ARE NEW WHEAT VARIETIES REALLY MAKING US FAT AND SICK?

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WHAT THIS TALK WILL COVER

• Review claims that humans did not evolve to eat grains and wheat.
• Review data on whether the wheat has changed.
• Review claims that modern agricultural processes cause toxic effects.
• Review claims suggesting that wheat especially, new varieties, are toxic and cause obesity, chronic disease and brain disorders.
• Look at the controversy and grain and carbohydrate (CHO) recommendations
• Discuss some aspects that have changed
• Highlight the contribution of grains to diet quality vs potential dietary problems with the omission of wheat, grains and other carbohydrate staples in terms of nutrition, cost and food supply issues.

ARE NEW WHEAT VARIETIES REALLY MAKING US FAT AND SICK?

We should be eating like the cavemen—bring on the mastodon steaks.

Modern grains are killing you.

GMO crops and modern plant breeding is killing us.

We should be eating like the cavemen—bring on the mastodon steaks.

Grains are not needed

Claim: Humans Did Not Evolve to Eat Grains

• Humans–eating grains >100,000 yrs
• Dental record evidence
• Hominids were and are omnivores
• Cooked grain DNA in dental calculus of Paleolithic humans
• Cave and cooking evidence*
  • Grains (sorghum, wild maize, others) found in caves
  • Grain DNA on stone tools and in cooking pots indicate processing and cooking of grains.

*Caves in Iraq and the Low Countries; the Americas

Claim: Humans Did Not Evolve to Eat Grains

• With the advent of agriculture
• Humans evolved to have 6 copies of amylase
  • other primates – 2 copies
• Amylase & cooking of CHO enabled ready supply of glucose to the brain
• Cooked CHO foods may have enabled evolution by increasing the brain size of humans

http://news.sciencemag.org/evolution/2012/10/raw-food-not-enough-feed-big-brains
news.nationalgeographic.com/.../121026-human-cooking-e... A surge in human brain size about 1.8 million years ago is linked to the innovation of cooking

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What Was Life Like in the Paleo Period

- Average lifespan ~ 37 years
- Paleo people were 65-85% vegetarians; more meat in colder climates
- Our ancestors did eat grains and legumes.
- Early humans ate very much like modern pigs and bear - getting calories to survive

CLAIM: PALEO DIETS ARE BETTER FOR YOU

Why Your Doctor Hates the Paleo Diet

EAT

CLAIM: GRAINS/GLUTEN-CONTAINING CARBOHYDRATE STAPLES ARE BAD FOR THE HUMAN DIET

Recommendations for Carbohydrates (CHO) and CHO Staples

- Dietary recommendations - most countries / health promotion orgs
- Food guidelines recommend grains as a food group
- CHO/ grain staples - Base of pyramid/ diet
  - 45-65% of E (up to 75% of E)
  - Australia / New Zealand Dietary Guidelines
  - European Food Safety Authority
  - UK Scientific advisory Committee on Nutrition
  - US Dietary Guidelines / US Institute of Medicine
  - Singapore Health Promotion Board
  - Indian Health
  - Health promotion bodies such as heart, cancer and diabetes associations

- World Health Organization / Food & Agriculture Organization (WHO/FAO)
  - "the macronutrient that humans need in the largest quantity."

Dietary Guidance - Central European Example

CLAIM: MODERN WHEAT HAS BEEN BRED (TRADITIONAL AND GENETICALLY) TO BECOME TOXIC AND FATTENING
Breeding Has Changed Everything Edible

Claim: Wheat Has Been Changed to Be Problematic

- What we eat these days isn’t the wheat your grandma had... It’s an 18-inch tall plant created by genetic research in the ’60s and ’70s.” Davis
- No significant changes
  Kasarda, USDA Albany 2013
  Chibbar, U. Saskatchewan 2015
  HealthGrain EU 2013

