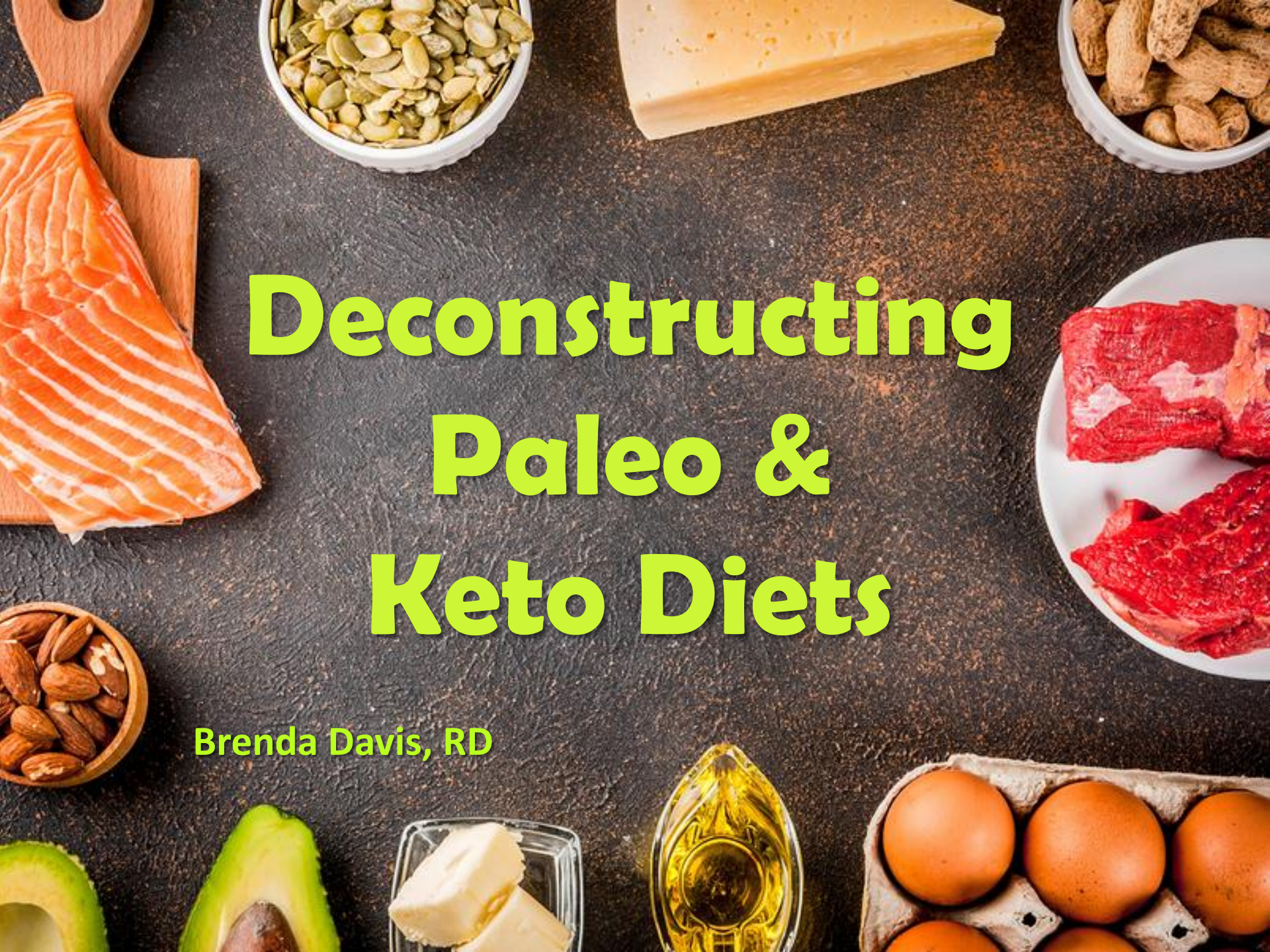




Deconstructing Paleo & Keto Diets

Brenda Davis, RD

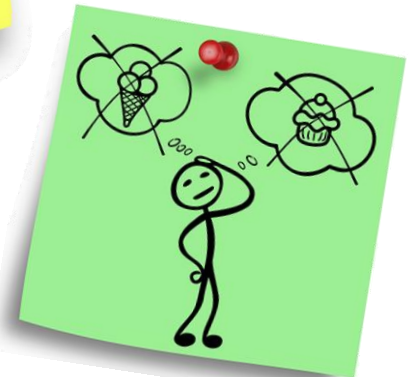
Faculty/Presenter Disclosure

- ▶ **Faculty:** Brenda Davis, RD
- ▶ **Relationships with commercial interests:**
 - Consulting Fees: Living Light Culinary Institute, Canvasback Missions, E4 Alive, Diabetes Undone.
 - Book Royalties: Book Publishing Co., Harper Collins Canada.
- ▶ **Potential conflict(s) of interest: None.**



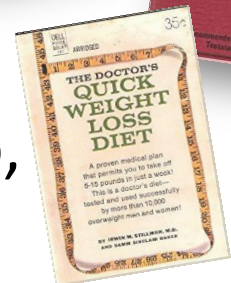
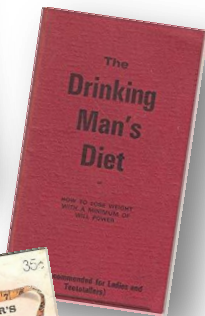
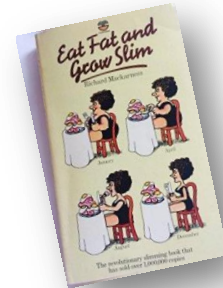
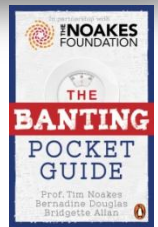
Outline

- ▶ History of low carb diets.
- ▶ Keto and Paleo diets defined. Differences?
- ▶ Digging deeper into Keto and Paleo claims.
- ▶ Plant-based vs Keto/Paleo
- ▶ Low carb diets – the good, the bad and the ugly.

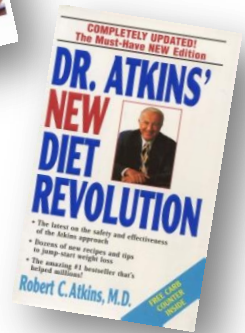
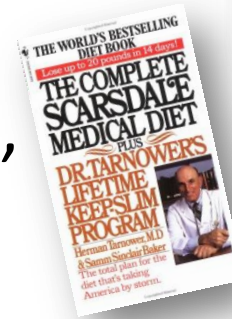
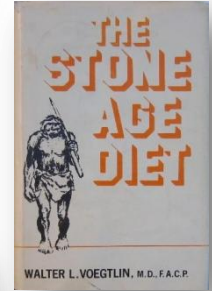
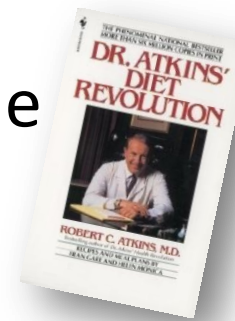


History of Low Carb Diets

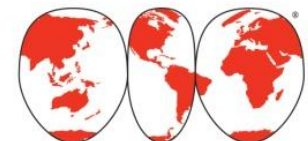
- ▶ **1800s – Ketogenic diets** – used to treat diabetes
- ▶ **1869 – The Banting Diet** – popular low carb, high fat diet; recently reinvented
- ▶ **1921 – Ketogenic diets** – used to treat epilepsy
- ▶ **1958 – Eat Fat & Grow Slim** – low carb, high protein diet book by Richard Mackarness
- ▶ **1964 – The Drinking Man's Diet** – up to 60 g CHO/day and daily alcohol
- ▶ **1967 – The Stillman Diet** – 6 small meals, low carb, high protein diet



- ▶ **1972 – Dr. Atkins’ Diet Revolution** – the diet that launched the low carb craze
- ▶ **1975 – The Stone Age Diet** – Walter Voegtlin – discouraged grains, dairy and sugar
- ▶ **1978 – The Scarsdale Diet** – low calories, moderately low carb diet (34.5% CHO)
- ▶ **1992 – Dr. Atkins New Diet Revolution** – slightly more liberal low carb than the 1972 diet
- ▶ **1999 – Birth of the Weston A Price Foundation** encouraging consumption of high animal fat diet

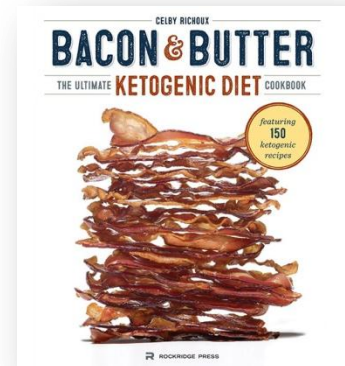
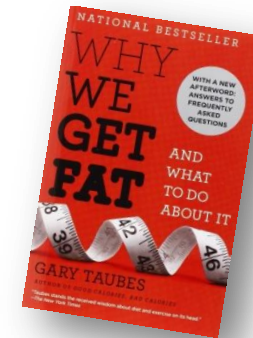
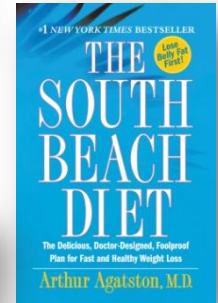
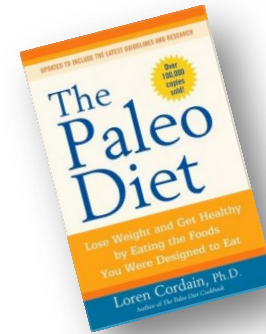


The Weston A. Price Foundation®
for **Wise Traditions**
IN FOOD, FARMING AND THE HEALING ARTS



Education • Research • Activism

- ▶ **2002 – The Paleo Diet** – Loren Cordain
- ▶ **2003 – The South Beach Diet** – low carb progressing to moderate carb
- ▶ **2007 to present – Gary Taubes books and articles**
- ▶ **2013 – Paleo diets** became extremely popular - #1 in Google weight loss methods search
- ▶ **2016 – Keto diets** enjoyed a dramatic rise in popularity



What is a Ketogenic Diet? (Keto Diet?)

