NUTRICIA LEARNING CENTER

Dietary Fiber, Prebiotics, and Adult Health

Hannah D. Holscher, PhD, RD

March 6, 2018

Dietary Fiber, Prebiotics, and Adult Health

Hannah D. Holscher, PhD, RD

Assistant Professor of Nutrition
Department of Food Science and Human Nutrition
Division of Nutritional Sciences
University of Illinois

Nutrition & Human
Microbiome Laboratory

Disclosures

- Research Grants
  - Foundation for Food and Agriculture Research
  - Hass Avocado Board
  - United States Department of Agriculture

- ***None pose any conflict of interest for this presentation***

The opinions reflected in this presentation are those of the speaker and independent of Nutricia North America.

Learning Objectives

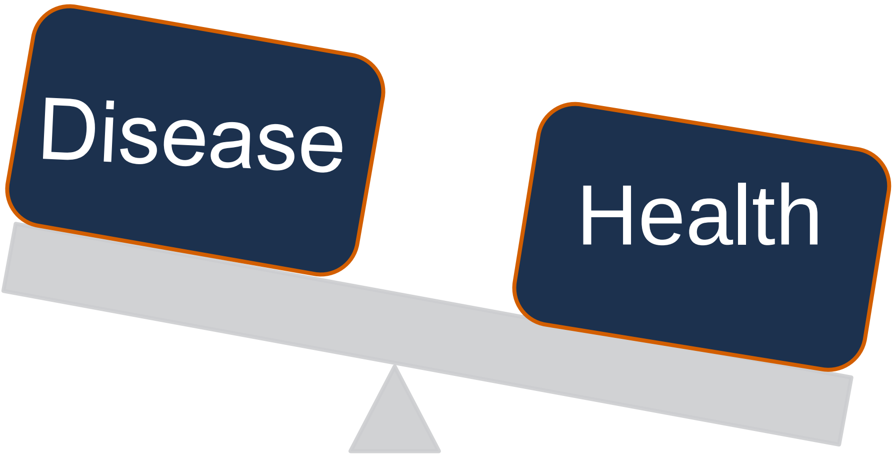
- Define dietary fiber and prebiotics.
- Identify dietary fibers and prebiotics that can be fermented by the microbiota.
- Establish a connection between the gastrointestinal microbiota and adult health:
  - Compare and contrast fiber consumption and microbial connections.
  - Discuss the ways fiber can be used to modulate GI microbes and adult health.

Definitions and Overview

Microbiome *- a collection of microbial genomes*

Microbiota *– a collection of microbes*

- As many bacteria as host cells in human body[1]
- > 150x more bacterial genes than our human genome[2]

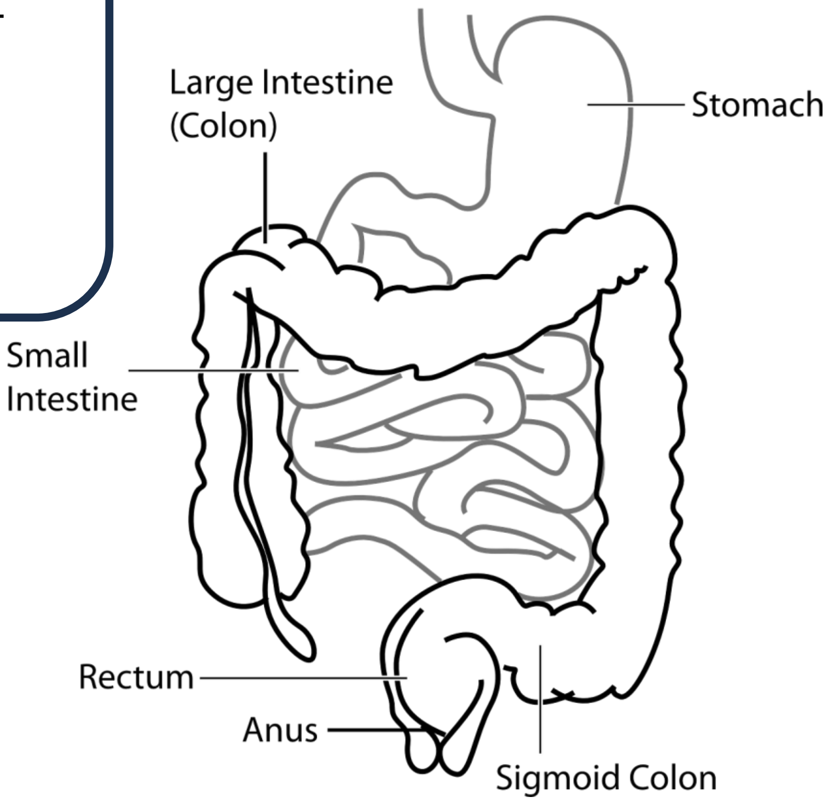


1. Sender, R., et al. (2016). Are we really vastly outnumbered? Revisiting the ratio of bacterial to host cells in humans. *Cell*, 164(3), 337-340.
2. Qin, J., et al. (2010). A human gut microbial gene catalog established by metagenomic sequencing. *Nature*, 464(7285), 59.

Microbiota Varies through GI Tract

Stomach & Duodenum
$10^1 – 10^2$ CFU/mL
Helicobacter
Streptococcus

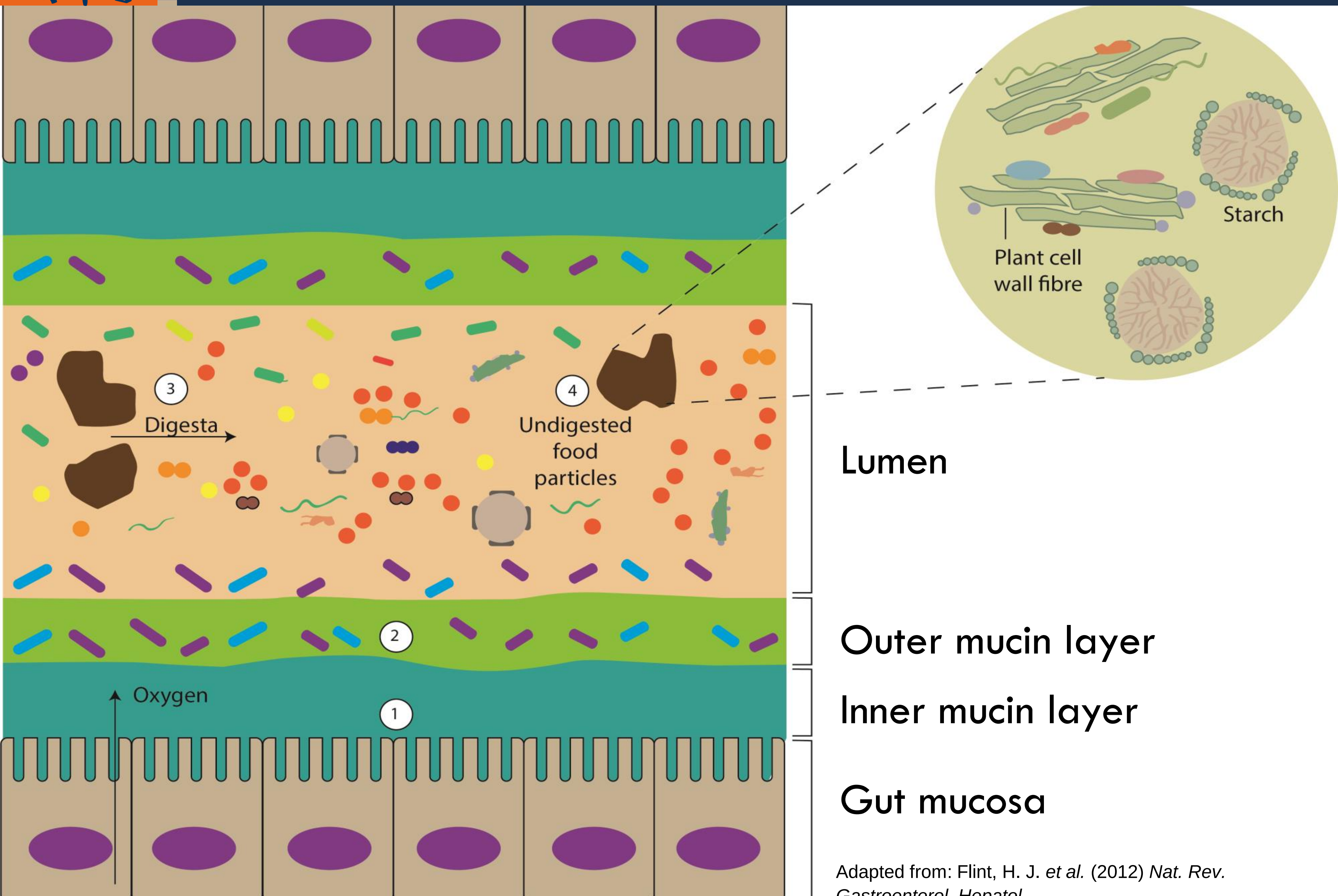
Jejunum & Ileum
$10^4 – 10^8$ CFU/mL
Bacteroides
Streptococcus
Lactobacillius
Bifidobacteria
Fusobacteria



Colon
$10^{10} – 10^{12}$ CFU/mL
Bacteroides
Prevotella
Facaelbacterium
Ruminococcus
Roseburia
Clostridium
Bifidobacteria
Collinsella
Desulfovibrio
Bilophila
Akkermansia
Methanobrevibacter

Adapted from: Krause's Food & the Nutrition Care Process, 14th Ed.