FACT: Triticum aestivum is found in many shapes / sizes.
Ancient/modern wheat – straw 12” t- 60” (USDA National Small Grains Collection)
Height genes do not code for glutens and gliadins
Gliadin – A new protein

**Debate claim:** Gliadin is a new toxic protein and opiate.
1745 studies of wheat proteins - Italy
1820 Gliadin - German chemists Osborne and Voorhees
1893 chemical constitution of gliadin and glutenin
1915 Osborne & Mendel: gliadin maintains life but would not promote growth without other plant proteins

**Claim: ‘Ancient Wheats’ less Immunogenic**
- ‘Ancient’ Grazzarella and Kamut vs modern durum accessions Cappelli, Flumino, Graziella and Svevo
- ‘...present results cannot confirm that ancient durum wheats would be less CD-toxic. In conclusion, we strongly advice celiac patients from consuming ancient wheats, including...’
- ‘not less allergenic by rice and pin prick tests’

**Food Allergies, Intolerances, and Sensitivities Defined**
- **Food Allergy***: an IgE mediated reaction to a food protein causing histamine release
- **Food Autoimmune:** reaction caused by the activation of a gene (celiac)
- **Food Intolerance:** reaction to a metabolite or ingredient such as lactose, caffeine, or tyramine (aged cheeses and Asian fermented sauces)
- **Food Sensitivity:** reaction to food component that is not an allergic, chemical or autoimmune response

* Celiac disease is an autoimmune disease not an allergy

**Food Allergy**: an IgE mediated reaction to a food protein causing histamine release

**Gliadin – An opiate**

- **Food Proteins – NIH in vitro study 1979**
  - Proteins, digestive enzymes, acid – wheat
  - milk, soy, rice, spinach

  *everybody else is susceptible to the gliadin protein that is an opiate. This thing binds into the opiate receptors in your brain and in most people stimulates appetite_such that we consume 440 more calories per day, 365 days per year.**

**Digestion and Gut Health: The First Point of Wellness**

“Digestion, of all the bodily functions, is the one which exercises the greatest influence on the mental state of an individual.”

Jean-Anthelme Brillat-Savarin
(1755-1826)
Digestion and Gut Health

• Human body has 10 trillion cells
  • Microbes outnumber human cells 10:1
    ≈ 3% of body

200 lb. Adult has ∼ 2-6 lbs bacteria

“We should start thinking about diets not only from the perspective of what we should eat, but what we should be feeding our entire gut microbial systems…. The gut microbiome has been linked to many diseases, including obesity, cancer, and inflammatory bowel disease….”

~Jeff Leach, founder of the Human Food Project and co-founder of American Gut.

Microbiome Diversity / Balance

• Assoc. with the Immune System
  • Allergies & Asthma
  • Crohn’s disease & Colitis
  • Obesity & Diabetes
  • Cancer risk
  • Heart disease
  • Poop transplants by changing microbes
  • Rats changed susceptibility to heart attacks
  • Lean rats became obese and vice versa

• Assoc. with Stress, Personality
  • Germ-Free mice & rats are more vulnerable to stress
    • Mice: Warm and friendly vs. aggressive and stand-offish strains

• Assoc. with Cognition and Behavior
  • High fat/ high protein diets reduce memory acuity; executive functioning
  • Markers of inflammation affect entire body incl. brain

Low Acid, Bacterial Overgrowth Dietary Dysbiosis & Disease

Low stomach acid allows:

1. Pathogenic bacteria to survive and populate the gut
2. Contributes to weak tight junctions → leaky gut
3. Proteins cross the gut → trigger immune reactions

Human Microbiome
A Vital Role in Human Health

• Influenced by
  • Diet – esp. fiber vs readily available carbs (CHO)
  • Fiber feeds the gut MO
  • Phytochemicals used by MO
  • Type of birth – Vaginal vs. Cesarean
  • Breast fed or not
  • Use of antibiotics and other drugs

• Greater diversity of types of MO assoc. with better health
  • “There is not just one way to be healthy, there doesn’t have to be one or two ‘just right’ gut communities, but rather a range of ‘just fine’ communities”… As predictable, the gut flora is probably dynamic and most influenced by the diet. As a matter of fact, the type of diet (vegetarian or non-vegetarian) decides the percentage count of Bacteroides spp., Bifidobacterium spp., etc. in the gut flora.”