- ▶ An eating plan that is very low in carbohydrates (“carbs”) and very high in fat.
- ▶ Ketogenic diets were originally designed to treat diabetes and epilepsy.
- ▶ They are now among the most popular weight loss diets.



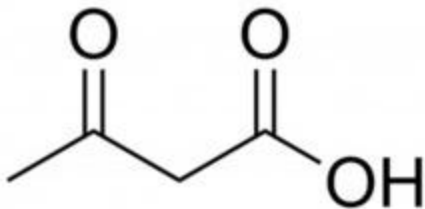
The Basic Premise

- ▶ If the body does not have access to glucose (the preferred fuel) through the diet:
 1. Glycogen stores are depleted.
 2. The body enters a state of ketosis where an alternative fuel called ketones are produced to supply the body's energy needs.
- ▶ This puts the body into a high fat-burning state – stored fats are released promoting weight loss.



3 Types of Ketone Bodies

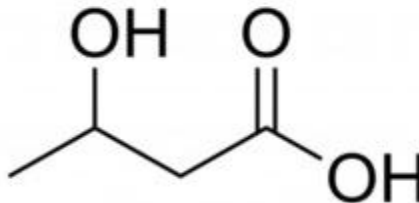
Acetoacetate (AcAc)



Acetoacetate
(technically, a ketone)

Produced from fatty acids.
Converted to BHB
or acetone.

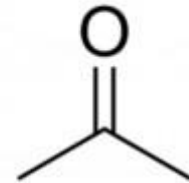
Beta-Hydroxybutyric Acid (BHB)



Beta-hydroxybutyric acid
(technically, NOT a ketone)

Formed from AcAc.
Not technically a ketone,
but similar structure -
considered one in
the keto diet.

Acetone

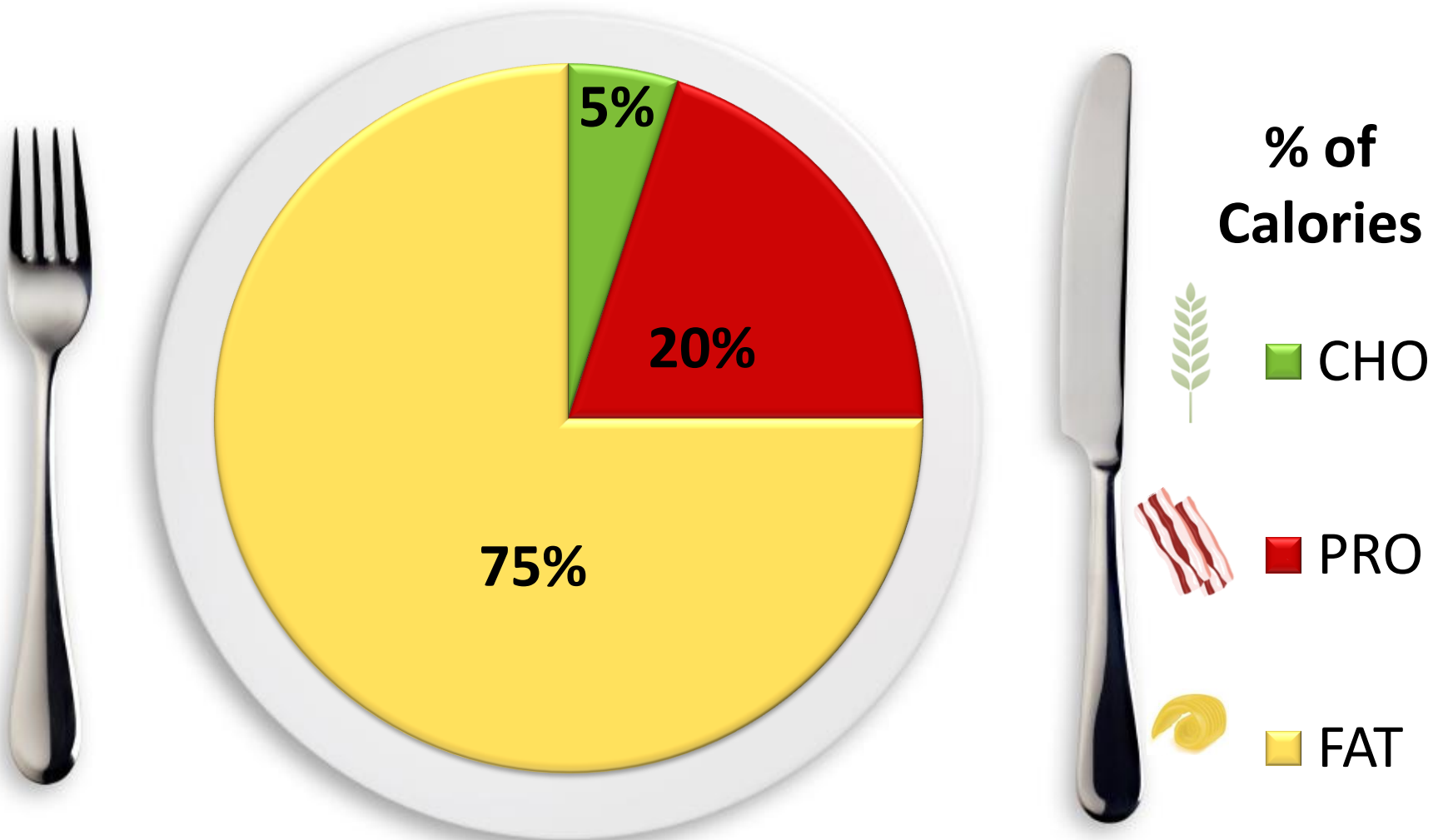


Acetone
(technically, a ketone)

Produced from AcAc
Rapid breakdown.
Exhaled in the breath.

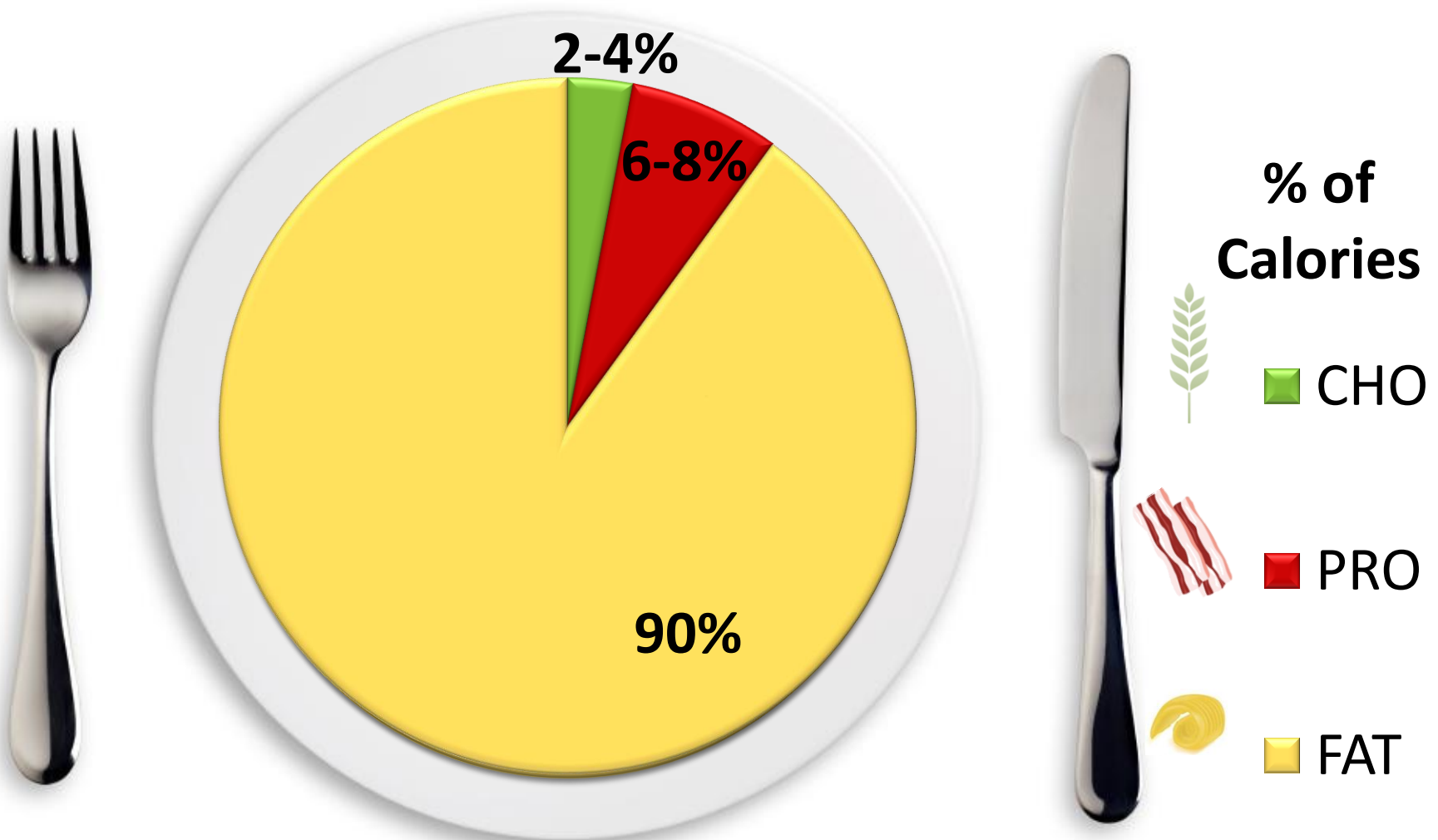
Keto Macronutrients

Most extreme form of low carb diet.