GI Microbial Microenvironments



Adapted from: Flint, H. J. *et al.* (2012) *Nat. Rev. Gastroenterol. Hepatol.*

GI Microbiota Functions

Metabolic functions

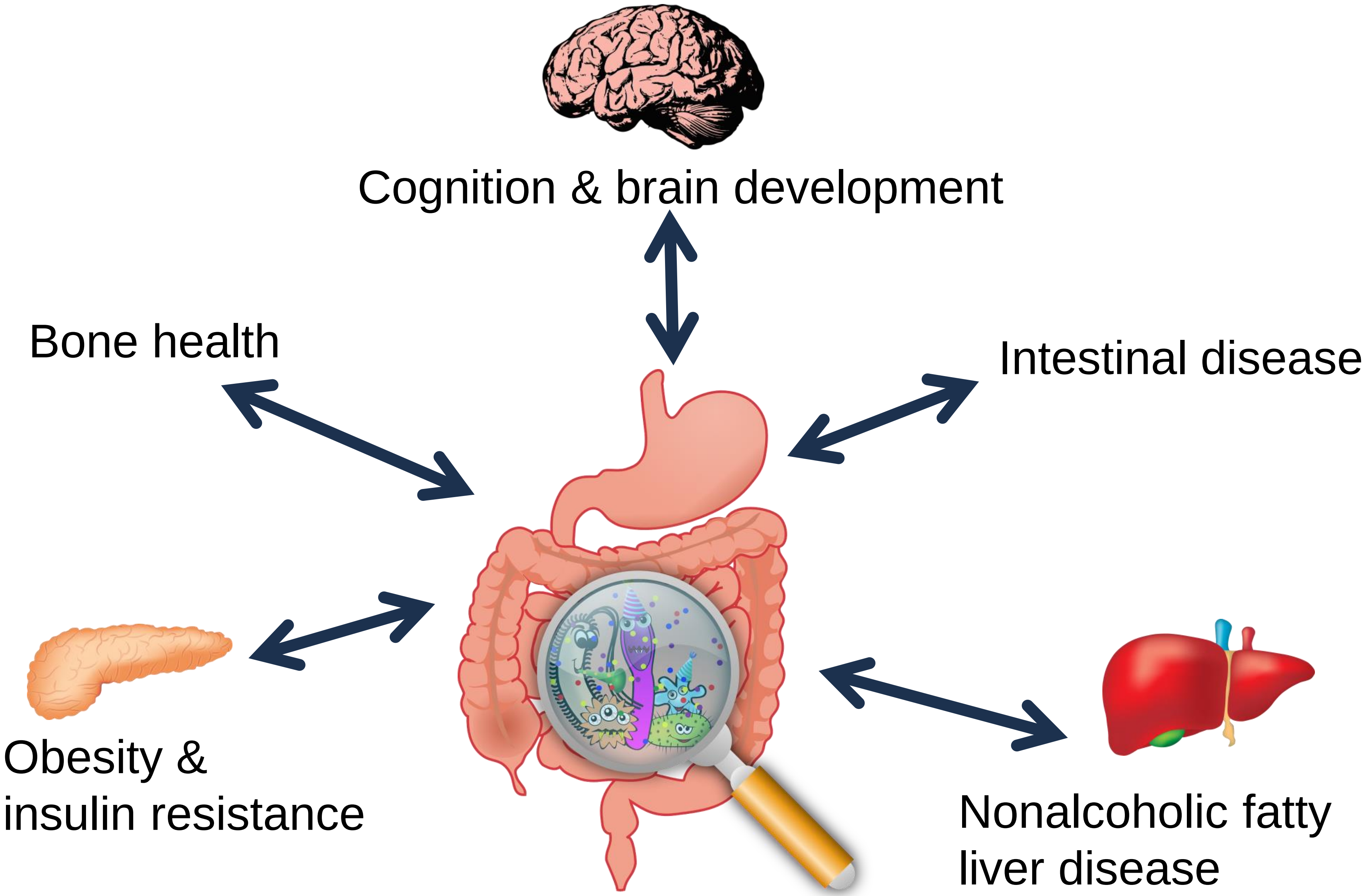
- Ferment nondigested food
  - Dietary fiber
  - Resistant starch
  - Protein
- Synthesize secondary bile acids
- Synthesize vitamins
  - B vitamins
  - Vitamin K
- Synthesize neurotransmitters
  - GABA
  - Serotonin

Protective functions

- Pathogen displacement
- Nutrient competition
- Immune stimulation
- Antimicrobial secretion

Goldszmid, R. S., & Trinchieri, G. (2012). The price of immunity. Nature immunology, 13(10), 932-938.
Sonnenburg, J. L., & Bäckhed, F. (2016). Diet-microbiota interactions as moderators of human metabolism. Nature, 535(7610), 56-64.

Systemic Influence of GI Microbiota



Adapted from: Goldszmid, R. S., & Trinchieri, G. (2012). The price of immunity. Nature immunology, 13(10), 932-938.

Fiber, Prebiotics & the Gastrointestinal Microbiota

Definitions: Fiber & Prebiotic

Dietary Fiber*: Non-digestible soluble and insoluble carbohydrates ($\geq$ 3 monomeric units), and lignin that are intrinsic and intact in plants; isolated or synthetic non-digestible carbohydrates ($\geq$ 3 or more monomeric units) determined by FDA to have* ***physiological effects that are beneficial to human health****.*[1]

Prebiotic*:* *A substrate that is selectively utilized by host microorganisms* ***conferring a health benefit****.*[2]

1. U.S. Food & Drug Administration, 26 May 2017. Final ruling on dietary fiber definition.
2. Gibson, G. R., et al. (2017). Expert consensus document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of prebiotics. Nature Reviews Gastroenterology & Hepatology.

