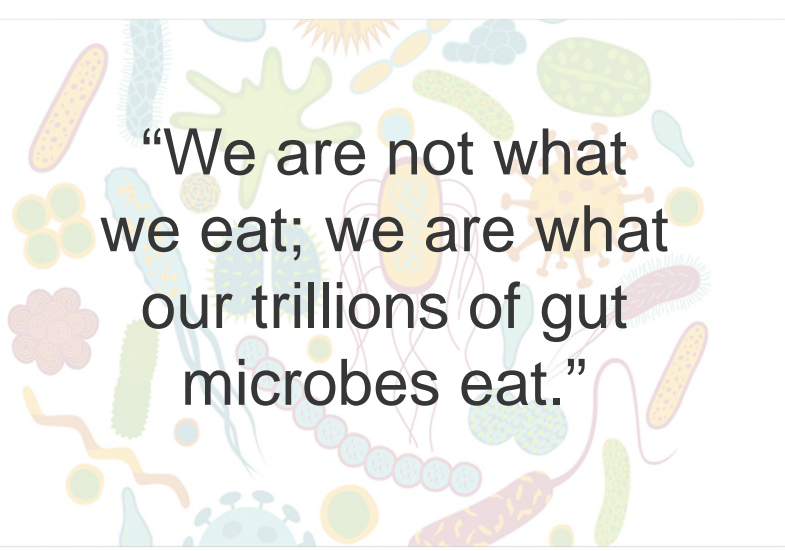


# GASTROINTESTINAL PROCESSES

## Microbiome Fiber

Rajko Bisevac ND, ABAHP, FAARFM  
tel: 630-846-1400  
PURELIFEHEALTH@YAHOO.COM

1

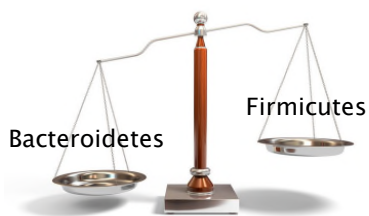


“We are not what  
we eat; we are what  
our trillions of gut  
microbes eat.”

2

## Landmark Studies

In 2006, a series of seminal papers led by Prof. Jeff Gordon were the first to demonstrate a difference in gut microbiota composition and quantity of microbial metabolites such as SCFAs between obese and lean humans.\*



\*Ley RE, Turnbaugh PJ, Klein S, Gordon J. Microbial ecology: human gut microbes associated with obesity. *Nature*. 2006;444(7122):1022-3.

3

## Early Research Microbiome Influence on Weight



Obese patients had higher levels of *Firmicutes*.



Lean patients had higher levels of *Bacteroidetes*.

\*Ley RE, Turnbaugh PJ, Klein S, Gordon J. Microbial ecology: human gut microbes associated with obesity. *Nature*. 2006;444(7122):1022-3.

4

# Microbiome Study 2017



High *Firmicutes*: High BMI  
Low *Firmicutes*: Low BMI  
High *Bacteroidetes*: Low BMI  
Low *Bacteroidetes*: High BMI

\*Association between body mass index and Firmicutes/Bacteroidetes ratio in adult Ukrainian population, Koliada et al, BMC Microbiology. 2017.

5

# TODAY



6

## Host-Microbe Interactions

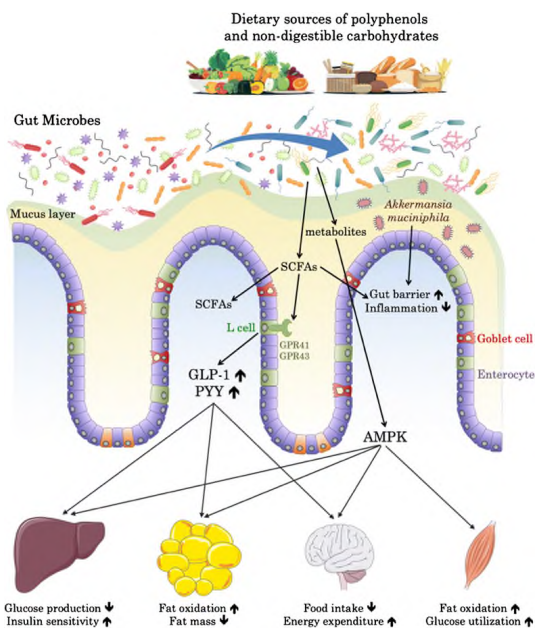
- ▶ Mediated through release of bioactive molecules by gut bacteria
- ▶ Absorption of these metabolites into circulation
- ▶ Two key metabolites:
  - SCFAs ( from fermentation of non-digestible carbohydrates)
  - By-products of polyphenols (flavonoids & non-flavonoids)

7

## Gut Interplay

Glucagon-like peptide-1 (GLP-1) and peptide YY (PYY) are involved in regulation of appetite, body weight and glucose metabolism.\* Higher levels found in healthier phenotypes.

