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Hidden Health Role of the Gut Microbiome

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The Gut Microbiome



- Bowel microbial environment
- Bacteria, archaea, fungi and viruses
- 1,800 genera
- 15,000 – 36,000 distinct species



The Gut Microbiome

- 37.2 trillion human cells
- 100 trillion gut bacteria
- 150 x larger genome
 - Human: 23,000 genes
 - Microbiome: 3.3 million genes
 - DNA: 1% human; 99% microbial

Gut Microbiome Functions

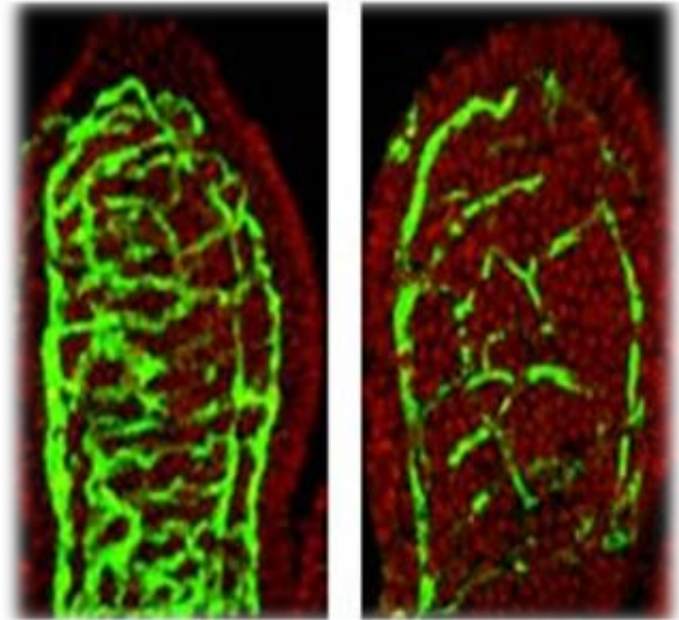


- Digestive functions
 - Fermentation of indigestible carbohydrates
 - Produce short-chain fatty acids
 - Energy substrate for colonocytes
 - Contributes approx. 30% daily energy
 - Produce Vitamin K and biotin

Gut Microbiome Functions



- Influence gene expression in microvilli development



Gut Microbiome Functions

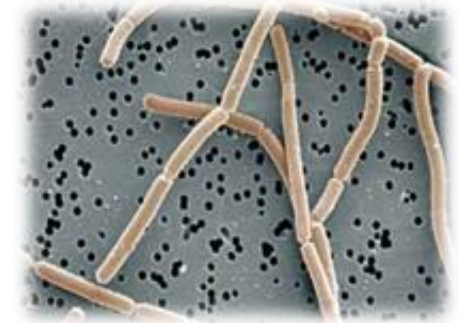


- Energy metabolism, obesity and DM2
 - Decreased microbial diversity in obesity
 - Alterations in gut microbiota in DM2
 - Decreased butyrate production
 - Increased caloric harvesting

Gut Microbiome Functions



- Maintain “gut-brain axis”
 - Regulate GI motility and secretions
 - Influence pain perception
 - Regulate appetite
 - Modulate mood and emotional response



Gut Microbiome Functions



- Support immune functions
 - Oppose pathogenic micro-organisms
 - Prevent adhesion
 - Provide competitive colonization
 - Produce bacteriocins

Gut Microbiome Functions



- Support immune function
 - Participate in GALT formation
 - Reduce inflammatory cytokines
 - Decrease allergic response
 - Improve gut barrier function

Gut Microbiome Functions



- Support immune function
 - Display anti-carcinogenic effects
 - Reinforce mucosal barrier
 - Bind toxic metabolites produced by pathogenic micro-organisms

Development of Microbiome

- Colonization of the fetal gut
 - Placental transfer
 - Vaginal delivery
 - Breastfeeding
- Digestive and immune benefits
- Vaginally-delivered infants:
 - ↓ pediatric otitis, allergies, asthma and atopy



Dysbiosis

- Imbalance between beneficial and potentially pathogenic micro-organisms



Causes of Dysbiosis

- Antibiotic therapy
 - Decreases stability and diversity of microflora
 - Only partial recovery at 4 years
- Stress
 - Increases intestinal permeability
 - Increases inflammation



Causes of Dysbiosis

- Poor diet
 - Low fiber intake
 - Lack of fermented foods
- Hypochlorhydria
 - Acid-blocking rx
- Toxic exposure
 - PCBs



Conditions Associated with Dysbiosis



- Inflammation
- Compromised immune function
- Inflammatory/Irritable Bowel disease
- Nutritional deficiencies
- Allergies

Conditions Associated with Dysbiosis



- Neurocognitive changes
- Depression
- Obesity
- Type 2 Diabetes
- Increased oxidative stress
- Increased cancer risk

Maintaining the Microbiome



- Decreased microbial diversity in developed world compared to traditional diets
- Decreased resilience and disease resistance
- Mice study:
 - Diet-induced changes in microbiota were reversible in one generation
 - Progressive decrease in diversity over multiple generations
 - Not reversible with dietary changes

Maintaining the Microbiome

- DNA does not equal destiny
- Phenotype subject to epigenetic influence.
- Food may be most powerful influence within our control.