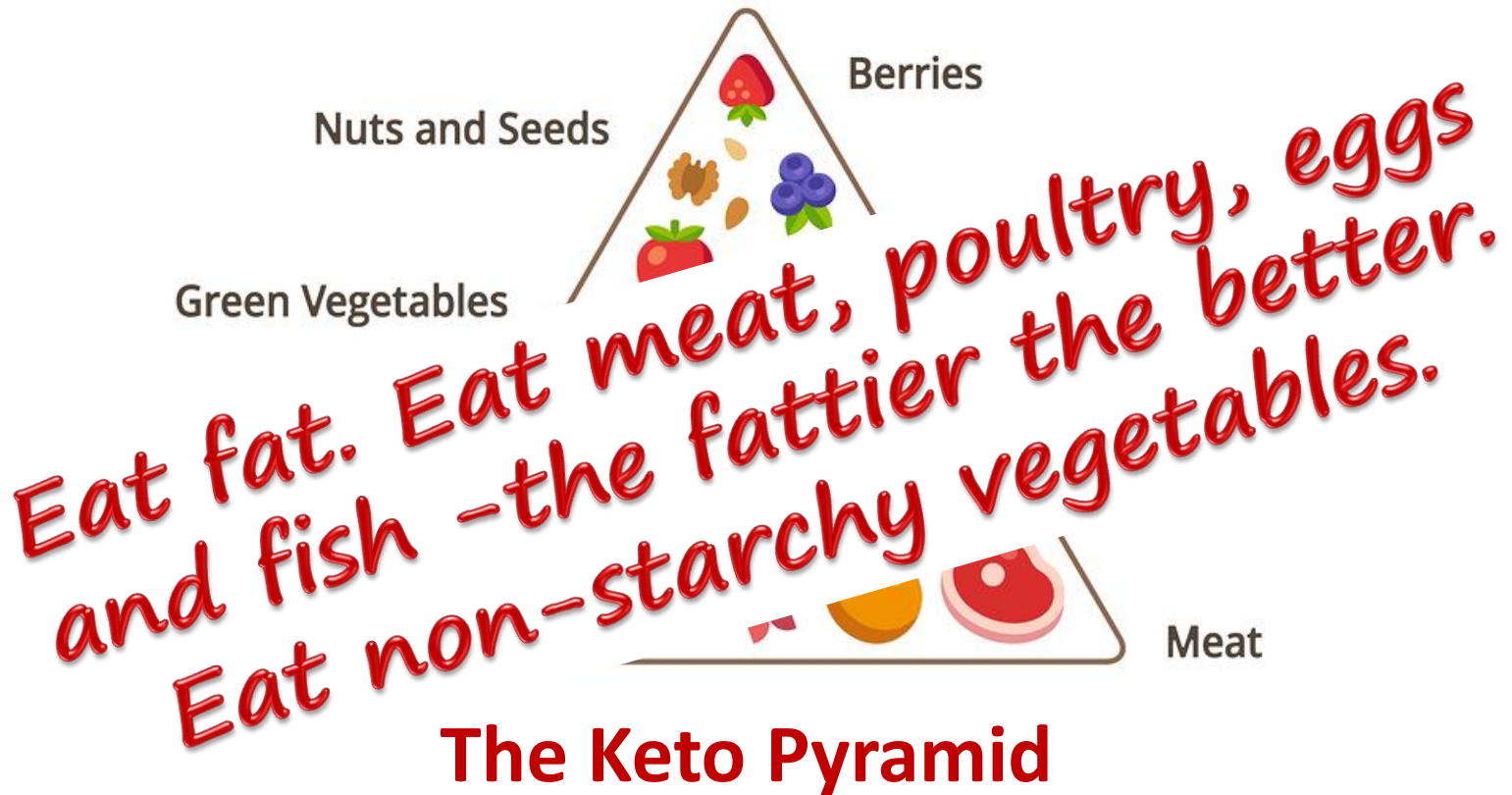


Keto Macronutrients

Classic Ketogenic Diet for Epilepsy



What foods are permitted?



Sample Recipe

Cheesy Taco Casserole

1/8th of recipe (787 calories)

Ingredients:

8 tsp taco seasoning
3 lbs 80/20 Ground Beef
2 Cups Pepper Jack Cheese
(Shredded)
4 Cups Colby &
Monterey Jack Cheese
(Shredded)
2 Cups Frozen Pepper Strips
(Green, Red, and Yellow)
thawed

61 g fat (70% of kcal)

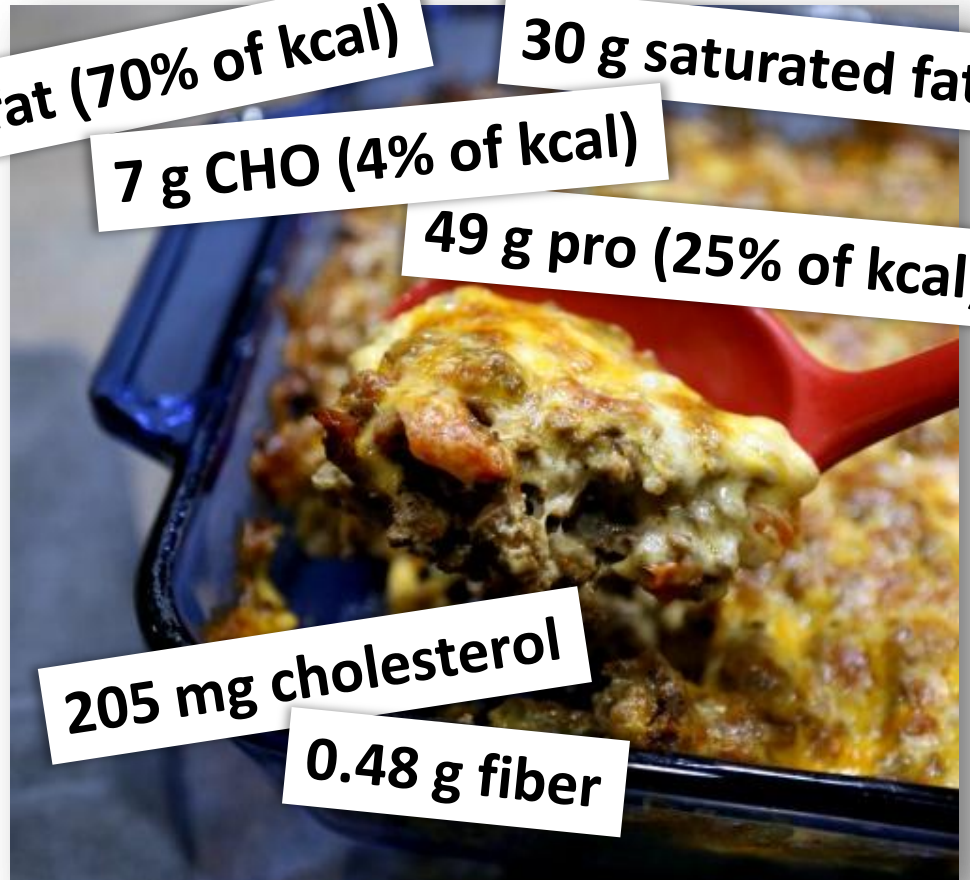
7 g CHO (4% of kcal)

30 g saturated fat

49 g pro (25% of kcal)