~Huse, a researcher in Human Microbiome Project (HMP)


Gut Bacteria Through the Lifecycle


Gut Permeability: Opening the Door to Many Health Problems

Dysbiosis: microbial imbalance in the GI tract

Factors affecting mucosal immune system resulting in intestinal barrier dysfunction, subclinical and nervous system abnormalities

Influence on the blood-brain barrier and neuroimmunity
Allergies, Antacids, Microbes, Carbohydrates & Wheat

Intestinal Microbes and Allergy

Clostridia, Enterobacteriaceae, Staphylococci

Decreased risk

Food allergy prone mice

Increased Risk

Lactobacillus Bifidobacterium


Prevalence of Food Allergy

• Up to 35% believe they have food allergy
• ~3.5% confirmed by oral food challenge
• 10-fold lower prevalence

Source: http://www.jacionline.org/article/S0091-6749(07)00991-8/abstract; Rona RJ et al. Journal of Allergy and Clinical Immunology 2007, 120:638-646

Top Food Allergens

<table>
<thead>
<tr>
<th>Children %</th>
<th>Adults %</th>
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</thead>
<tbody>
<tr>
<td>Milk</td>
<td>2.5*</td>
</tr>
<tr>
<td>Eggs</td>
<td>1.5*</td>
</tr>
<tr>
<td>Peanuts 1.4 / Nuts</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Wheat</strong></td>
<td><strong>0.4</strong>*</td>
</tr>
<tr>
<td>Soy</td>
<td>0.4*</td>
</tr>
<tr>
<td>Fish 0.1 &amp; Shellfish</td>
<td>0.1</td>
</tr>
<tr>
<td>Sesame</td>
<td>0.1</td>
</tr>
</tbody>
</table>


Wheat Allergy – What Is It?

• A classic allergy, usually to the seed storage proteins
• ~27 wheat proteins have been identified
• Glutenins (wheat gluten): most frequent allergens
• Gliadins: most severe allergens
  - γ-gliadin
  - ω 5 gliadin - Wheat dependent exercise induced anaphylaxis (WDEIA)
• Albumins and maybe some globulins and enzymes
  - α-amylase/trypsin inhibitor family in wheat, barley and rye flour

Source: Mills et al Plant Food Allergens 2007 Blackwell

Wheat Allergy Symptoms

• IgE Immunoglobulin response
• Mast cells release histamine after binding with IgE
• Eczema & hives, swelling
• Asthma & hay fever-like symptoms, cough
• Tiredness
• GI symptoms

• Rare: anaphylactic shock
  - Neurological
  - Joint/muscle pains ➔ arthritis
  - Other IBS


Source: http://www.jacionline.org/article/S0091-6749(07)00991-8/abstract; Rona RJ et al. Journal of Allergy and Clinical Immunology 2007, 120:638-646


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Allergy & Acid Suppression

Antacids and anti-ulcer drugs:
• Stomach acid leads to protein digestion and potential allergic reaction
• Promote IgE formation by dietary protein fragments
  ➢ Milk, potato, celery, carrots, apple, orange, wheat, rye
• Sensitivities lingered > 3 mo. after antacid use

Sources: Unternberger et al. JAGS. 2005 Apr;18(4):466-8
McCarthy DM Curr Opin Gastroenterol. 2010 Nov;26(6):624-31

Acid Suppression & Allergy

• Acid suppression while in utero associated in offspring (Swedish cohort>29,000)
  ➢ Allergy (OR 1.43)
  ➢ Childhood asthma (OR 1.51)


