reduce gastrointestinal symptoms
- In some cases, probiotics from food or supplements may help individuals with irritable bowel syndrome, Crohn's disease or other health problems (but there is also potential for harm if used improperly or in combination with other medications)
- Individuals who are on antibiotics
    - Help restore gut flora following antibiotics
    - “one month of probiotic treatment for every week that a patient was on antibiotics.”

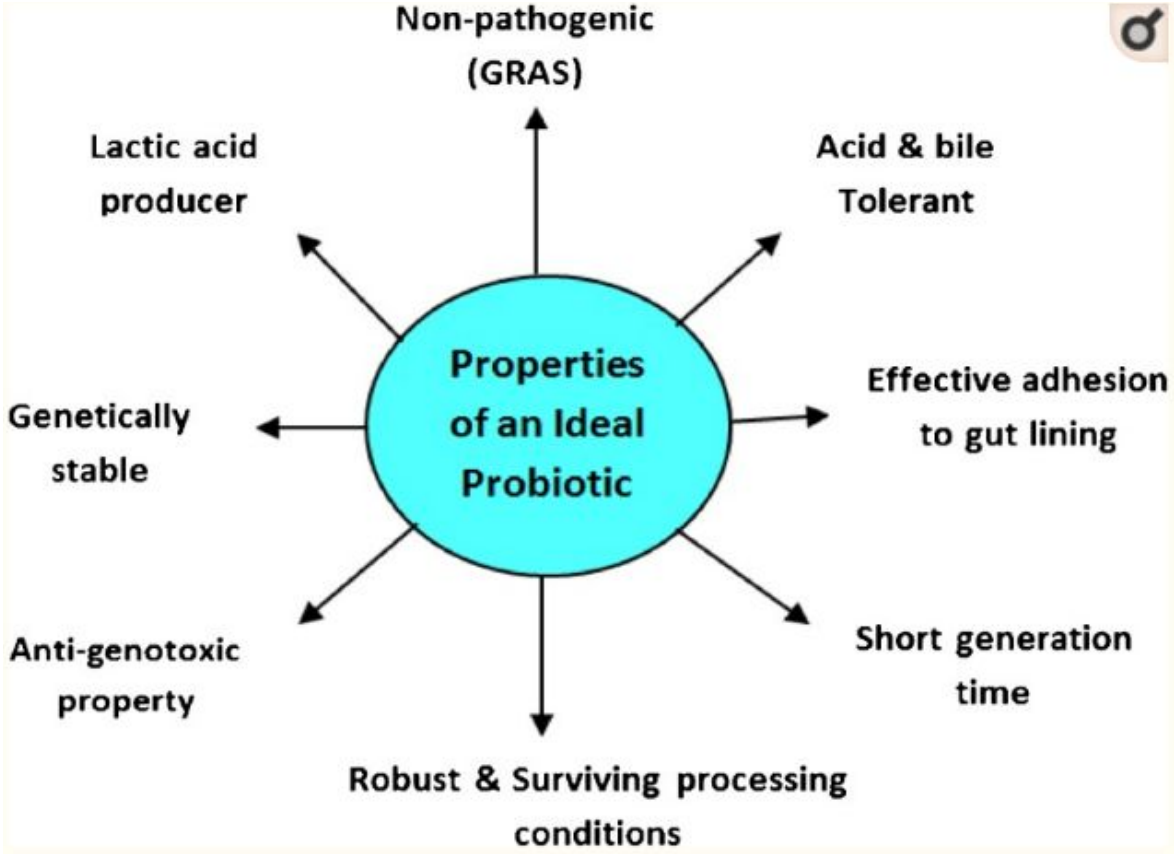
Regulation of prebiotics

- In the United States, functional foods can be regulated as conventional food, a dietary supplement, a food for special dietary use, a medical food, or a drug. Often these distinctions depend on the claims made for the product and how they are marketed. The addition of prebiotics to foods may classify the food as functional foods.
- The 2010 Dietary Guidelines Advisory Committee understands that the role of gut microbiota is an important emerging area of research, however more research needs to be done

Regulation of Probiotics

- FAO and WHO created a global standard of guidelines for a systematic approach for evaluation of probiotics in foods to substantiate health claims
  - Guidelines make it necessary to perform the following evaluations:
    - Strain identification.
    - Functional characterization of the strain(s) for safety and probiotic attributes.
    - Validation of health benefits in human studies.
    - Honest, not misleading labeling of efficacy claims and content for the entire shelf life.

According to FAO and WHO these are some of the prerequisites of an ideal probiotic:



Potential Benefits and Health Claims

- Many claims are general, including “boosts the immune system” and “improves gut health”
- However, there is evidence that prebiotics reduce intestinal permeability, leading to lower inflammation, which has positive effects for many conditions
- Prebiotics are generally dietary fiber, which is correlated with reduced risk of Type 2 Diabetes, coronary heart disease, and better weight management
- Probiotics have similar claims, but shakier evidence.

Delcour, J., Aman, P., Courtin, C., Hamaker, B., & Verbeke, K. (2016).

Potential Risks and Side Effects

- Short term side effects include gas and bloating, but immunocompromised people, pregnant women, as well as infants and young children should be more cautious
- Because both pre- and probiotics are found in foods that most people already consume, it is safe to eat them in foods in amounts you already consume
- However, if you are taking them as pills or capsules, or have digestive problems, you should consult a physician or dietitian

Would we recommend them?

Yes!

Eating recommended amounts of vegetables and fermented foods in moderation is helpful to you in many ways!

BUT!

If you have any health concerns (irritable bowel disease, immunocompromised, etc.), or are looking to use pre- and probiotics as a way to lose weight, consult a doctor or dietitian!

Questions?

Resources

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