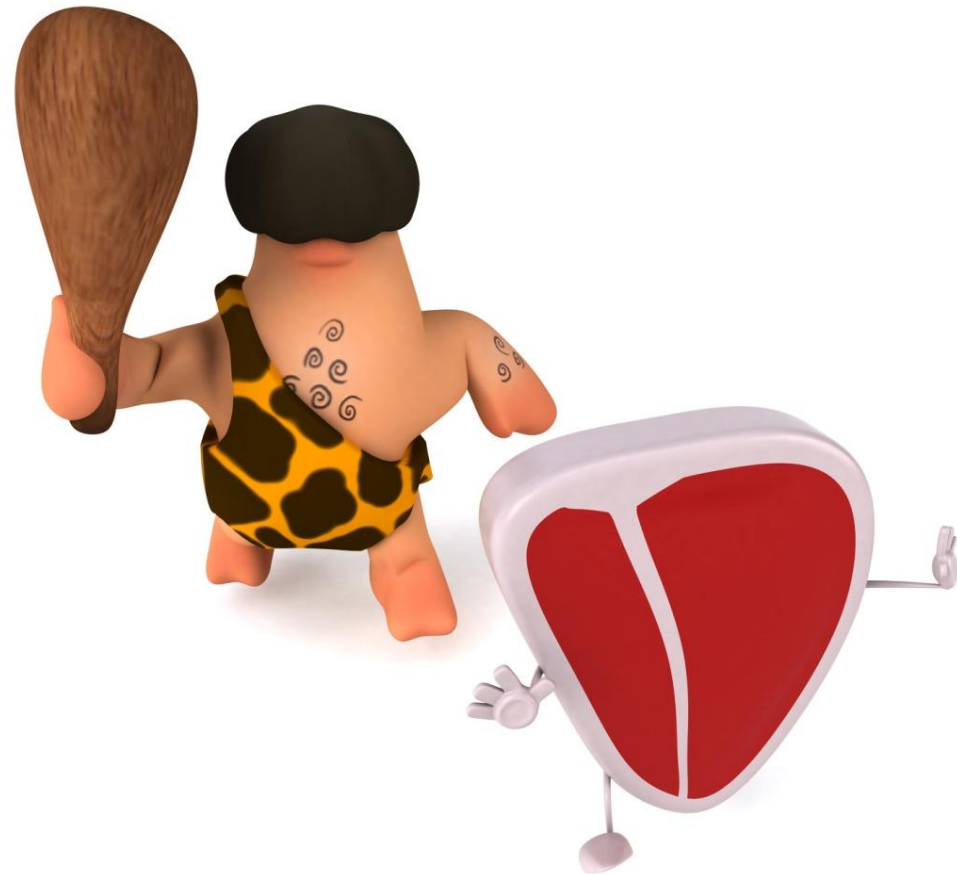
205 mg cholesterol

0.48 g fiber



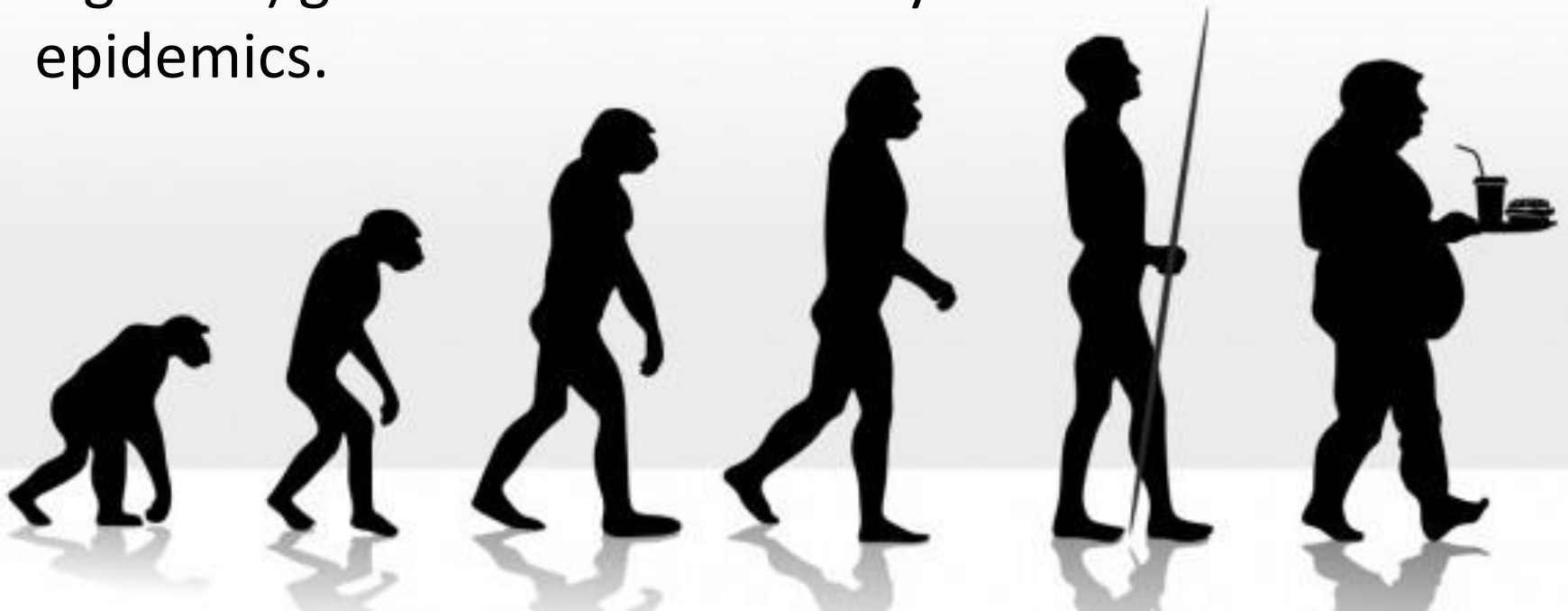
What is a Paleo Diet?

- ▶ A pattern of eating that attempts to mimic the diet of our Paleolithic ancestors.
- ▶ **Other names** – caveman diet, primal diet, stone age diet.



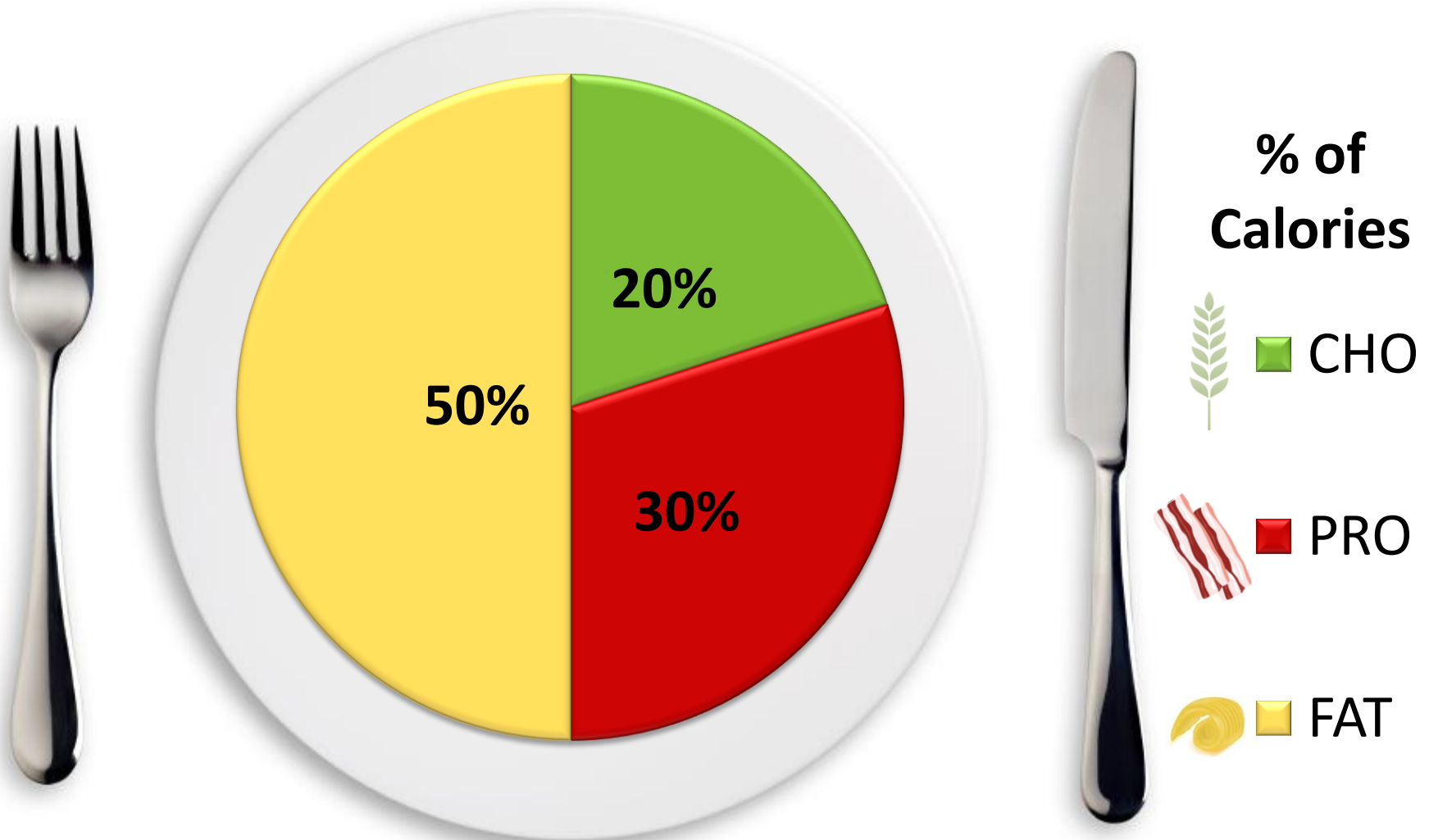
The Basic Premise

What humans ate in pre-agricultural times is the diet best suited to our genetic make-up. The shift from a hunting and gathering diet (rich in wild meat and wild plants) to an agricultural diet (rich in grains and legumes) gave rise to our obesity and chronic disease epidemics.

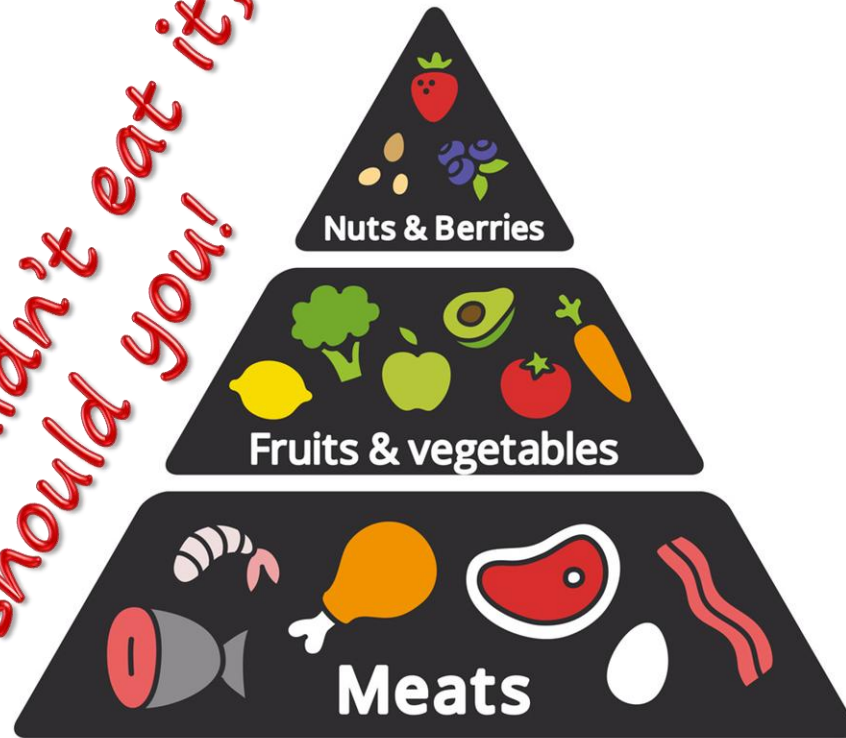


Paleo Macronutrients

Least extreme form of low carb diet.



What foods are permitted?