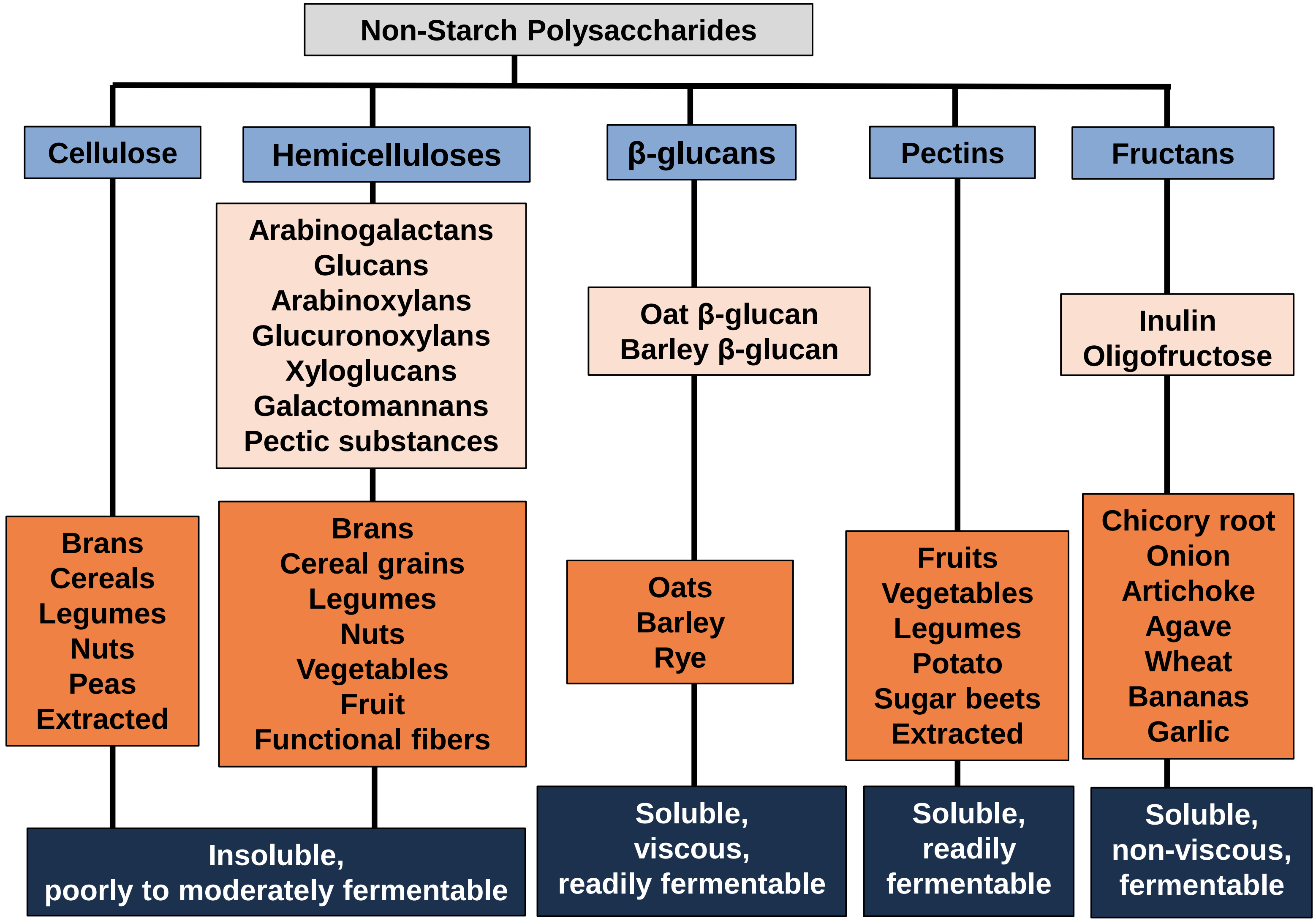
Dietary Fiber & Prebiotics

- Different types of fibers in different types of plants

- Physicochemical properties of fibers:
  - **Solubility** - the ability of the fiber to dissolve in water (soluble) or remain as discrete particles (insoluble).
  - **Viscosity** - the ability of some polysaccharides to thicken when hydrated (gel-forming).
  - **Fermentability** - the degree to which fiber, after resisting digestion, can be broken down by the microbiota.

Holscher, H. D. (2017). Dietary fiber and prebiotics and the gastrointestinal microbiota. *Gut Microbes*, *8*(2), 172-184.

Dietary Fibers in Foods



Livingston KA, Chung M, Sawicki CM, Lyle BJ, Wang DD, Roberts SB, et al. (2016) Development of a Publicly Available, Comprehensive Database of Fiber and Health Outcomes: Rationale and Methods. PLoS ONE 11(6): e0156961.

Dietary Fiber Health Benefits

- ***Insoluble (cellulose, bran)***
  - Laxative effect
- ***Soluble, viscous, non-fermented (psyllium)***
  - Cholesterol-lowering, improve glycemia, weight loss, stool normalization
- ***Soluble, viscous, readily fermented (β-glucan, pectin)***
  - Cholesterol-lowering, improve glycemia

McRoie JW & Fahey GC. (2013). A review of gastrointestinal physiology and the mechanisms underlying the health benefits of dietary fiber: Matching an effective fiber with specific patient needs. *Clinical Nursing Studies*, *1*(4), 82-92.

Dietary Fiber Health Benefits

- ***Soluble, non-viscous, fermentable***:
  - Fructooligosaccharides (FOS)
  - Galactooligosaccharides (GOS)
  - Inulin
  - Polydextrose
  - Soluble Corn Fiber
  - Resistant Starch

- Accumulating data on health benefits

McRoie JW & Fahey GC. (2013). A review of gastrointestinal physiology and the mechanisms underlying the health benefits of dietary fiber: Matching an effective fiber with specific patient needs. *Clinical Nursing Studies*, *1*(4), 82-92.

Dietary Fiber Fermentation

- Different types of fibers in different types of plants
- Synthesized fibers
  - Physicochemical properties
  - Chemical structure

- Microbes in the human gut are able to ferment specific fibers
  - ~~Cellulose~~
  - ~~Psyllium~~
  - *Inulin*
  - *Polydextrose*

Holscher, H. D. (2017). Dietary fiber and prebiotics and the gastrointestinal microbiota. *Gut Microbes*, *8*(2), 172-184.

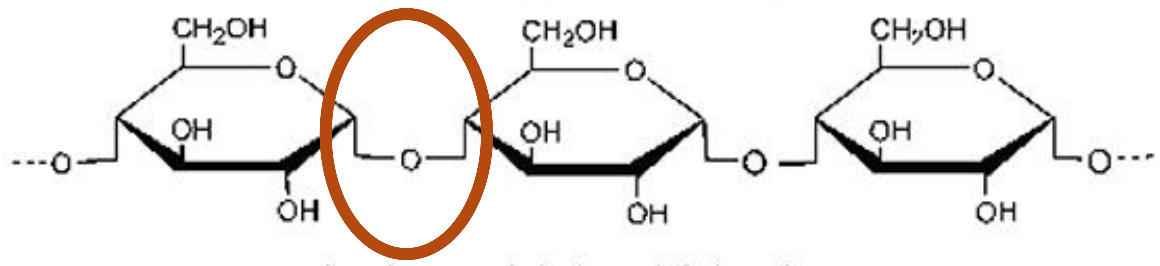
Dietary Fiber Fermentation

Fermentability - The degree to which dietary fiber, after resisting digestion by human digestive enzymes, can be broken down (fermented) by the gut microbiota to produce short-chain fatty acids (acetate, propionate, and butyrate).

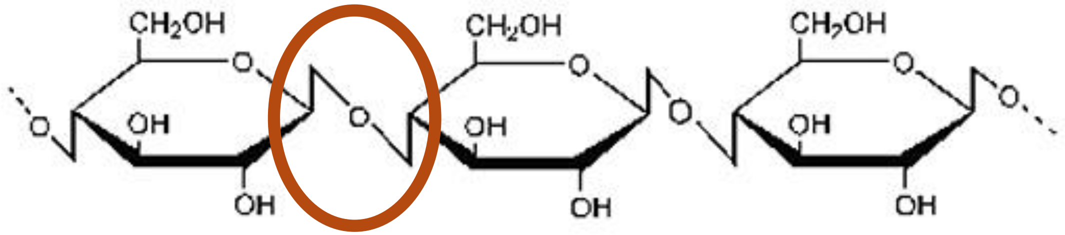
- Different types of fibers in different types of plants
- Different botanical origins and chemical structure
  - FOS
  - Inulin
  - Polydextrose (PDX)

Holscher, H. D. (2017). Dietary fiber and prebiotics and the gastrointestinal microbiota. *Gut Microbes*, *8*(2), 172-184.