Causal Factors for Celiac Symptoms

1. Gluten
2. Genetics (>97%)
   ➢ HLA-DQ2
   ➢ HLA-DQ8
3. Trigger - stress, trauma
   ➢ Surgeries, pregnancy, etc.
   ➢ Viral infections
4. Intestinal Permeability
   ➢ Emerging Factor
   ➢ “Leaky Gut”

Celiac Incidence

• US Average (healthy people): 1 in 133; only 1: 4700 diagnosed
  ➢ Higher if Scandinavian, Irish, parts of Middle East: 1 in 50-60
  ➢ Est. African, Hispanic- and Asian-Americans: 1 in 236
• In people with related gut symptoms: 1 in 56
  ➢ 1st-degree relatives: 1 in 32
  ➢ 2nd-degree relatives (aunt, cousin): 1 in 39
• Incidence is increasing: 2 to 5x higher

• Based on the presence of tissue trans-glutaminase antibodies
• No continuous data relating to the incidence of celiac disease in the U.S. population on a year-by-year basis


Gluten Sensitivity - New

• Abdominal pain (IBS) 68%
• Eczema, rash 40%
• Headache 35%
• “Foggy mind” 34%
• Fatigue 33%
• Diarrhea 33%
• Depression 22%
• Numbness in extremities 20%
• Joint pains 11%

Source: Center for Celiac Research in Baltimore. Dr. Alessio Fasano 2004-2010; 347/5896 patients. 61 fulfilled criteria for CS
No validated or agreed upon test for non-celiac gluten sensitivity..
Theories about Increasing Prevalence of Celiac/ Autoimmunes

1. Increased awareness, better diagnostics
   - Recognition of gluten sensitivity; controversial
2. Bacterial overgrowth: medications, age
3. Salt intake
4. Increased autoimmune diseases overall
   - Clean theory or hygiene hypothesis


Theories about Increasing Prevalence of Celiac

5. Infant & Early Feeding Practices
   - Gradual introduction of gluten at 4 and 7 mo risk
   - Celiac disease
   - Gluten allergies
   - Type 1 diabetes (another autoimmune disease)
   - Introducing gluten while breastfeeding appears to be protective in some studies, not all
   - 33% of babies born by Caesarian

6. Foodborne infections and viruses: trigger autoimmune diseases


CLAIM: WHEAT, GRAINS AND CARBS CAUSE OBESITY AND CHRONIC DISEASE

Theories about Increasing Prevalence of Celiac

7. Short fermentations for bread vs sourdough: breakdown the offending peptides; free gluten additive
8. Agronomic practices: fertilizers, growing conditions, specific varieties
9. Poor diets overall: low fiber, folate, vitamins, too many calories
10. Change in the gut microbiome: may increase autoimmune diseases


Obesity, CHO/Grains Alleged as Culprits
Wheat Consumption Trends Do Not Follow Obesity Trends 1830-2010

Available Calories Have Increased

Grain Intake Is Flat or Decreasing as Obesity Climbs

‘Make Half Your Grains Whole’ Lowest Visceral Abdominal Fat

Claim: No Gluten/Grain (Paleo) Diet Reduces Diabetes/Metabolic Syndrome

- Systematic review - 16 cohorts Type 2 Diabetes (T2DM) Risk
- 3 servings (minimum 45g) whole grain (WG)
- Relative risk (RR) = 0.68
- Inverse associations
  - WG including WG bread
  - Bran
  - Refined grains RR = 0.95
- >3000 children/adolescents in Tehran
- No association with
  - low CHO diet score and incidence of MetS
  - MetS components
  - risk from energy dense snacks


http://www.fao.org/docrep/005/ac911e/ac911e05.htm


Framingham Heart Study (n=2834)

**Whole Grain: Coronary Heart Disease**

Iowa Women’s Health N=35,000

36% risk – 1 sv/d

ARIC Men/ Women N=36,000
Nurses’ Health Study N=75,800

25% - 28% risk

3 sv= ~ 50 g WG/d

2015 meta analysis
- 15 cohorts, 1 case-control n> 400,000

22% risk – 3 sv/d


Jacobs et al, 1999;

Liu, et al., 1999; Steffan et al, 2003; Mozaffarian et al. JAMA. 2003

**Claim: “Grain Fiber Unnecessary”**

- Davis & Paleo: other fibers will do the same job.