The Paleo Diet



*If a caveman couldn't eat it,
neither should you!*

Sample Recipe

Pork and Vegetable Stir Fry

Ingredients:

- 2 Tbsp coconut oil
- 1 lb pork tenderloin
- 2 tsp minced garlic
- 1 tsp minced ginger
- 1 cup green beans
- 1 cup sugar snap peas
- ½ tsp red pepper flakes
- 1 cup carrots, sliced
- ½ cup coconut milk
- Juice of half lemon
- Salt to taste
- 1 Tbsp sesame seeds

1/2th of recipe (643 kcal)

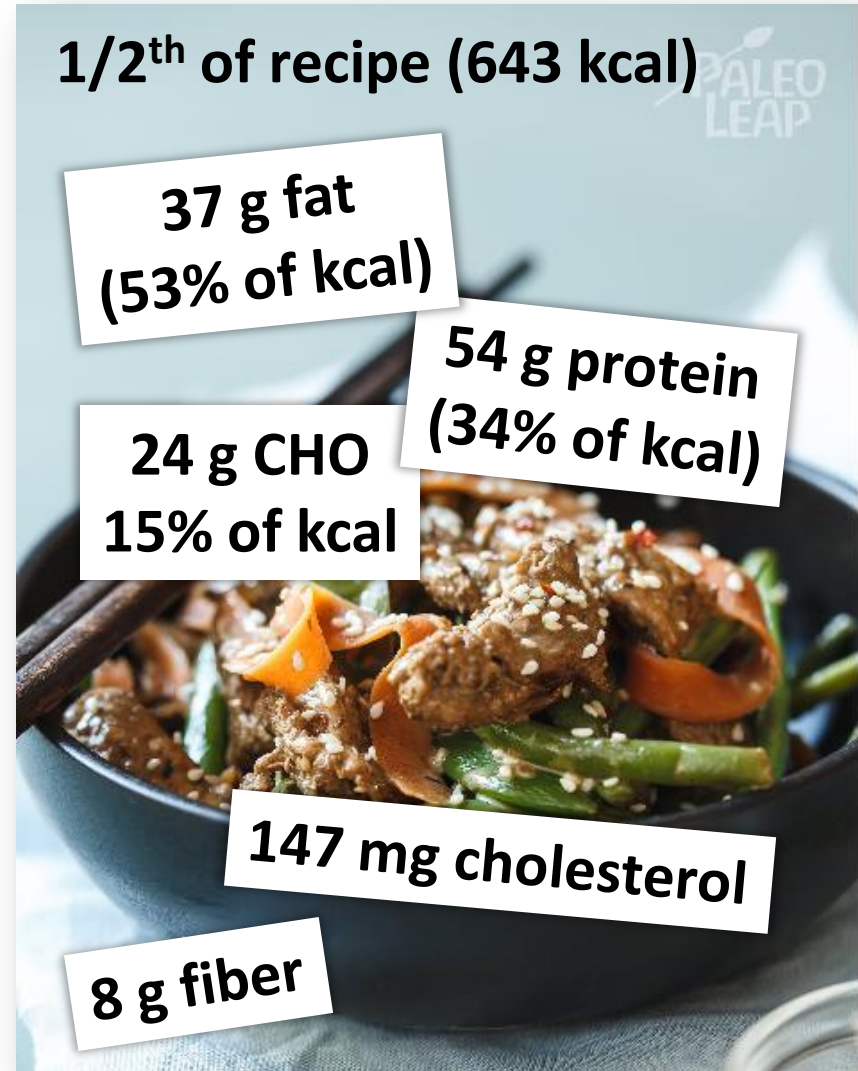
37 g fat
(53% of kcal)

54 g protein
(34% of kcal)

24 g CHO
15% of kcal

147 mg cholesterol

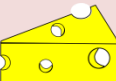
8 g fiber



□ Similarities

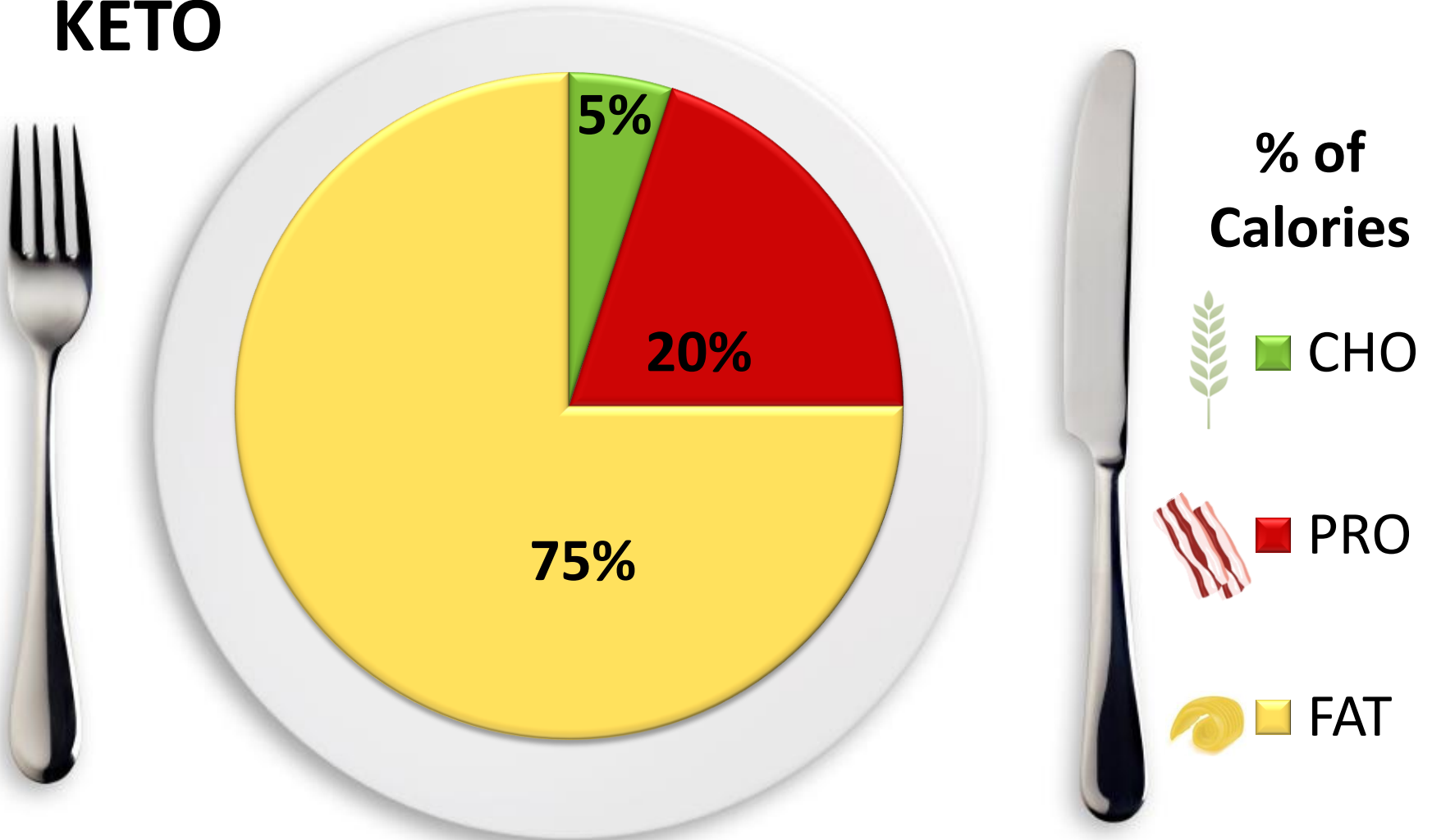
Paleo and Keto

□ Differences

Diet Component	Paleo	Keto
Meat, poultry, fish, eggs	High 	High 
Nuts and seeds	Included 	Included 
Green vegetables	Included 	Included 
Legumes	Excluded 	Excluded 
Grains	Excluded 	Excluded 
Dairy	Excluded 	High cheese 
Other non-starchy veg	Included 	Limited 
Starchy vegetables	Limited 	Excluded 
Fruits	Moderate    	Minimized  
Concentrated fats & oils	Moderate 	Very high 