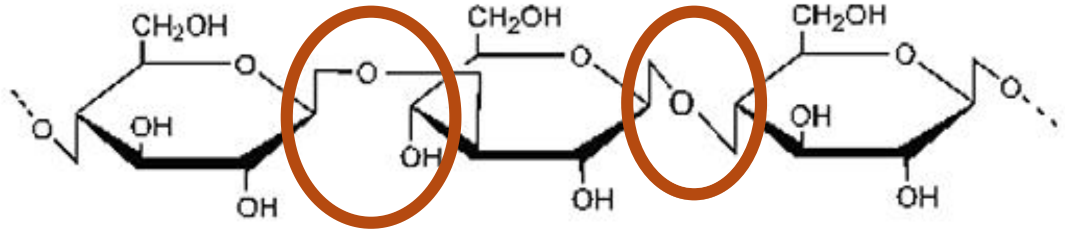
Microbes Ferment Dietary Fiber



Amylose: α-1,4 glucosidic bonds



Cellulose: β-1,4 glucosidic bonds

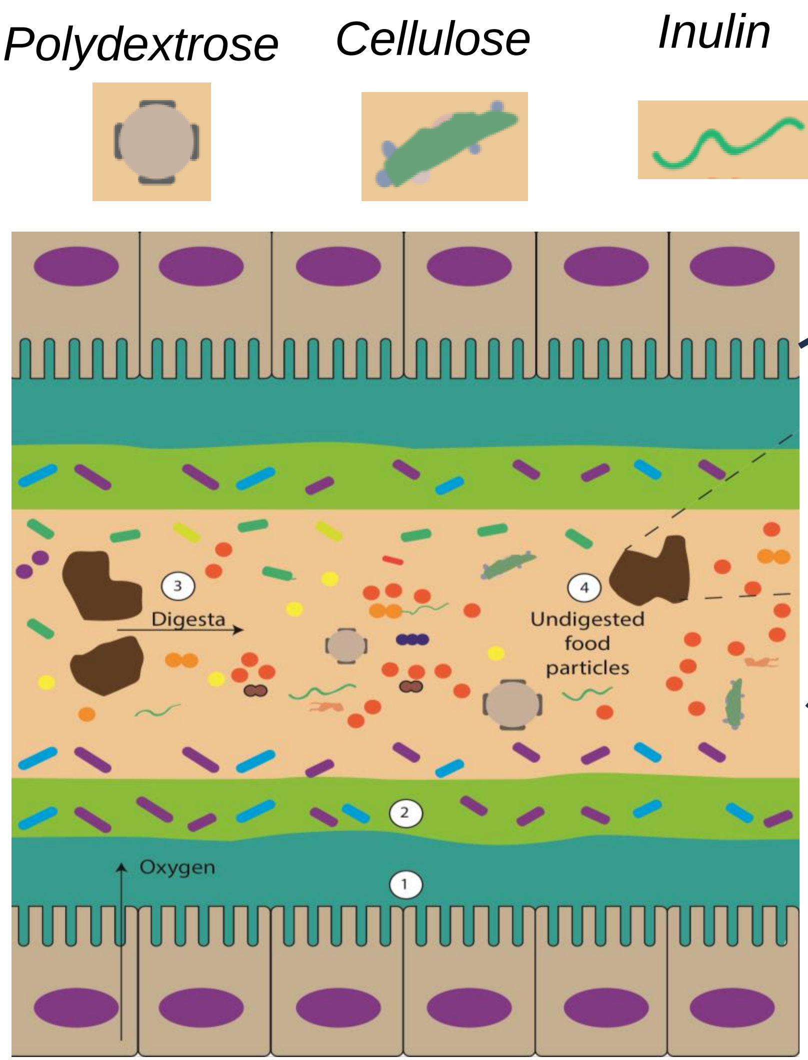


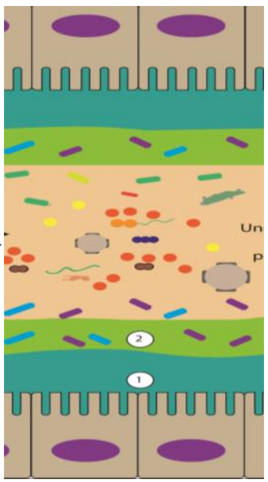
β-Glucan: mixed β-1,3 and β-1,4 glucosidic bonds

Image: Linus Pauling Institute, OSU

Diet-Microbiota Interactions

Low fiber and microbiota diversity changes fermentation profiles





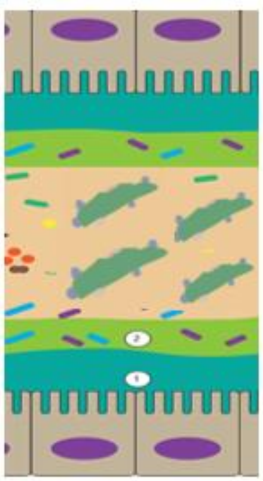
Increased access to complex carbohydrates

Increased diversity and Metabolic output

Acetate ↑

Propionate ↑

Butyrate ↑



Decreased fiber complexity

Decreased diversity

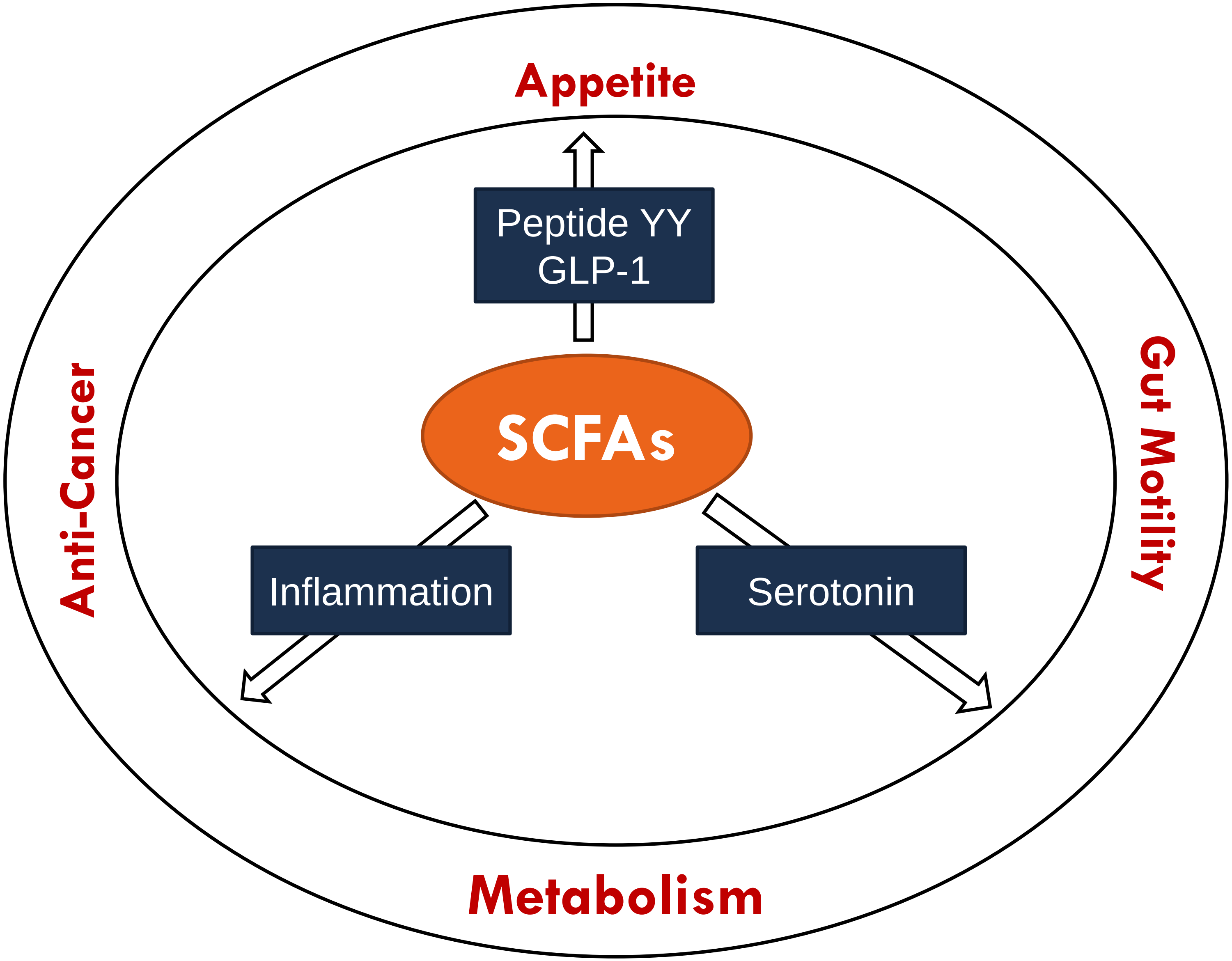
Acetate ↓

Propionate ↑

Butyrate ↓

Adapted from: Sonnenburg, J. L., & Bäckhed, F. (2016). Diet-microbiota interactions as moderators of human metabolism. Nature, 535(7610), 56-64.

Microbiota-Derived Signaling



Evans, James M., Laura S. Morris, and Julian R. Marchesi. *Journal of Endocrinology* 218.3 (2013): R37-R47.

Polling Question
Objective 1: Review

Define dietary fiber and prebiotics

True or False*?* Dietary fiber is defined as:

Non-digestible soluble and insoluble carbohydrates (≥ 3 monomeric units), and lignin that are intrinsic and intact in plants; isolated or synthetic non-digestible carbohydrates (≥ 3 or more monomeric units).

Objective 1: Answers

False

Dietary Fiber*: Non-digestible soluble and insoluble carbohydrates (≥ 3 monomeric units), and lignin that are intrinsic and intact in plants; isolated or synthetic non-digestible carbohydrates (≥ 3 or more monomeric units)* ***determined by FDA to have physiological effects that are beneficial to human health****."* [1]

Prebiotic – *a substrate that is selectively utilized by host microorganisms* ***conferring a health benefit****.* [2]

1. U.S. Food & Drug Administration, 26 May 2017. Final ruling on dietary fiber definition.
2. Gibson, G. R., et al. (2017). Expert consensus document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of prebiotics. Nature Reviews Gastroenterology & Hepatology.

