

High Protein Fad Diets and Their Effects on Gut Health

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Before we start . . .

- Most of what we know about the gut is due to the Human Microbiome Project; established by NIH
 - 2007-2012: Identify genetic composition of microbial communities
 - 2012-2015: How are the microbes associated with health and disease
- There are many microbiomes – for the purpose of this presentation I will be referring exclusively to the biome of the gut and specifically the biome of the large intestine

Effects of the SAD on Gut Health

Disorders associated with gut dysbiosis (not established as cause):

- Gastrointestinal cancers
- Autoimmune diseases, especially inflammatory joint diseases
- IBS and IBD
- Clostridium difficile infection
- Cardio metabolic disorders
- Hypercholesterolemia
- Obesity (preliminary research)
- NAFLD (non-alcoholic fatty liver disease)
- Allergic Disorders
- CNS disorders (anxiety, autism, depression, chronic pain, alcoholism) – there is ongoing research with this
- Respiratory infections

What about the Alaska Native Diet?

- Mostly Raw Foods
- Grass Fed Caribou, Moose, Musk Ox
- Sea Mammals (meat and fat)
- Fish
- Sea Vegetables
- Fermented Greens
- Berries

- Lots and **lots** of exercise

Presentation Outline

1. Discuss the link between diet, serotonin and gut motility.
2. Discuss the effects of a low carb diet on gut microflora and gut motility.
3. Discuss the characteristics of a diet which supports a diverse and healthy gut microflora with optimized gut motility.
4. Compare and contrast a low carb, high protein diet with this diet.

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Introduction to Serotonin

- Serotonin is a neurotransmitter.
- Functions:
 - Influence mood, sexual desire and function, appetite, sleep, memory and learning, temperature regulation, some social behavior, gut motility, milk production in the breast.
 - Defects in serotonin availability or production are implicated in IBD, SIDS, and more recently, it is being studied for it's role with insulin and Alzheimer's disease.
 - We don't yet know everything there is to know about this neurotransmitter.

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Serotonin Synthesis

- There are many nutrients involved in some aspect of neural serotonin synthesis.
 - Tryptophan
 - Vitamin B-6
 - Thiamin
 - Niacin
 - Folate

Tryptophan

- A high protein diet decreases the availability of tryptophan.
 - Tryptophan competes for absorption with other amino acids.
 - After a high protein meal, circulating serotonin levels decrease.
- A high carb meal increases the availability of tryptophan.
 - A high carb meal stimulates release of insulin.
 - Insulin transports both glucose, fatty acids and amino acids (except tryptophan) out of the bloodstream.
 - There is less competition for tryptophan to enter the brain.

Vitamin B-6

- Vitamin B6
 - Deficiency of B6 is very common in the United States, even in people who take supplements. (25%-75%)
 - Cooking, milling, sterilization, and freezing all damage vitamin B6.
 - . . . so the best food sources are those foods which are eaten raw – like sunflower seeds, pistachios, dried prunes, banana, avocado, spinach and watermelon

Plasma pyridoxal 5'-phosphate in the U.S. population: the National Health and Nutrition Examination Survey, 2003–2004. Martha Savaria Morris, Mary Frances Picciano, Paul F Jacques and Jacob Selhub. From the Jean Mayer U.S. Department of Agriculture Human Nutrition Research Center on Aging at Tufts University and the National Institutes of Health Office of Dietary Supplements, Am J Clin Nutr 2008 87: 1446-1454. Learn more: http://www.naturalnews.com/023586_vitamin_B6_deficiency_nutrition.html#ixzz3hDD1Jmca

Thiamin, Niacin and Folate

- Thiamin
 - Thiamin deficiency is common in some populations (Heart Failure, Anorexia, Alcoholism).
- Niacin
 - Unlikely a person would be niacin deficient if eating a high protein diet.
 - If inadequate in diet, tryptophan will be sacrificed for niacin synthesis.
- Folate
 - Deficiency used to be more widespread before mandatory fortification in the early 1990's.

Recap

- In summary, it is highly likely that most people following a low carb diet will be deficient in some of the nutrients required for neural serotonin synthesis.

Serotonin in the gut?