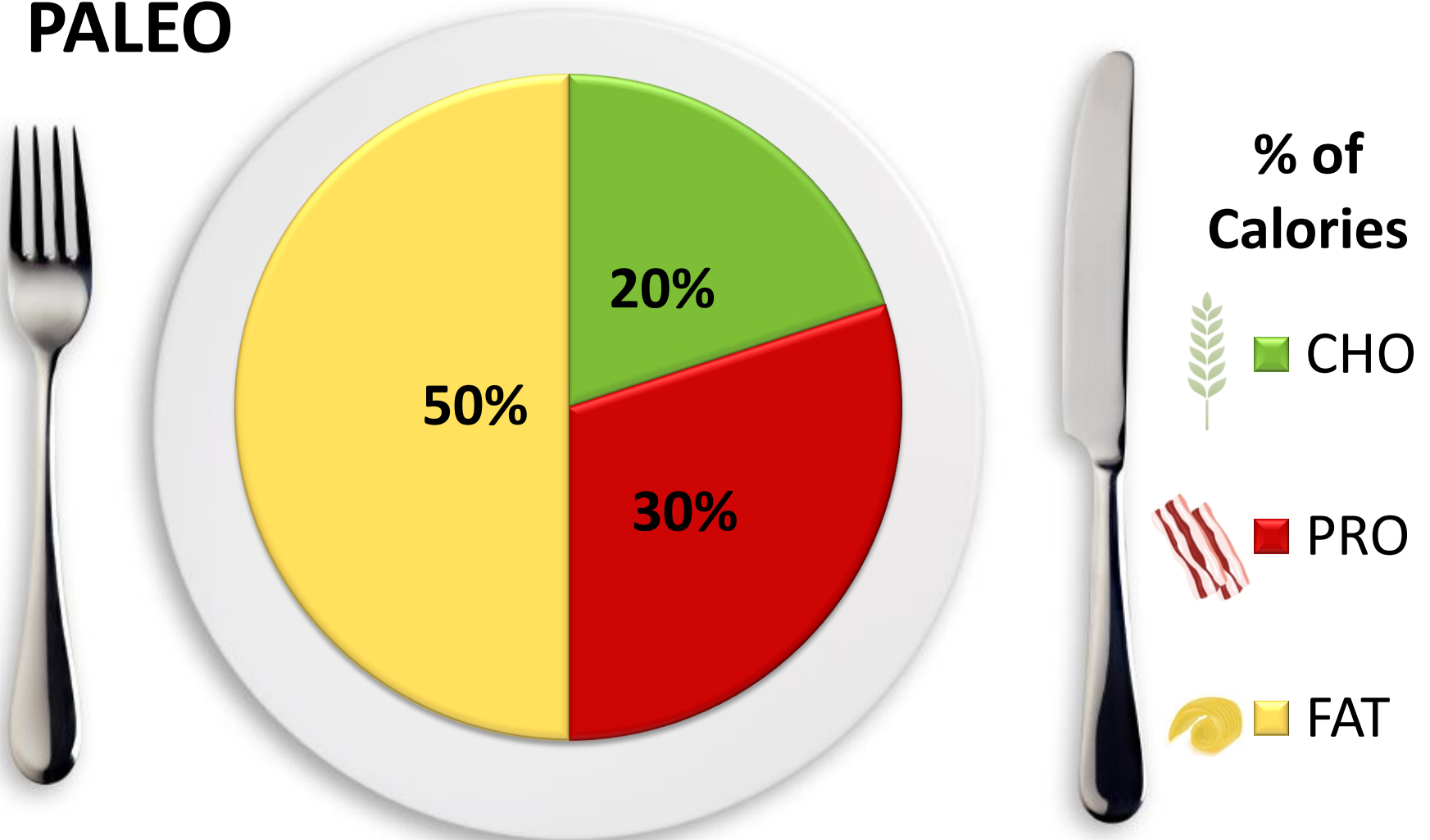
Macronutrients

KETO



Macronutrients

PALEO

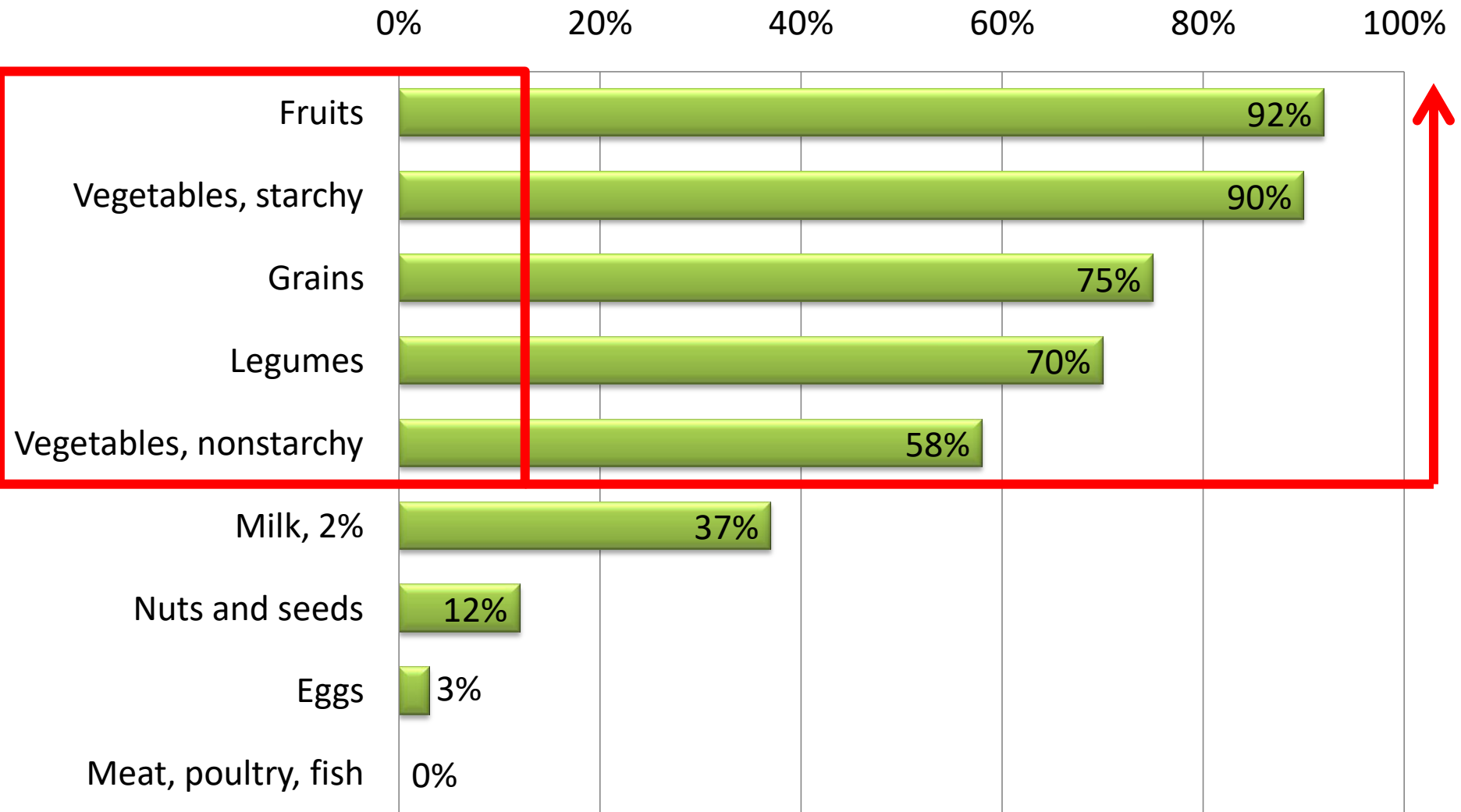


Carbohydrate Restriction

- ▶ Keto diets - $\leq 5\%$ CHO
- ▶ Other low carb diets - 6-20% CHO (Paleo at the highest end of the range).
- ▶ **How many grams of CHO?**
 - Keto ~ 20 grams
 - Paleo ~ 100 grams



Average % of Calories from Carbohydrates in Common Foods



Source: Davis and Melina. *Becoming Vegan: Comprehensive Edition*, 2014.

CHO in Non-starchy Vegetables

Typical CHO limit: Keto – 20 g; Paleo – 100 g

Food	CHO (g)	Food	CHO (g)
Avocado, 1 (136 g)	12	Peppers, raw, sliced, 1 c	6
Turnips, mashed, 1 c	12	Tomato, medium, 1 raw,	4
Brussels sprouts, ckd, 1 c	11	Zucchini, raw, chopped, 1 c	4
Green beans, , ckd, 1 c	10	Cucumber, raw, sliced, 1 c	4
Eggplant, boiled, 1 c	9	Cauliflower, raw, 1 c	5
Cabbage, boiled, 1 c	8	Celery, 1 large stalk	2
Carrots, 1 large	7	Romaine, shredded, 1 c	1.5
Asparagus, ckd, 1 c	7	Kale, raw, 1 c	1
Broccoli, raw, chopped, 1 c	6	Spinach, raw, 1 c	1

CHO Content of Other Foods

Food, serving size	CHO, g	Food, serving size	CHO, g
Granola, 1 c	66	Sweet potato, 1 medium	24
Bagel, 1 medium	56	Bran flakes, 1 c	24
Rice, brown, ckd, 1 c	52	Blueberries, 1 c	21
Barley, ckd, 1 c	44	Squash, winter, cubes, 1 c	15
Instant oatmeal, raisin spice, 1 c	43	Whole wheat bread, 1 slice	15
Beans/ lentils, ckd, 1 c	40	Strawberries, 1 c	13
Quinoa, ckd, 1 c	40	Milk, whole, 1 c	11
Potato, 1 medium	37	Cream, light, 1 c	9
Pasta, ckd, 1 c	36	Cream cheese, 2 Tbsp	1.5
Corn, ckd, 1 c	31	Sour cream, 2 Tbsp	1
Apple, 1 medium	30	Cheese, 1 oz	1
Banana, 1 medium	27	Butter, lard, oil	0
Mango, raw, 1 c	25	Meat, chicken, fish, eggs	0



Which is more healthful?

KETO



- ▶ Most extreme of the low carb diets.
- ▶ Mainly fat and meat.
- ▶ Plant foods heavily restricted.

PALEO



- ▶ Least extreme of the low carb diets.
- ▶ Allow more liberal intake of plant foods.

Paleo is more healthful than Keto.

Higher levels of protective nutrients (e.g. fiber, prebiotics, phytochemicals, antioxidants, plant sterols).

Digging Deeper: KETO



6 Common Claims...

Keto Diets...

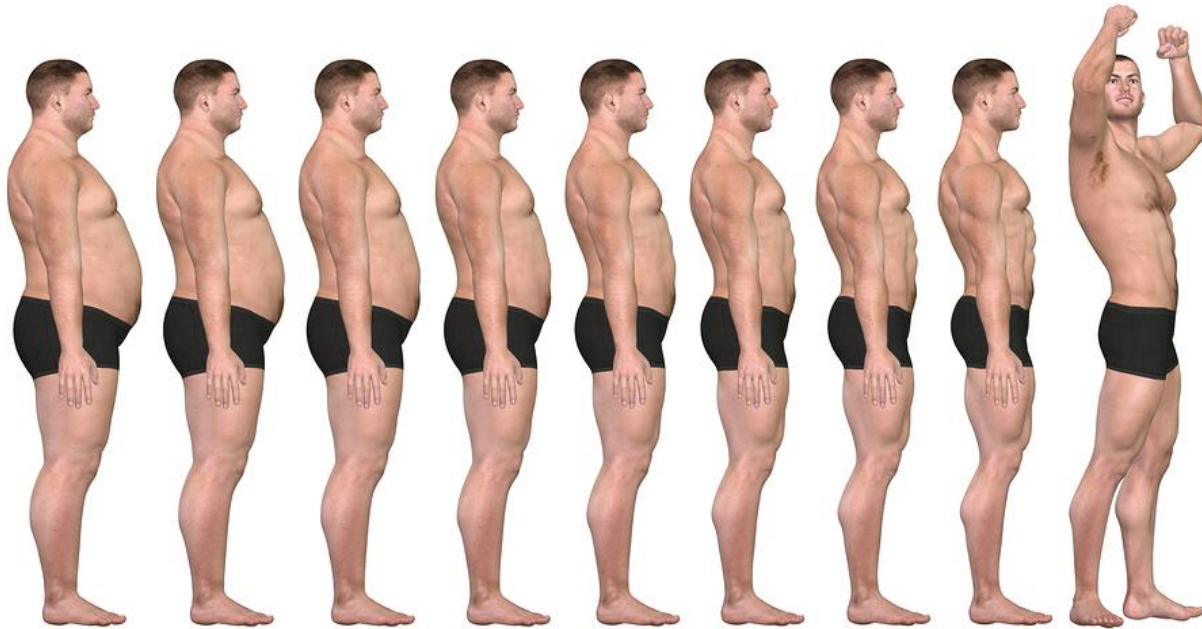
1. Induce rapid weight loss
2. Improve brain function
3. Improve endurance performance
4. Reduce diabetes risk
5. Reduce cardiovascular risk
6. Increase longevity



1. Induce Rapid Weight Loss

The Claim

“A keto diet is a very low-carb diet, which turns the body into a fat-burning machine.”