Polling Question
Objective 2: Review

Identify dietary fibers and prebiotics that can be fermented by the microbiota. **Select all that apply**.

a) *Cellulose*
b) *Psyllium*
c) *Inulin*
d) *Polydextrose*

Objective 2: Review

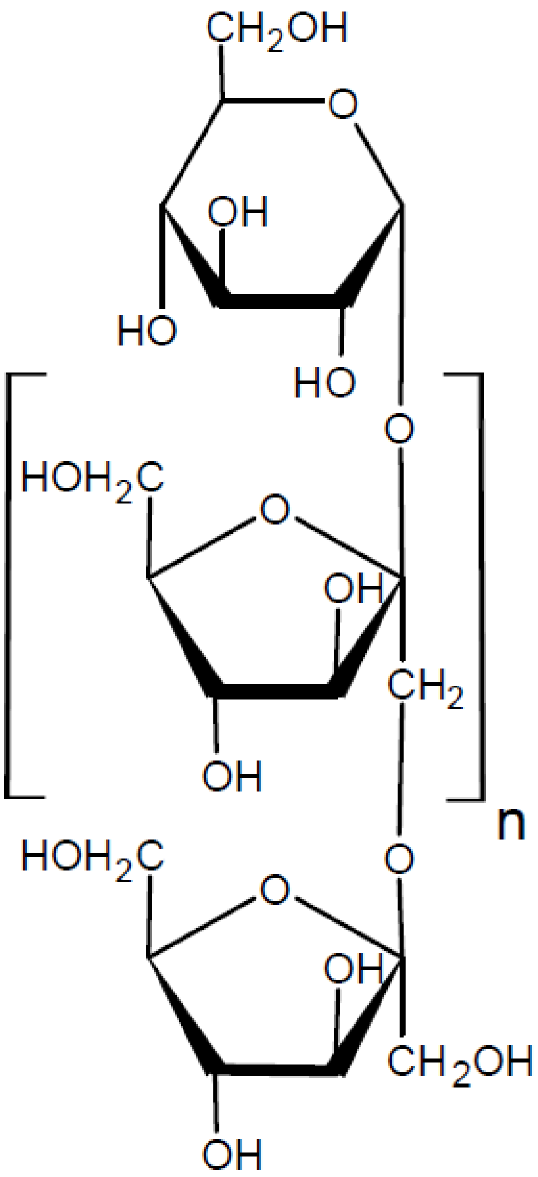
Identify dietary fibers and prebiotics that can be fermented by the microbiota.

a) *Cellulose*
b) *Psyllium*
c) *Inulin*
d) *Polydextrose*

Inulin Type Fibers

- ***Food Sources***
  - Chicory root
  - Onion
  - Artichoke
  - Agave
  - Wheat
  - Bananas
  - Garlic

- ***Structures***
  - Fructose polymer linked by β-2,1 linkages
  - Varying degrees of polymerization (2-60)
  - Fructooligosaccharides (FOS) → Inulin



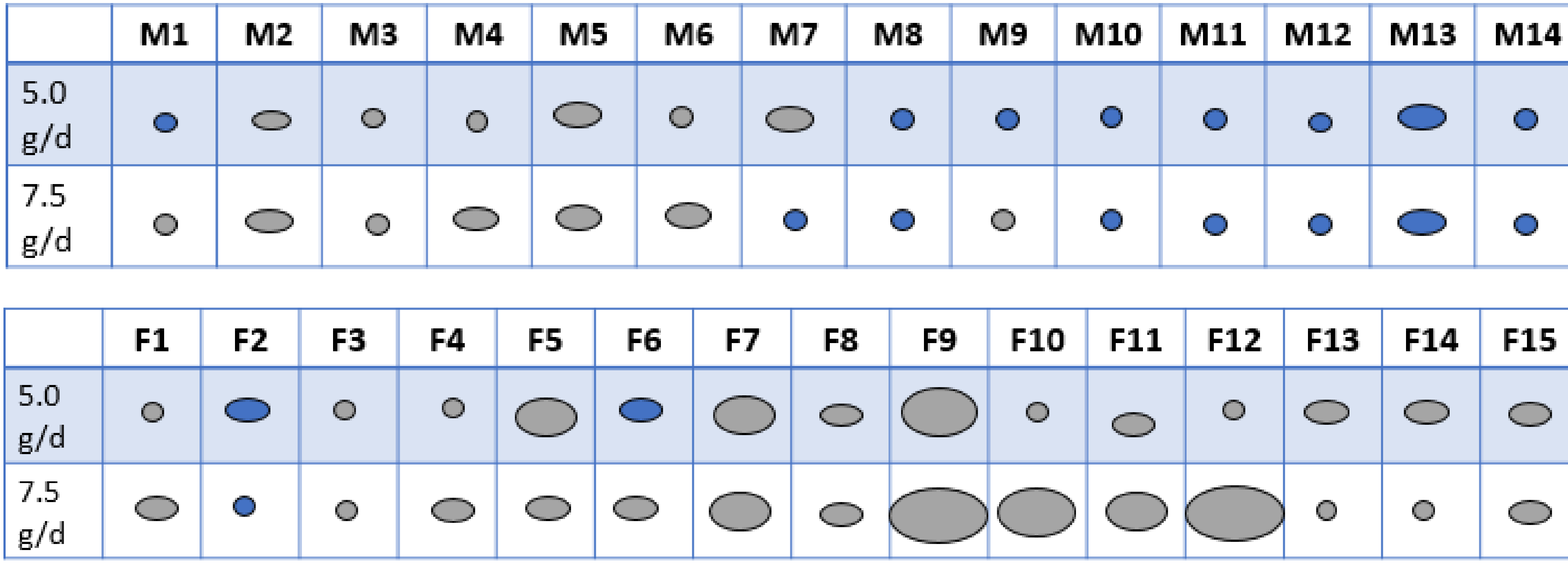
Meyer TSM (2015). Biotechnological Production of Oligosaccharides — Applications in the Food Industry, Food Production and Industry. DOI: 10.5772/60934.

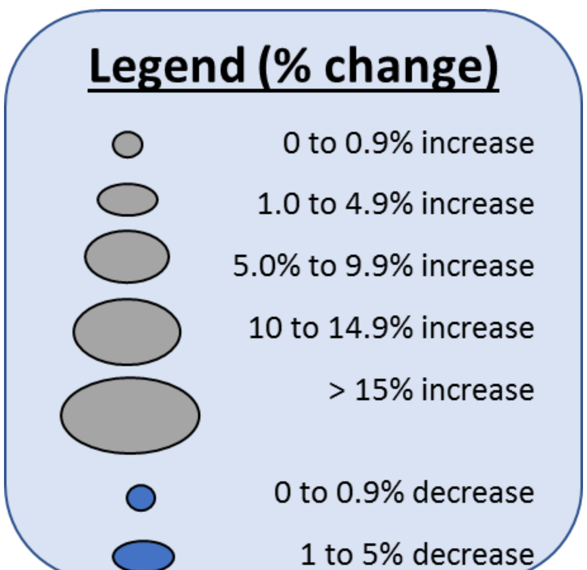
Inulin Type Fibers & Microbiota

- ***Microbial***
  - 16 g/d inulin and oligofructose (50/50) for 12 wk increased *Bifidobacterium and Faecalibacterium prausnitzii*[1]
  - 5 & 7.5 g/d agave inulin increased *Bifidobacteria* and SCFA[2]
  - Positive correlation between *Faecalibacterium* and butyrate concentrations[2]
  - 12 g/d inulin increased *Bifidobacterium* and decreased *Bilophila*, no change in SCFA[1]

1. Dewulf EM (2013). Insight into the prebiotic concept: lessons from an exploratory, double-blind intervention study with inulin-type fructans in obese women. Gut; 62: 1112-21.
2. Holscher HD (2015) Agave Inulin Supplementation Affects the Fecal Microbiota of Healthy Adults Participating in a Randomized, Double-Blind, Placebo-Controlled, Crossover Trial. J Nutr; 145:2025–32.
3. Vandeputte (2017). Prebiotic inulin-type fructans induce specific changes in the human gut microbiota. Gut 66: 1968-1974.