- 90% of serotonin is produced in the gut. It has always been believed that this serotonin was responsible for gut motility and neural serotonin was responsible for all the other activities.
- Research does not entirely support this theory. It is known that without the neural serotonin, GI motility is negatively impacted.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3272651/>

Conclusion #1

- Neural serotonin is responsible for gut motility.
- A low carb diet is likely deficient in the nutrients necessary for adequate neural serotonin production.
- A common consequence of a low carb diet is increased stool transit time as a result of decreased serotonin levels, thus decreased gut motility.

Gut Motility -vs- Gut Health

- Creates changes to the intestinal bacteria
 - All bacteria produce substances
 - Some of these substances, like certain vitamins, are helpful
 - Some of these substances are not helpful
- Compromised motility is connected to excessive permeability, aka "Leaky Gut"
- Increased allergic responses

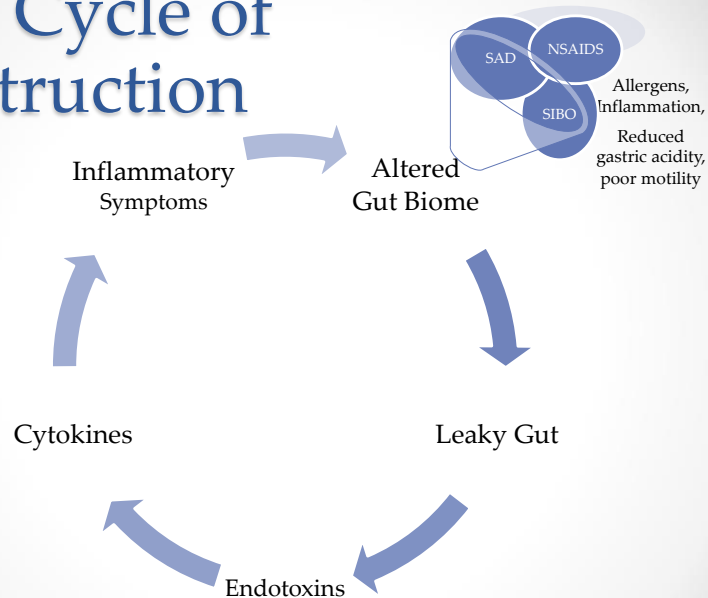
Leaky Gut

- ***“Increased inflammation in response to excessive endotoxin leaking from the gut and an unhealthy gut biome appears to promote diabetes, metabolic syndrome, obesity, alcoholism, and suicide.”***

Impact of Diet and Lifestyle Changes from the Past on
Inflammatory Processes and Disease in AI/AN Today
Dr. John Umhau

- www.ihs.gov click on SDPI link; under TRAINING, click on CME/CE Online Education.

The Cycle of Destruction



Probiotics

- Probiotics “seed” the gut with a healthy mix of bacteria.
- They are available as supplements.
- Also naturally available in lacto-fermented foods.

Lacto-Fermented Foods

- Support appropriate impermeability of the gut
- Restores gastric acidity
- Improves absorption of nutrients
- Lacto-Fermentation is fermentation by *Lactobacillus* from the air
- Some lacto-ferment cultures include other bacterial strains – like *Bifidobacteria*
- Includes more than just yogurt

For more information on fermenting, see www.culturesforhealth.com or The Art of Fermentation by Sandor Katz

Prebiotics

- Prebiotics are the preferred foods for *Bifidobacteria* and *Lactobacilli*.
- FOS – Fructooligosaccharides
- GOS – Galactooligosaccharides
- Inulin
- Prebiotics are not good food choices for pathogenic bacteria.
- Good Sources: onion, burdock root, asparagus, rye, Jerusalem artichoke, banana, sugar maple, and Chinese chive.

What about SIBO?

- Small Intestine Bacterial Overgrowth
- Caution against the ingestion of FOS . . . so what then?
- FODMAP Diet
 - Elimination of Fermentable Oligo-, di-, and monosaccharides and polyols, a group of short-chain carbs.