NIH-AARP Diet & Health Study 367,442 older Americans

- High cereal fiber intake 15% lower risk of all-cause mortality

- 15-34% lower risk of disease-specific mortality

"Dietary fiber from grains, but not from other sources, was significantly inversely related to total and cause-specific death in both men and women."


**Claim: Fibers from All Sources Have the Same Impact**

- **DF & Small Intestinal Cancer**  RR

  - Total Dietary Fiber 0.79 ns

  - Grain Fiber 0.51  P < 0.01

  - Whole Grain foods 0.59  P < 0.06

NIH AARP  N> 500,000


**Claim: Vegetable Fibers Will Do the Job**

- **FIBER LAXATION** per g fiber fed

  - Wheat bran  5.4

  - Psyllium  4.0

  - Oats  3.4

  - Corn  3.3

  - Legumes  2.2

  - Pectin  1.2

  - RS2 resistant starch  1.1

  - Inulin  1.0

Affordability and Nutritional Quality of No Grain/ Gluten Free/ Paleo

- Gluten-free diets – can cost 242% more
- May be less nutritious and may not be fortified and are more costly
- Paleo and Grain –free diets - meats, seafood, fruits, vegetables, and nuts

- USDA data: 9.3% income needed for Paleolithic diet that meets all daily recommended intakes
- Inadequate Ca++ or cereal/legume fiber

USDA “not feasible for low-income consumers”

Crop Yields – Wheat vs Ancient Grains

- Wheat: 50 bu/acre (3000 lbs of grain)
- Spelt: 2400 lbs naked grain
- Emmer Farro: 1900 lbs
- Einkorn: 1500 lbs

Nutritional Contribution of Grains

Traditional Grains
- >1000 kcal per square meter
- >400 kg protein/ha

<table>
<thead>
<tr>
<th>Cereal/Pseudocereal</th>
<th>Calories/m²</th>
<th>Protein (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize (corn)</td>
<td>1,847</td>
<td>415</td>
</tr>
<tr>
<td>Oats</td>
<td>1,506</td>
<td>384</td>
</tr>
<tr>
<td>Rice (paddy)</td>
<td>1,482</td>
<td>307</td>
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<tr>
<td>Triticale</td>
<td>1,256</td>
<td>470</td>
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<tr>
<td>Amaranth</td>
<td>1,133</td>
<td>418</td>
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<tr>
<td>Wheat</td>
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<td>453</td>
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<td>Sorghum</td>
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<td>Millet</td>
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<tr>
<td>Quinoa</td>
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<tr>
<td>Soybeans</td>
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<td>870</td>
</tr>
<tr>
<td>Lentils</td>
<td>322</td>
<td>244</td>
</tr>
<tr>
<td>Green Beans</td>
<td>229</td>
<td>127</td>
</tr>
</tbody>
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Grains and the World Food Supply

Why 80% of People Worldwide Will Soon Stop Eating Wheat

Protein (g)/Unit Area by Crop

Grains/carbohydrate staples deliver much needed protein

Conclusions

- We did evolve to eat grains
- Wheat has not changed but we have. Many possibilities including aspects that cause changes in the microbiome increase all autoimmune diseases.
- Around 5% of the population should avoid wheat and or gluten
- Grains and grain fiber are unique and protective to health
- Diets without gluten and grains may be inadequate. Need careful planning and may lack cereal fiber.
- Elimination of grains bodes problems for 2050 in terms of the world food supply