Phenotypic Responses





Adapted from: Holscher, H. D., et al. (2015). Agave inulin supplementation affects the fecal microbiota of healthy adults participating in a randomized, double-blind, placebo-controlled, crossover trial. *The Journal of Nutrition*, *145*(9), 2025-2032.

FOS & Health

- ***Metabolic***
  - 21 g/d for 12 wk reduced body weight, fat mass and trunk fat[1]
  - 16 g/d for 2 wk decreased postprandial glucose responses after a standardized meal[2]
  - 16 g/d inulin and oligofructose (50/50) for 12 wk did not significantly change body composition, although fat mass tended to decrease[3]
  - 10 g/d oligofructose-enriched inulin for 8 weeks reduced glucose, A1C, IL-6, TNFa, and LPS in women with overweight/obesity and type 2 diabetes[4]
  - 12.5 g/d for 17 wk reduced total body weight, BMI, waist circumference, fasting insulin, and HOMA in women with obesity[5]

1. Parnell JA (2009) Weight loss during oligofructose supplementation is associated with decreased ghrelin and increased peptide YY in overweight and obese adults. AJCN; 89:1751–59.
2. Cani PD (2009). Gut microbiota fermentation of prebiotics increases satietogenic and incretin gut peptide production with consequences for appetite sensation & glucose response after a meal. AJCN;90(5),1236-43
3. Dewulf EM (2013). Insight into the prebiotic concept: lessons from an exploratory, double-blind intervention study with inulin-type fructans in obese women. Gut; 62: 1112-21.
4. Dehghan P (2013). Oligofructose-enriched inulin improves some inflammatory markers and metabolic endotoxemia in women with type 2 diabetes mellitus: A randomized controlled clinical trial. Nutrition; 30:418-23.
5. Genta (2009). Yacon syrup: beneficial effects on obesity and insulin resistance in humans. Clin Nutr 28, 182–187.

FOS & Health

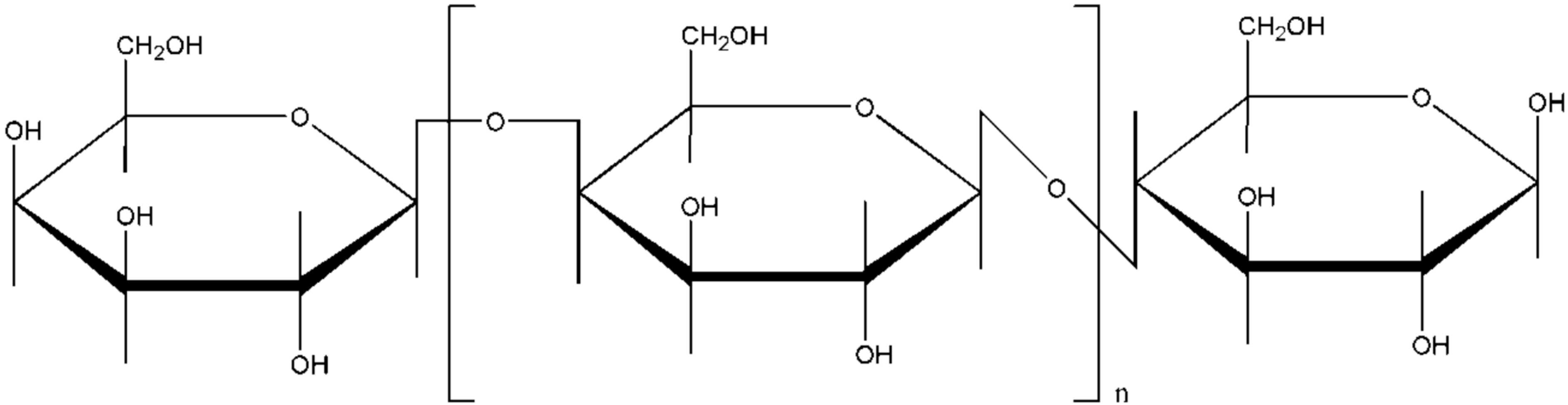
- ***Appetite, food intake, and satiety***
  - 21 g/d for 12 wk increased PYY, decreased ghrelin, & reduced food intake[1]
  - 16 g/d for 2 wk increased glucagon-like peptide 1 and PYY[2]
  - 12.5 g/d for 17 week improved satiety in women with obesity[3]
  - 8 g/d for 2 weeks increased satiety following breakfast and dinner, reduced energy intake at breakfast and lunch, overall 5% reduction in energy intake[4]

1. Parnell JA (2009) Weight loss during oligofructose supplementation is associated with decreased ghrelin and increased peptide YY in overweight and obese adults. AJCN; 89:1751–59.
2. Cani PD (2009). Gut microbiota fermentation of prebiotics increases satietogenic and incretin gut peptide production with consequences for appetite sensation & glucose response after a meal. AJCN;90(5),1236-43.
3. Genta (2009). Yacon syrup: beneficial effects on obesity and insulin resistance in humans. Clin Nutr 28, 182–187.
4. Cani (2006). Oligofructose promotes satiety in healthy human: a pilot study. Eur J of Clin Nutr 60, 567-572.

Galactooligosaccharides (GOS)

- ***Food Sources***
  - Synthesized and added to enteral formulations

- ***Structures***
  - β-(1,4) linked galactose oligomer, attached to glucose by β-(1,4) bond



Meyer TSM (2015). Biotechnological Production of Oligosaccharides — Applications in the Food Industry, Food Production and Industry. DOI: 10.5772/60934.

GOS & Health

- ***Microbial***
  - 5- to 10-fold increases in *Bifidobacteria*[1]
  - Increased *Bacteroides*, *Bifidobacteria*, and fecal lactate[2]

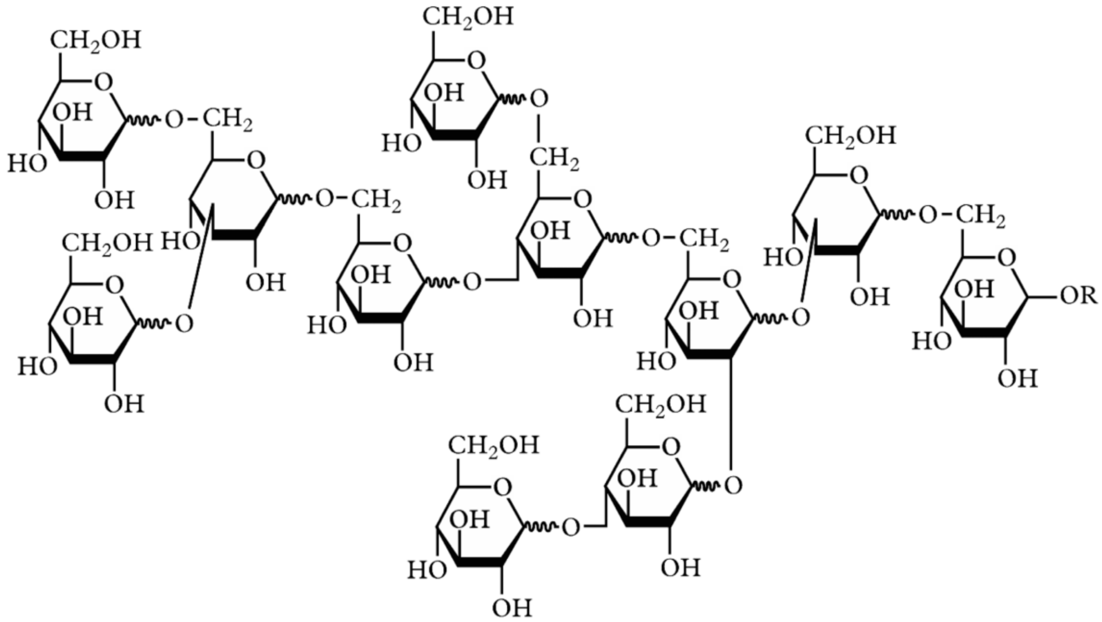
- ***Immunomodulation***
  - 5.5 g/d for 10 wk increased IL-10, IL-8, natural killer cell activity and reduced IL-1 β[2]
  - 5.5 g/d for 12 wk increased fecal secretory IgA and decreased calprotectin, decreased plasma CRP in overweight adults[3]

- ***Psychological***
  - 5.5 g/day for 3 wk reduced waking salivary cortisol and increased attentional vigilance in the processing of positive versus negative stimuli[4]

1. Davis LMG (2011). Barcoded Pyrosequencing Reveals That Consumption of Galactooligosaccharides Results in a Highly Specific Bifidogenic Response in Humans. PLoS
2. Vulevic J (2015). Influence of galacto-oligosaccharide mixture (B-GOS) on gut microbiota, immune parameters and metabonomics in elderly persons. BJN.
3. Vulevic J (2013) A Mixture of trans-Galactooligosaccharides Reduces Markers of Metabolic Syndrome and Modulates the Fecal Microbiota and Immune Function of Overweight Adults
4. Schmidt, K (2015) Prebiotic intake reduces the waking cortisol response and alters emotional bias in healthy volunteers. Psychopharmacology 232:1793–1801

Polydextrose (PDX)

- ***Food Sources***
  - Synthesized fiber that is a multi-purpose food ingredient found in baked goods, dairy products, and beverages
- ***Structures***
  - Highly branched, randomly bonded glucose polysaccharide units with DP of 2-120 (average 12). Glucose linked by α- and β-linked 1,2, 1,3, 1,4, and 1,6 glycosidic linkages[1].