The Theory

- ▶ Provides a metabolic advantage – the body is retrained to use fat instead of glucose as an energy source – fat stores are used as fuel.
- ▶ Suppresses appetite. Ghrelin (the hunger hormone) does not increase as you lose weight, as it does with non-keto weight loss diets.



The Evidence – Short Term

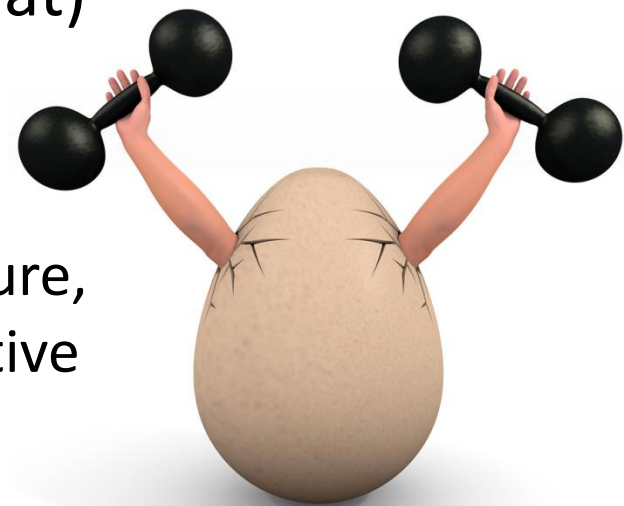
- ▶ Reports of significant weight loss in trials of 3 weeks to 4 months.
- ▶ Generally favorable changes in body composition and markers of inflammation.



The Evidence – Long Term

2013 meta-analysis – 13 RCTs

- ▶ Slightly more weight loss (-0.91 kg/2 lbs) over 1 year on Keto vs low fat (<30% fat)
 - Lower TG
 - Higher LDL and HDL cholesterol
 - No significant differences in blood pressure, fasting glucose, insulin, HbA1c or C-reactive protein.
- ▶ Weight loss similar to low fat over 2 years.



2016 Metabolic Ward Trial

17 overweight men

- ▶ Compared with a baseline diet (50% CHO), the Keto diet (5% CHO) increased energy expenditure less than predicted (<100 calories/day) – benefit waned over time.
- ▶ Body fat loss was no greater than with the 50% CHO diet.
- ▶ Loss of fat-free mass was greater (muscle mass) with the Keto diet.



The Verdict

- ▶ Keto diets promote weight loss and appear more effective than many other diets for accelerating weight loss short term.
- ▶ However, they do not offer significant weight loss advantages over other diets long term, and have serious downsides.



US News Best Diet Rankings 2018

Out of 40 diets:

- **Best Diets Overall Category** – Keto tied for last place
- **Best Diets for Healthy Eating** – Keto ranked last

WHY?

- Diet is extremely high in total and saturated fat, and in fatty animal products.
- High potential for nutritional deficiencies (e.g. fiber, potassium, folate, magnesium and vitamin C).
- Multiple adverse side effects.



Lots of Ways to Lose Weight

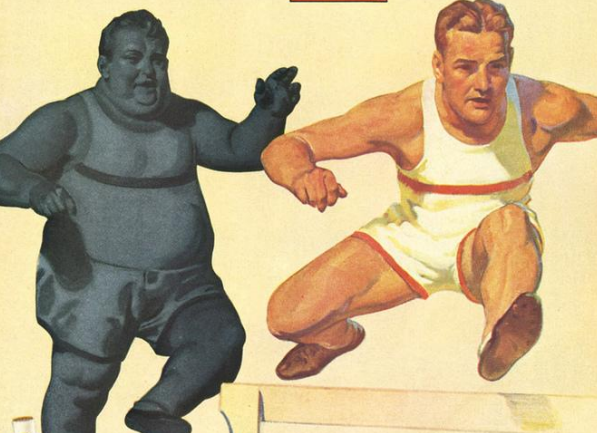
Anything that promotes an energy deficit will promote weight loss. It doesn't mean it is healthful.



“Reach for a Lucky” Diet

In 1929, a successful marketing campaign encouraged reaching for a cigarette instead of a sweet to avoid weight gain.

FACE THE FACTS!
When tempted to over-indulge
“Reach for a Lucky instead”



Be moderate—be moderate in all things, even in smoking. Avoid that future shadow* by avoiding over-indulgence, if you would maintain that modern, ever-youthful figure. “Reach for a Lucky instead.”

Lucky Strike, the finest Cigarette you ever smoked, made of the finest tobacco—The Cream of the Crop—“IT’S TOASTED.” **Lucky Strike** has an extra, secret heating process. Everyone knows that heat purifies and so 20,679 physicians say that **Luckies** are less irritating to your throat.

“It’s toasted”
Your Throat Protection—against irritation—against cough.

*We do not say smoking **Luckies** reduces flesh. We do say when tempted to over-indulge, “Reach for a **Lucky** instead.”

To keep a slender figure
No one can deny...



Reach
 for a
LUCKY
 instead of a
 sweet



“It’s toasted”
 No Throat Irritation—No Cough.

“THE SHADOW
which pursues us all”
 John Greenleaf Whittier, 1807-1892

“COMING EVENTS CAST THEIR SHADOWS BEFORE”
 (Thomas Campbell, 1777-1844)

AVOID THAT FUTURE SHADOW
 by refraining from over-indulgence, if you would maintain the modern figure of fashion

We do not represent that smoking **Lucky Strike** Cigarettes will bring modern figures or cause the reduction of flesh. We do declare that when tempted to do yourself too well, if you will “Reach for a **Lucky**” instead, you will thus avoid over-indulgence in things that cause excess weight and, by avoiding over-indulgence, maintain a modern, graceful form.

When Tempted
Reach
 for a
LUCKY
instead




“It’s toasted”
 Your Throat Protection—against irritation—against cough.

©1929, The American Tobacco Co., Manufacturers.

2. Improve Brain Function

The Claim

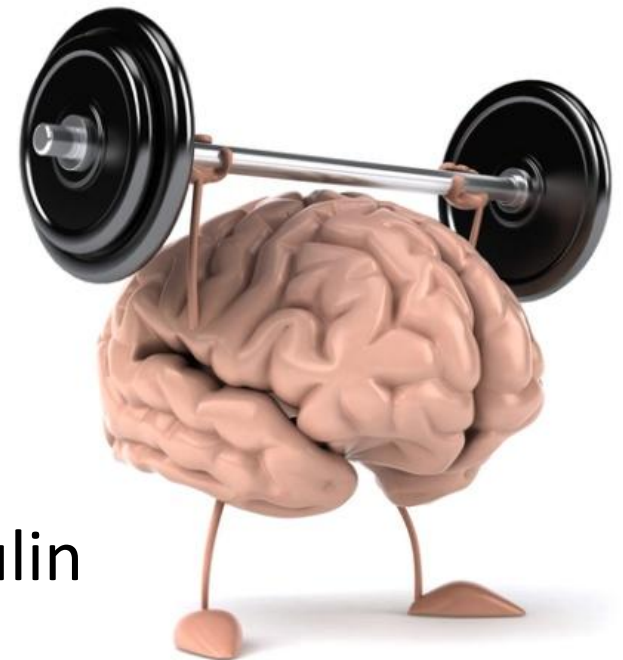
“Various types of low carb and ketogenic diets are effective at reducing seizures in patients with drug-resistant epilepsy... They can improve memory in older adults, help reduce migraines and reduce symptoms of Parkinson's disease.”



The Theory

Keto diets work for epilepsy and several brain disorders because they:

- ▶ Provide an alternative fuel for brain cells.
- ▶ Increase the number of mitochondria (energy factories).
- ▶ Reduce free radical production.
- ▶ Reduce protein tangles.
- ▶ Reduce insulin secretion and insulin resistance.



The Evidence - Epilepsy

- ▶ 36–85% of patients with epilepsy experience more than 50% seizure reduction with ketogenic diets.
- ▶ Epileptic syndromes are especially responsive to keto diets. An example is glut 1 deficiency – this is a rare genetic mutation resulting in a shortage of the glucose transport protein (GLUT 1).
- ▶ Switching to an alternate fuel for the brain reduces seizures and improves cognitive function across epilepsy subtypes.



Other Brain Disorders

Very preliminary evidence suggests:

- **Alzheimer's disease** – possible benefits for APOEε4 allele negative patients.
- **Cognitive function** – benefits in animal studies.
- **Migraines** – case reports, one observational study suggested benefit.
- **Parkinson's disease** – one study suggested improvement in motor and nonmotor symptoms.



McDonald TJW, Cervenka MC. *Brain Sci.* 2018;8(8).

Di Lorenzo C, et al. *The Journal of Headache and Pain.* 2013;14(Suppl 1):P219.

Phillips MCL, et al. *Mov Disord.* 2018;33(8):1306-1314.

The Verdict

- ▶ **Epilepsy** - Effective for many infants, children and adults, especially those who are not controlled with medication. Improves cognitive function in affected individuals.
- ▶ **Other brain disorders** - inconclusive, but preliminary research suggests potential benefit for conditions in which the pathogenesis includes abnormalities in cellular energy utilization.



3. Improve Endurance Performance

The Claim:

“If you are an endurance athlete, and you haven’t looked into the benefits of ketosis and endurance performance you are potentially missing out on a massive edge over your competition.”



The Theory

- ▶ Ketone bodies can improve mitochondrial function, and serve as an alternative fuel source.
- ▶ Keto diets increase the rate of free fatty acid (FFA) metabolism during exercise, while preserving muscle glycogen for later stages of an event.



The Evidence

8 small studies on humans (2014-2018)

- Between 5 and 42 participants each; 4 days to 10 weeks duration.
- Despite consistent fat loss, most studies reported reduced performance.

Wroble KA, et al. *J Sports Med Phys Fitness*. 2018 Apr 4.

Kephart WC, et al. *Sports* (Basel). 2018;6(1).

Zinn C, et al. *J Int Soc Sports Nutr*. 2017;14:22.

Urbain P, et al. *Nutr Metab* (Lond). 2017;14:17.