\*Drucker DJ. Mechanisms of action and therapeutic application of GLP-1. *Ciel Metb.* 2018;27(4):740-56.



8

## Butyrate: the short-chain fatty acid in the gut

- Reduces inflammation; creates climate favorable for beneficial bacteria to grow
- Creates less favorable climate for pathogenic bacteria
- Butyric Cal/Mag

Received: 17 January 2020 | Revised: 6 April 2020 | Accepted: 11 May 2020  
DOI: 10.1111/owm.13934

ORIGINAL ARTICLE

### Microbiota changes induced by microencapsulated sodium butyrate in patients with inflammatory bowel disease

Sonia Facchin<sup>1</sup> | Nicola Vitulo<sup>2</sup> | Matteo Calgaro<sup>2</sup> | Andrea Buda<sup>1</sup> | Chiara Romualdi<sup>3</sup> | Daniel Pohl<sup>4</sup> | Barbara Perini<sup>5</sup> | Greta Lorenzon<sup>1</sup> | Carla Marinelli<sup>2</sup> | Renata D'Inca<sup>1</sup> | Giacomo Carlo Sturniolo<sup>1</sup> | Edoardo Vincenzo Savarino<sup>1</sup>

<sup>1</sup>Department of Surgery, Oncology and Gastroenterology (DISCOG), University Hospital of Padua, Padua, Italy  
<sup>2</sup>Department of Biotechnology, University of Verona, Verona, Italy  
<sup>3</sup>Department of Biology, University of Padua, Padua, Italy  
<sup>4</sup>Department of Gastroenterology, University Hospital Zurich, Zurich, Switzerland

**Correspondence**  
Sonia Facchin, Department of Surgery, Oncology and Gastroenterology (DISCOG), University Hospital of Padua, Via Giustiniani 2, Padua, Italy.  
Email: sonia.facchin@unipd.it

**Funding information**  
This work was partially supported by the Department of Surgery, Oncology and Gastroenterology, University of Padua (DISCOG MicroBIOD). Drug and placebo were provided by S.I.A.M., Health Service, Italy. The study and part of analysis were supported by an unrestricted Grant from S.I.A.M., H.S.M., V.E., S.F. and C.M. were supported, respectively, by DISCOG, MicroBIOD and BR2258. Grants from University of Padua. M.C. was supported by a Grant from the Italian Group of Inflammatory Bowel Disease.

**Abstract**  
**Background:** Butyrate has shown anti-inflammatory and regenerative properties, providing symptomatic relief when orally supplemented in patients suffering from various colonic diseases. We investigated the effect of a colonic-delivery formulation of butyrate on the fecal microbiota of patients with inflammatory bowel diseases (IBD).  
**Methods:** In this double-blind, placebo-controlled, pilot study, 49 IBD patients (n = 19 Crohn's disease, CD and n = 30 ulcerative colitis, UC) were randomized to oral administration of microencapsulated-sodium-butyrate (BEM) or placebo for 2 months, in addition to conventional therapy. Eighteen healthy volunteers (HV) were recruited to provide a healthy microbiota model of the local people. Fecal microbiota from stool samples was assessed by 16S sequencing. Clinical disease activity and quality of life (QoL) were evaluated before and after treatment.  
**Key Results:** At baseline, HVs showed a different microbiota composition compared with IBD patients. Sodium-butyrate altered the gut microbiota of IBD patients by increasing bacteria able to produce SCFA in UC patients (*Lachnospiraceae* spp.) and the butyrogenic rotobion bacteria in CD patients (*Butyrivibrio*). In UC patients, QoL was positively affected by treatment.  
**Conclusions and Inferences:** Sodium butyrate supplementation increases the growth of bacteria able to produce SCFA with potentially anti-inflammatory action. The clinical impact of this finding requires further investigation.