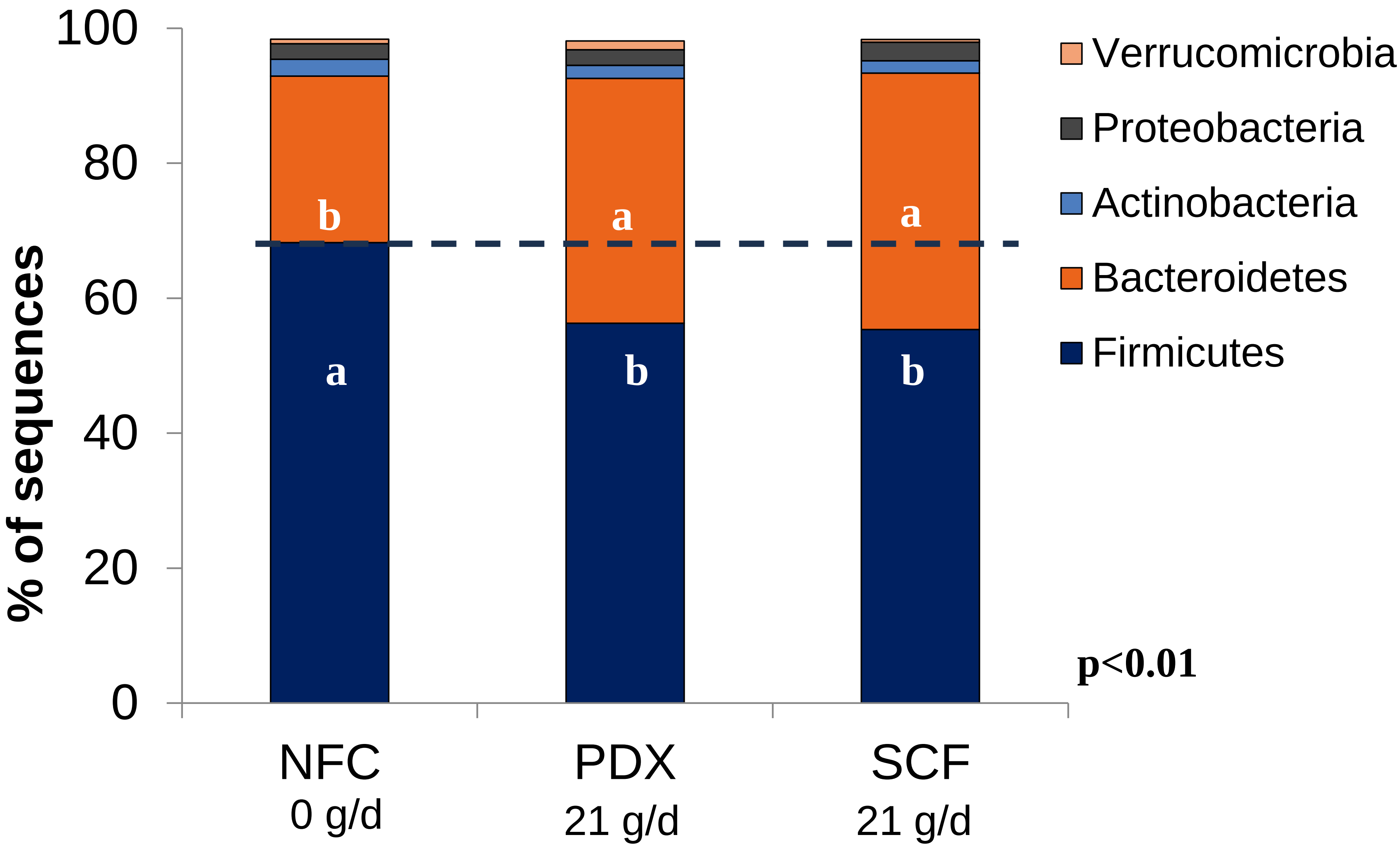
1. Lahtinen SJ, Knoblock K, Drakoularakou A, Jacob M, Stowell J, Gibson GR, Ouwehand AC. Effect of molecule branching and glycosidic linkage on the degradation of polydextrose by gut microbiota. *Biosci Biotechnol Biochem* 2010;74:2016–21.

PDX & Health

- ***Microbial***
  - Up to 40% fermented, up to 60% excreted
  - Increased *Parabacteroides* and and reduced *Eubacterium*, *Ruminococcus*, and *Roseburia*[1]
  - Reduced ammonia, phenols, indoles, branched-chain fatty acids and butyrate[1]

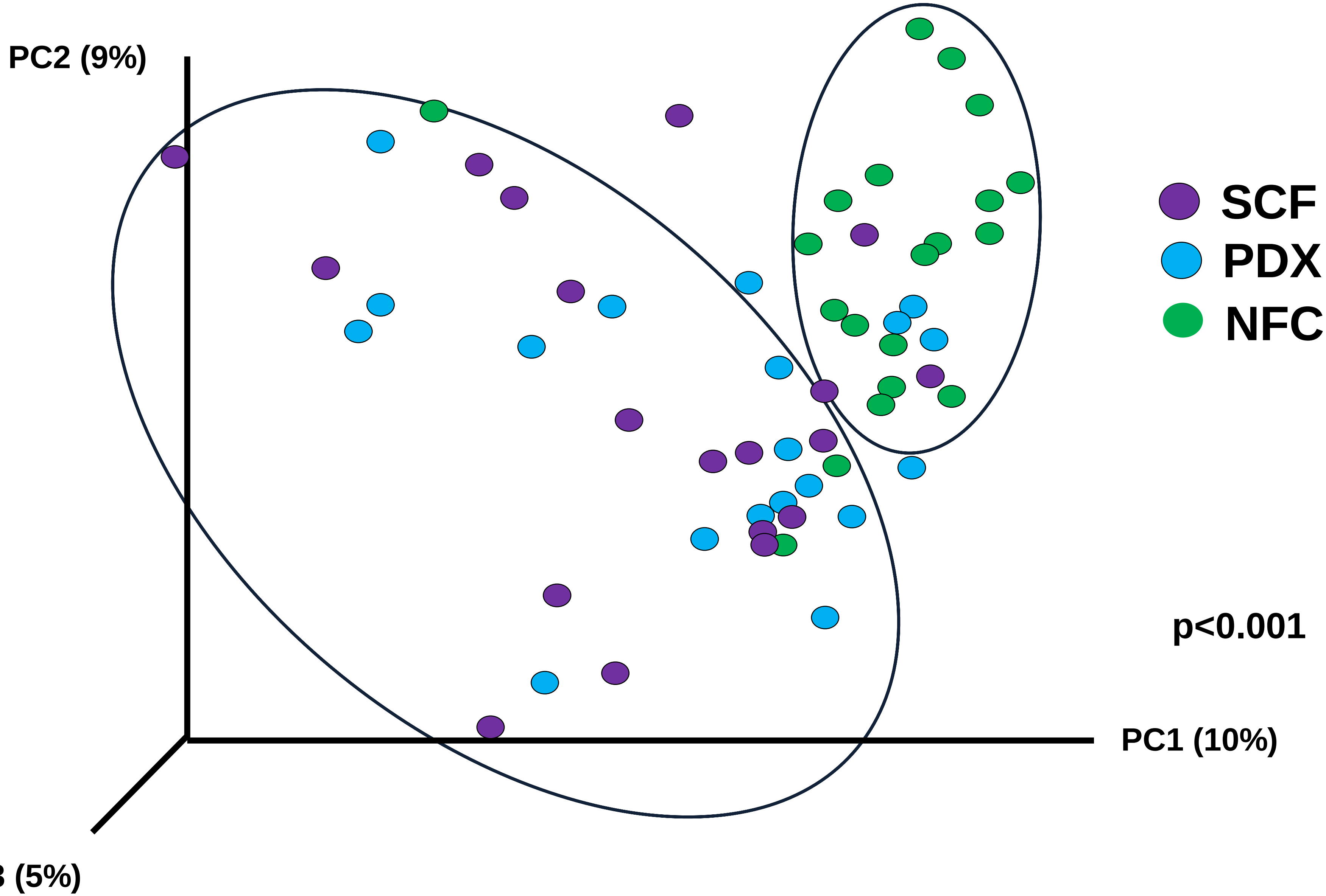
1. Holscher HD et al. (2015) Fiber supplementation influences phylogenetic structure and functional capacity of the human intestinal microbiome: follow-up of a randomized controlled trial. AJCN 101: 55-64

Microbiota: PDX & Soluble Corn Fiber (SCF)



Holscher, H. D., et al. (2015). Fiber supplementation influences phylogenetic structure and functional capacity of the human intestinal microbiome: follow-up of a randomized controlled trial. *The American journal of clinical nutrition*, *101*(1), 55-64.