Conclusion #2

- **Conclusion #1 Recap:**
- A low carb diet is likely to be deficient in the nutrients necessary for adequate neural serotonin synthesis.
- As a result, A common consequence of a low carb diet is increased transit time as a result of reduced gut motility.
- The use of probiotics and prebiotics can support the health and improvement of the microbiome (gut environment).
- A low carb diet would be deficient in both pro and pre-biotics

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Nutritional Support of the Intestinal Cells

- *L-Glutamine*
 - A nonessential amino acid
- Butyric Acid
 - A short-chain fatty acid
 - Fibers that intestinal bacteria can convert to short chain fatty acids (especially FOS, GOS, Inulin)
- EPA and GLA
 - Omega 3 and Omega 6 fatty acids
- Gamma-Oryzanol
- Refer to the textbook "Clinical Nutrition, A Functional Approach" from the **Institute for Functional Medicine** for more information.

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L-glutamine

- The preferred fuel for small intestinal cells.
- Formed from the breakdown of essential AA
 - Leucine
 - Isoleucine
 - Valine
- OR can be formed from the breakdown of glucose
- Helps to heal the small intestine – increases the number of intestinal cells . . . the number of villi on those cells . . . and the height of the villi.

<http://www.todaysdietitian.com/newarchives/011211p40.shtml>

Butyric Acid

- Fuel of choice for the large intestine
- Is a 4-carbon non-essential fatty acid
- Can be formed in the body from the breakdown of simple sugar
- 75% of all dietary carb that reaches the colon can be converted by colonic bacteria to short chain fatty acids including butyric acid
 - Fiber from vegetables and legumes are more easily converted to butyric acid than fiber from grains
- Butyric acid is fundamental for colon cancer risk reduction

A Brief Digression . . .

- Water Soluble Fiber
 - Overall, is the best type for improving gut health
 - Decreases ammonia level
- Resistant Starches
 - Significantly increase butyric acid and is the best choice for reducing colon cancer
 - Resistant starches may also help with insulin resistance
- Insoluble Fiber
 - Overall, has the best laxative effects
 - Fiber from grains is also the most cardio-protective

EPA and GLA

- EPA is a nonessential fatty acid derived from Linoleic acid
- Belongs to Omega-3 family
 - Best food sources are cold water fish and wild grazed animals.
 - Some plant sources
- GLA is a nonessential fatty acid derived from Linolenic acid
- Belongs to Omega-6 family
 - Best food sources are plant oils, nuts and seeds
 - Some animal sources
- Both are important for immunity and to reduce inflammatory process – both in the gut and body

Gamma-oryzanol

- A naturally occurring component of rice bran oil
- Has been extensively studied for its role in intestinal health; specifically to support the barrier function in the gut.
- Very effective at normalization of gastric secretions

Conclusion #3

- (A low carb diet changes microbiome. Balance restoration requires carb)
- Adequate ingestion of essential amino acids supports the production of *L-glutamine*
- Fiber from vegetables and legumes supports production of butyric acid
- Both essential fatty acids are important – the Omega-3 family from cold water fish for EPA and the Omega-6 family from nuts and seeds for GLA
- Inclusion of a healthy dose of unprocessed brown rice for gamma-oryzanol supports a healthy gut

Microbiome Insults

- The use of non-caloric sweeteners is associated with dysbiosis in the microbiome
- Any antibiotic use is associated with an increase in breast cancer
- Antacid use, especially PPI create long-lasting problems in the gut microbiome

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Conclusion

No Probiotic Foods
No Prebiotics
Inadequate fiber
Microbiome Insults likely

Inadequate
Intestinal
Support

Reduced
Serotonin

May cause
Leaky Gut

Reduced
Gut
Motility

Altered Gut
Biome

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Microbiome Supporting Diet

- Variety of meats and protein
 - Fish or grass-fed animals for production of EPA
 - Nuts and Seeds for production of GLA
 - As a source of thiamin
 - As a source of niacin
 - For production of *L-Glutamine*
- Some of these nutrients can also be obtained from plants
- Variety of carbs
 - Insulin secretion supports availability of tryptophan
 - As a source of folate
 - (Raw) for Vitamin B-6
- Fermented Foods
 - As a source of probiotics
- Fiber – all types
 - For production of butyric acid (fruits/veg)
 - As a source of prebiotics
 - For laxative effects (whole grains)
- Brown Rice
 - or rice bran oil for gamma-oryzanol

Questions?

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