**KEY WORDS**  
16S metabarcoding, gut inflammation, inflammatory bowel disease, probiotics, short-chain fatty acid

9

## Whole foods provide diverse approach

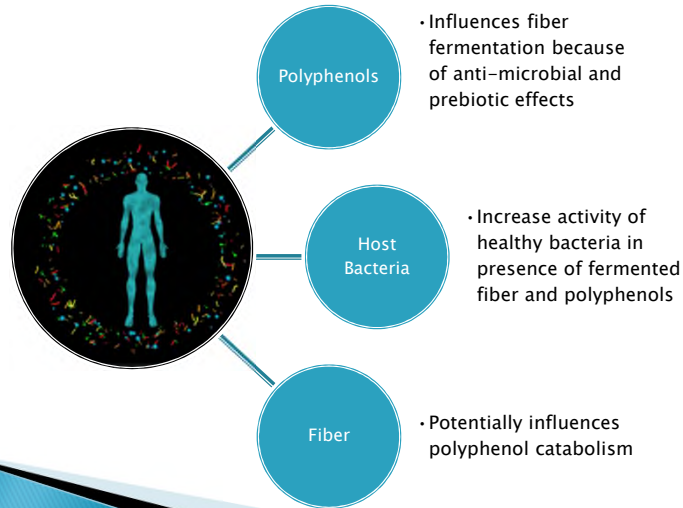
Why is a plant-predominant diet so unarguably healthy?

- o High in fiber
- o High in micronutrients
- o High in polyphenols

*Optimal for microbiome health & metabolism*

10

## Feeding the Lean-Loving Gut Microbes



11

## Impact of Polyphenols on Microbiota



- Polyphenols found in fruits, vegetables, coffee, tea, and dark chocolate.
- Plant metabolites that exert prebiotic activity.
- When metabolized by the microbiota, they produce glycans, foundational nutrition for gut bacteria.
- *Bacteroidetes* have more glycan-degrading enzymes to ferment polyphenols to phenolic compounds, exerting a weight-lowering effect.

Rastamanesh R. Chem Biol Interact. 2011 Jan 15;189(1-2):1-8.

12

## Polyphenol Mechanism of Action

- ▶ High antioxidant capacity, but so much more...
- ▶ Inhibit digestive enzymes, hampering starch, lipid and protein digestion to reduce energy efficiency
- ▶ Reduce inflammation
- ▶ Modulates glucose homeostasis
- ▶ Suppresses adipogenesis
- ▶ Increases energy expenditure via thermogenesis
- ▶ Stimulates fat oxidation
- ▶ \*AMPK Hypothesis\* – activate AMPK, the “master metabolic molecule” regulating how cells process energy

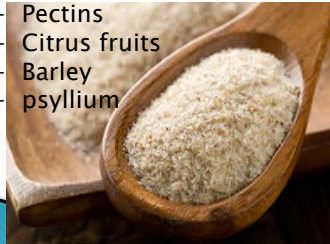
Adenosine monophosphate-activated protein kinase

13

## 2 Types of Fiber

### Soluble

- dissolves in water
- slows digestion
- gives you “full feeling”
- Helps lower cholesterol and glucose levels
- Oats
- Gums
- Beta-glucans
- Pectins
- Citrus fruits
- Barley
- psyllium



### VS

### Insoluble

- adds bulk to stool
- helps with constipation or irregular stools
- gives “laxative” benefit
- wheat bran
- Nuts
- Beans
- Cauliflower
- Green beans
- Potatoes
- Nuts
- Cellulose

14

## A Long Time in the Making

- ▶ Create a program that mimics the effects of a diversified plant-based diet
- ▶ Goals:
  - Optimize gut microbiota through polyphenolic stimulation
  - Balance blood sugars through healthy macronutrient balance and blood sugar-supportive nutrients

15

## MetabolicBiome™ Fuel



- ▶ Two-pronged weight loss program:
  - Promote healthy microbiome, specifically provide nutrients to support the growth of lean-loving gut bacteria
  - Support healthy glucose and insulin levels

16



## MetabolicBiome™ Fuel

- ▶ Protein: Whey, Beef or Pea Protein
- ▶ Fats: Coconut and avocado oil
- ▶ Fibers: Non-GM sugar beet fiber, apple fiber, fenugreek fiber, bamboo fiber, apple pectin, organic flax seed, chia seed
- ▶ Polyphenols: Acai berry extract, blueberry, carrot, organic broccoli sprout, organic cauliflower sprout, organic kale sprout

*\*Sweetened with Monk Fruit\**

17