Microbiome Changes with Daily PDX & SCF



Adapted from: Holscher, H. D., et al. (2015). Fiber supplementation influences phylogenetic structure and functional capacity of the human intestinal microbiome: follow-up of a randomized controlled trial. *The American journal of clinical nutrition*, *101*(1), 55-64.

PDX & Health

- ***Gastrointestinal[1]***
  - 3.6 g/d reduced transit time in adults with constipation
  - 8 g/d reduced transit time in adults with constipation[2]
  - 8 g/d reduced abdominal discomfort and tended to reduce stool hardness

- ***Metabolic[1]***
  - 12.5 or 15 g/d decreased postprandial triglyceride response to high fat meal
  - 56.7 g/d tended to reduce peak glucose response and significantly reduced insulin response

1. Ramiro do Carmo MM et al. (2016). Polydextrose: Physiological Function, and Effects on Health. Nutrients 8:553.

PDX & Health

- ***Appetite, satiety, and food intake[1]***
  - 8 g/d PDX for 21 day reduced snack consumption and increased butyrate producing bacteria in healthy adults
  - 6.25 g or 12.5 g PDX 90 min prior to meals decreased hunger.12.5 g decreased energy intake in healthy adults
  - 12 g PDX 60 min prior reduced energy intake at ad-libitum lunch in healthy males
  - 6.25, 12.5, and 25 g PDX 90 min prior to ad-libitum lunch decreased energy intake in healthy adults
  - 15 g PDX decreased hunger and increased satiety and GLP-1 concentrations postprandial in non-diabetic, obese adults

1. Canfora EE and Blaak EE. The role of polydextrose in body weight control and glucose regulation. Curr Opin Clin Nutr Metab Care 2015, 18:395-400

Polling Question
Objective 2: Review

Identify dietary fibers and prebiotics that can be fermented by gut microbiota.

True or False? All fibers and prebiotics change the composition of the microbiome in the same way.

Objective 2: Answer

False

Fibers and prebiotics differentially change the composition of the microbiome. Inulin, FOS, and GOS can increase *Bifidobacterium,* while PDX increases the abundances of Bacteroidetes.

Prebiotic Health Effects[1]

Health end point	Prebiotic
Satiety	Fructooligosaccharide (FOS)
Calcium and other mineral absorption, bone health	FOS
Stimulation of neurochemical-producing bacteria in the gut	Galactooligosacharide (GOS)
Urogenital health	GOS
Irritable Bowel Syndrome (IBS)	GOS
Skin health, improved water retention and reduced erythema	GOS
Traveler's diarrhea	GOS
Allergy	FOS, GOS
Metabolic health: glycemia, dyslipidemia, inflammation	FOS, GOS
Bowel habit and general gut health in infants	FOS, GOS
Infections and vaccine response	FOS, GOS, and PDX
Necrotizing enterocolitis	FOS, GOS

Prebiotics and health end points in clinical trials (*adapted from Table 1[1]***)**

1. Gibson, G. R., et al. (2017). Expert consensus document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of prebiotics. Nature Reviews Gastroenterology & Hepatology.

Prebiotics, Synbiotics & SCFA: Meta-analysis

- 14 of 29 ***prebiotic*** and 13 of 26 ***synbiotic*** studies reported a ***decrease in $\geq$ 1 marker of systemic inflammation***
  - Meta-analyses indicated that ***prebiotics and synbiotics reduce CRP***
- 60 mM acetate enema reduced TNFα
- 200 mL mixture of acetate, propionate, & butyrate (200 mM) reduced fasting IL-1β[1]

- Prebiotics ***reduced total and LDL cholesterol*** [2]

- Soluble, fermentable, and non-viscous fiber treatments ***reduced postprandial glucose and insulin***[3]

1. RF McLoughlin, *et al. Short-chain fatty acids, prebiotics, synbiotics, and systemic inflammation: a systematic review and meta-analysis. AJCN. 2017*
2. Beserra BT, et al. (2015). A systematic review and meta-analysis of the prebiotics and synbiotics effects on glycaemia, insulin concentrations and lipid parameters in adult patients with overweight or obesity. Clinical Nutrition, 34(5), 845-858.
3. Kellow NJ. Metabolic benefits of dietary prebiotics in human subjects: a systematic review of randomised controlled trials. Br J Nutr. 2014;111:1147–61.

Fiber & Prebiotic Health Effects: Meta-analyses

- Soluble fiber reduced ***BMI, body weight, percent body fat, fasting glucose, and fasting insulin***[1]
- Insoluble and soluble fiber interventions resulted in ***weight loss*** with 14 g/d of additional dietary fiber[2]
- Glucomannan ***reduced fasting glucose and body weight***[3]
- Soluble fiber treatments ***decreased energy intake*** and ***appetite*** more frequently than insoluble fiber treatments[4]
- Soluble, fermentable, and non-viscous fiber treatments ***reduced postprandial glucose and insulin***[5]
- Prebiotics ***reduced total and LDL cholesterol*** [6]

1. Thompson SV, et al. Effects of isolated soluble fiber supplementation on body weight, glycemia, and insulinemia in adults with overweight and obesity: a systematic review and meta-analysis of randomized controlled trials. AJCN. 2017 1061514-1528
2. Howarth NC, et al. Dietary fiber and weight regulation. Nutr Rev. 2001;59:129–39.
3. Sood N, et al. Effect of glucomannan on plasma lipid and glucose concentrations, body weight, and blood pressure: systematic review and meta-analysis. Am J Clin Nutr. 2008;88:1167–75.
4. Wanders AJ, et al. Effects of dietary fibre on subjective appetite, energy intake and body weight: a systematic review of randomized controlled trials. Obes Rev. 2011;12:724–39.
5. Kellow NJ, et al. Metabolic benefits of dietary prebiotics in human subjects: a systematic review of randomised controlled trials. Br J Nutr. 2014;111:1147–61.
6. Beserra BT, et al. (2015). A systematic review and meta-analysis of the prebiotics and synbiotics effects on glycaemia, insulin concentrations and lipid parameters in adult patients with overweight or obesity. Clinical Nutrition, 34(5), 845-858.

Resource: Dietary Fiber Database

Dietary Fiber Database

Developed by an expert team at Tufts University led by Dr. Nicola McKeown
Version 3 released 12/31/2016
Containing 983 entries capturing new literature through May 2016

1. Total and LDL cholesterol
2. Post-prandial glucose & insulin
3. Blood pressure
4. Increased fecal bulk and laxation
5. Transit time
6. ***Colonic fermentation & short chain fatty acid production***
7. ***Modulation of colonic microbiota***
8. Weight loss, maintenance, and reduction in adiposity
9. Satiety
10. Bone health

Database and user manual are available at the ILSI North America site (http://ilsina.org/our-work/nutrition/carbohydrates/).

AHRQ Agency for Healthcare Research and Quality

SRDR SYSTEMATIC REVIEW DATA REPOSITORY™

Key Takeaways

- ✓ Dietary fibers and prebiotics differentially impact health and the human gastrointestinal microbiota.

- ✓ Connections between the microbiota and adult health include gastrointestinal as well as metabolic and psychological health.

Questions?

CEU/CPE Instructions

To receive your CEU/CPE certificate:

1) Complete the webinar survey at:
https://www.surveymonkey.com/r/dietaryfiber

2) Once webinar code is obtained, visit www.NutriciaLearningCenter.com and click on ‘CE Credit Request’

3) Enter the webinar code obtained

4) Certificate will be visible for download on your NLC dashboard