Maintaining the Microbiome



- Probiotics
 - “Live micro-organisms which, when administered in adequate amounts, confer a health benefit on the host”
 - World Health Organization
 - Functional foods and supplements
 - Modulate microbiome



Maintaining the Microbiome



- Benefit of probiotics:
 - Interfere with the growth or survival of pathogenic micro-organisms
 - Improve mucosal barrier and immune function

Maintaining the Microbiome



- Consume fermented foods
 - Zymology: *Food produced or preserved by micro-organisms*
 - Naturally-occurring bacteria
 - Pellicle/SCOBY
 - Symbiotic Colony of Bacteria and Yeast

Maintaining the Microbiome

- Traditional Asian fermented foods:
 - Tofu
 - Soy/tamari/fish sauce
 - Miso
 - Tempeh
 - Amazake
 - Preserved duck eggs
 - Fresh pickles



Maintaining the Microbiome

- Traditional Asian fermented foods:
 - Kim chi
 - Fermented cabbage
 - Atchara
 - Bagoon
 - Soybean paste
 - Natto



Maintaining the Microbiome



- Kombucha
 - Fermented green/black tea
 - SCOBY fermentation
 - Lightly effervescent
 - Varying alcohol content
 - Unknown origin - possibly Japanese



Maintaining the Microbiome



- Other Fermented Foods
 - Yogurt
 - Kefir
 - Cheese
 - Buttermilk
 - Crème fraiche
 - Lassi
 - Ayran/doogh/tan
 - Fresh sauerkraut
 - Cacao beans
 - Kvass
 - Poi
 - Sauces
 - Worcestershire
 - Tabasco

Maintaining the Microbiome



- Fermented foods may not contain live cultures in the finished product
 - Sourdough bread or cooked cheese
 - Smoked/cooked fermented meats
 - Filtration removes most active bacteria in alcoholic beverages
 - Preservatives can destroy bacteria

Maintaining the Microbiome



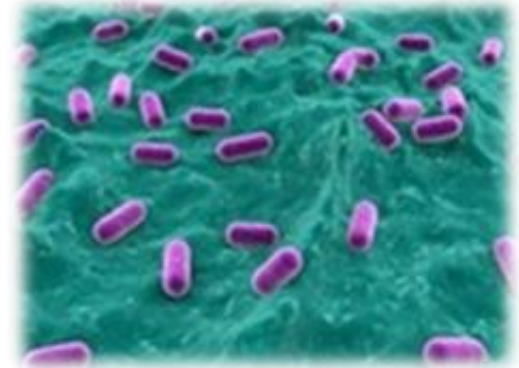
- Minimize refined carbohydrates and sugars
 - Impair immune function
 - Promote inflammation
 - Feed pathogenic organisms



Maintaining the Microbiome



- Avoid processed fructose
 - Alters the gut microbiome
 - Overharvesting of sugars and fat
 - Increased gut permeability
 - Increased inflammation
 - Promotes NAFLD



Maintaining the Microbiome

- Prebiotics
 - Non-digestible fiber
 - Stimulate development/activity of beneficial bacteria.
 - Enhance immune function
 - Improve absorption of dietary minerals

Maintaining the Microbiome

- Prebiotic foods
 - FOS (Fructo-oligosaccharides)
 - Inulin/chicory root, asparagus, Jerusalem artichoke, leeks, onion, garlic, bananas
 - Often included in probiotic supplements



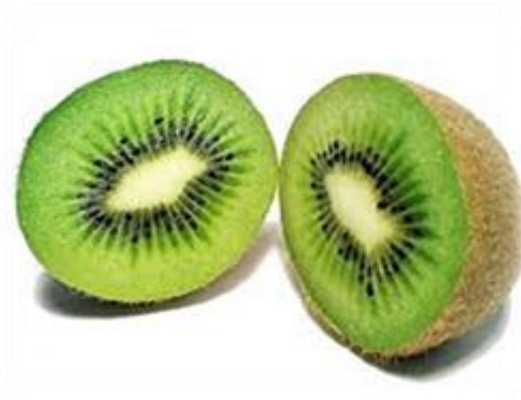
Maintaining the Microbiome

- Prebiotic foods
 - Arabinogalactans
 - Carrots, pears, tomatoes, turmeric, Shitake mushrooms
 - Astragalus and Echinacea



Maintaining the Microbiome

- Other prebiotic sources:
Almonds, burdock root, endive, leafy greens, jicama, kiwifruit, oats, salsify, whole wheat





Maintaining the Microbiome

- Probiotic Supplements
 - Broad-spectrum/Multiple species
 - Reputable manufacturers
 - Internal and third-party analysis
 - High Colony-Forming Units (billions)
 - Refrigerated/freeze-dried products



Maintaining the Microbiome

- Probiotics in supplements and food
 - Sensitive to environmental factors:
 - Heat
 - Moisture
 - Oxygen
 - pH
 - Food labels: “Live, active cultures”

Making a Difference



- Model healthy choices
- Educate patients
- Encourage traditional diet
- Utilize nutrition professionals





References and Resources



- Books
 - *I Contain Multitudes*, Ed Yong
 - *The Swift Diet*, Kathie M. Swift
 - *The Inside Tract*, G Mullin & Kathie Swift

References and Resources



Publications

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