Burke LM, et al. *J Physiol*. 2017;595(9):2785-2807.

Rubini A, et al. *Lung*. 2015 Dec;193(6):939-45.

Rhyu HS, Cho SY. *J Exerc Rehabil*. 2014;10(5):326-31.

Zajac A, et al. *Nutrients*. 2014;6(7):2493-508.



Study (Author, Yr)	Negative Changes Reported Positive
	Performance
Wroble, 2018	↓Peak power, ↓mean power , ↓recovery
Kephart, 2018	No change
Zinn, 2017	↓VO2 max, time to exhaustion, peak power
Urbain, 2017	↓VO2 peak and peak power
Burke, 2017	↓ Performance in elite athletes
Rubini, 2015	No change in V02, VC02 or REE Decrease in CO2 body stores
Rhyu, 2014	↑ Performance and aerobic capacity
Zaiac, 2014	↑ Performance - moderate intensity ↓ Performance - high intensity

The Verdict

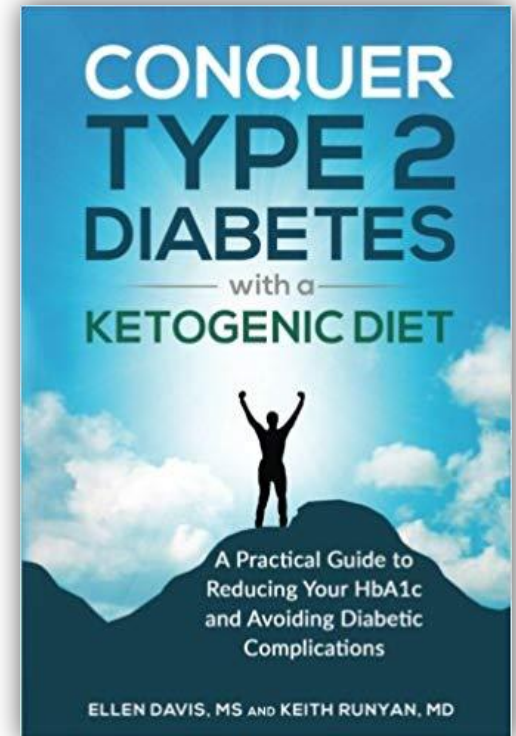
Despite some positive findings, fat may be unable to produce energy fast enough to meet the demands of the muscles of athletes, especially in endurance events.



4. Reduce Type 2 Diabetes Risk

The Claim

“...there is an overwhelming amount of research suggesting a low carbohydrate, high fat ketogenic diet may help ease symptoms of diabetes or, in some cases, eliminate it completely.”



Claims Continued

“Specifically, Keto can help people with or at risk for type 2 diabetes by:

- Promoting weight loss
- Improving insulin sensitivity
- Regulating your hunger hormones to reduce food cravings
- Increasing levels of good cholesterol
- Improving HbA1c markers”



The Theory

- ▶ With minimal carbohydrate intake, your body will naturally have lower blood sugar levels and require less insulin to move that sugar into your cells.
- ▶ Keto diets have powerful fat burning effects, produce weight loss and improve insulin sensitivity.



The Evidence

Short term

- Weight loss
- Improved glucose control
- Reduced HbA1C
- Lower triglycerides
- Fewer medications



Gupta L, et al. *J Postgrad Med*. 2017;63(4):242-251.

Hussain TA, et al. *Nutrition*. 2012;28(10):1016-21.

McKenzie AL, et al. *JMIR Diabetes*. 2017;2(1):e5.

Saslow LR, et al. *J Med Internet Res* 2017;19(2):e36.

Long Term

- ▶ No long term studies using Keto diets to treat diabetes in humans.
- ▶ **Low-carb studies** – favorable short term; less favorable long term.
- ▶ Systematic review of studies ≥ 12 weeks – no differences in weight or HbA1C with long-term treatment.



Castañeda-González LM, et al. *Nutr Hosp.* 2011;26(6):1270-6.

Czyżewska-Majchrzak Ł, et al. *Ann Agric Environ Med.* 2014;21(2):320-6.

The Big Concerns

Ketogenic diets are associated with fatty liver, systemic glucose intolerance, insulin resistance, insufficient insulin secretion, reduced beta and alpha cell mass, fatty liver, dyslipidemia and inflammation, although studies in humans are limited.



Brouns F. *Eur J Nutr.* 2018;57(4):1301-1312.

Gupta L, et al. *J Postgrad Med.* 2017;63(4):242-251.

Kosinski C, Jornayvaz FR. *Nutrients.* 2017;9(5). pii: E517.

The Verdict

While some favorable changes in the short term, long term benefits have not been demonstrated, and risks are significant.



5. Reduce Cardiovascular Risk

The Claim

“There are numerous studies reflecting the safety and superiority of a ketogenic diet and its use for reducing cardiovascular risk factors in adults and children...”



The Theory

Ketogenic diets improve metabolic risk factors such as low HDL-cholesterol, high triglycerides, inflammation, oxidation, insulin resistance, and hypertension, thereby reducing risk overall.



The Evidence

2002-2004 – One research team (small, short term studies in adults using keto diets) reported:

- Increased total, LDL-C and HDL-C
- Decreased triglycerides and fasting insulin

2006 – A second team reported low-carb diets:

- Increased HDL-C and LDL-C
- Decreased triglycerides
- Improved particle size



Sharman MJ, et al. *J Nutr.* 2002;132(7):1879-85.
Volek JS, et al. *J Nutr.* 2003 Sep;133(9):2756-61.
Volek JS, et al. *J Am Coll Nutr.* 2004;23(2):177-84.
Krauss RM, et al. *Am J Clin Nutr.* 2006;83(5):1025-31

3 Meta-Analyses

Low-Carb vs Low-Fat

- 2012 – 23 studies
- 2013 – 32 studies
- 2016 – 11 studies



FINDINGS

- **Low-fat diets:** ↓total and LDL-C
- **High-fat diets:** ↓TG, ↑HDL-C, ↑total and LDL-C

Hu T, et al. *Am J Epidemiol*. 2012;176

Schwingshackl L, Hoffmann G. *J Acad Nutr Diet*. 2013;113(12):1640-61.

Mansoor N, et al. *Br J Nutr*. 2016;115(3):466-79.

Children with Epilepsy

2015-2017 – Keto diet consistently promoted negative changes in lipid profile and particle size increasing atherogenic risk.

- Increased total and LDL-C
- Increased triglycerides
- Increased oxidation
- Unfavorable changes in particle size



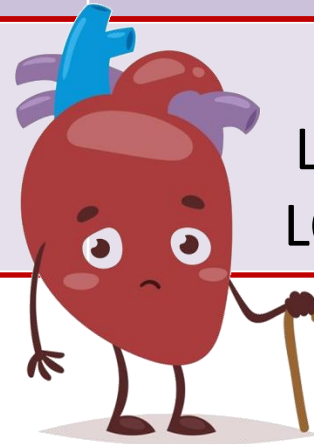
Lima PA, et al. *Nutr Neurosci*. 2015;18(8):337-44.

Güzel O, et al. *Neurol Sci*. 2016;37(3):465-70.

Azevedo de Lima P, et al. *Nutrition*. 2017;33:271-277.

CVD & Low Carb Diets

Study, Author, Year, Place	Details	CVD
Fung, 2010, United States	129,716 participants 20-26 yr follow up	CVD Mortality: LC Animal - ↑14% LC Plant – ↓23%
Lagiou, 2012, Sweden	43,396 women ~ 16 yr follow up	CVD Incidence Lowest CHO ↑60% Daily: -20 g CHO and +5 g PRO = 5%↑ in CVD
Li, 2014, United States	4,098 post MI participants	CVD Mortality: LC Animal - ↑51% LC Plant – no assoc



Fung TT, et al. *Ann Intern Med.* 2010;153(5):289-98.

Lagiou P, et al. *BMJ.* 2012;344:e4026.

Li S, et al. *J Am Heart Assoc.* 2014;3(5):e001169.

The Verdict

Keto and low-carb diets tend to reduce intake of foods most strongly associated with CVD protection – high fiber fruits, vegetables, legumes and whole grains – and increase intake foods associated with CVD risk – protein from animal sources and saturated fat.



6. Increase Longevity

The Claim

“...if we want to live longer, we need to look after our mitochondria. A growing number of studies seem to suggest that one way of doing this may be through a ketogenic diet. Its effects on mitochondrial function are almost too good to be true.”



More Claims

“Eating high carbohydrate diet does not only make us fat, it also makes us sick, senile and makes our journey to the other worlds more painful and very often faster. And the only reason why some people still deny it, like global warming, is not the lack of evidence, but the lack of willingness to change the comforting habits.”



The Theory

Ketogenic diets mimic the metabolic states of fasting or caloric restriction, which can increase longevity. The ketone body hydroxybutyrate (BHB) may help regulate inflammation and gene expression, promoting longevity.



The Evidence - PRO

- ▶ Two 2017 studies reported increased midlife longevity using ketogenic diets in mice.
- ▶ Improved memory and healthspan (memory, strength, speed, tumors) were also reported.
- ▶ No human studies.



Roberts MN, et al. Cell Metab. 2017;26(3):539-546.e5.

Newman JC, et al. Cell Metab. 2017;26(3):547-557.e8.

CON – RCTs (Low-Carb)

Study, Author, Year	Details	Overall Mortality RR
Fung, 2010, United States	129,716 participants 20-26 yr follow up	LC Animal - ↑23% LC Plant – ↓20%
Li, 2014, United States	4,098 post MI participants	LC Animal - ↑33% LC Plant – no assoc
Banach, 2018	24,825 participants Average 6.4 yr follow up	Lowest CHO intake – ↑32%

Fung TT, et al. *Ann Intern Med*.

2010;153(5):289-98.

Li S, et al. *J Am Heart Assoc*.

2014;3(5):e001169.

Bamach M. European Society of Cardiology. (2018, Aug 28).

ScienceDaily.



Meta-analysis (Low-Carb)

- ▶ **2013:** 17 studies, 272,216 participants
- ▶ Lowest CHO consumers → 31% increased risk of mortality compared with the highest CHO consumers.

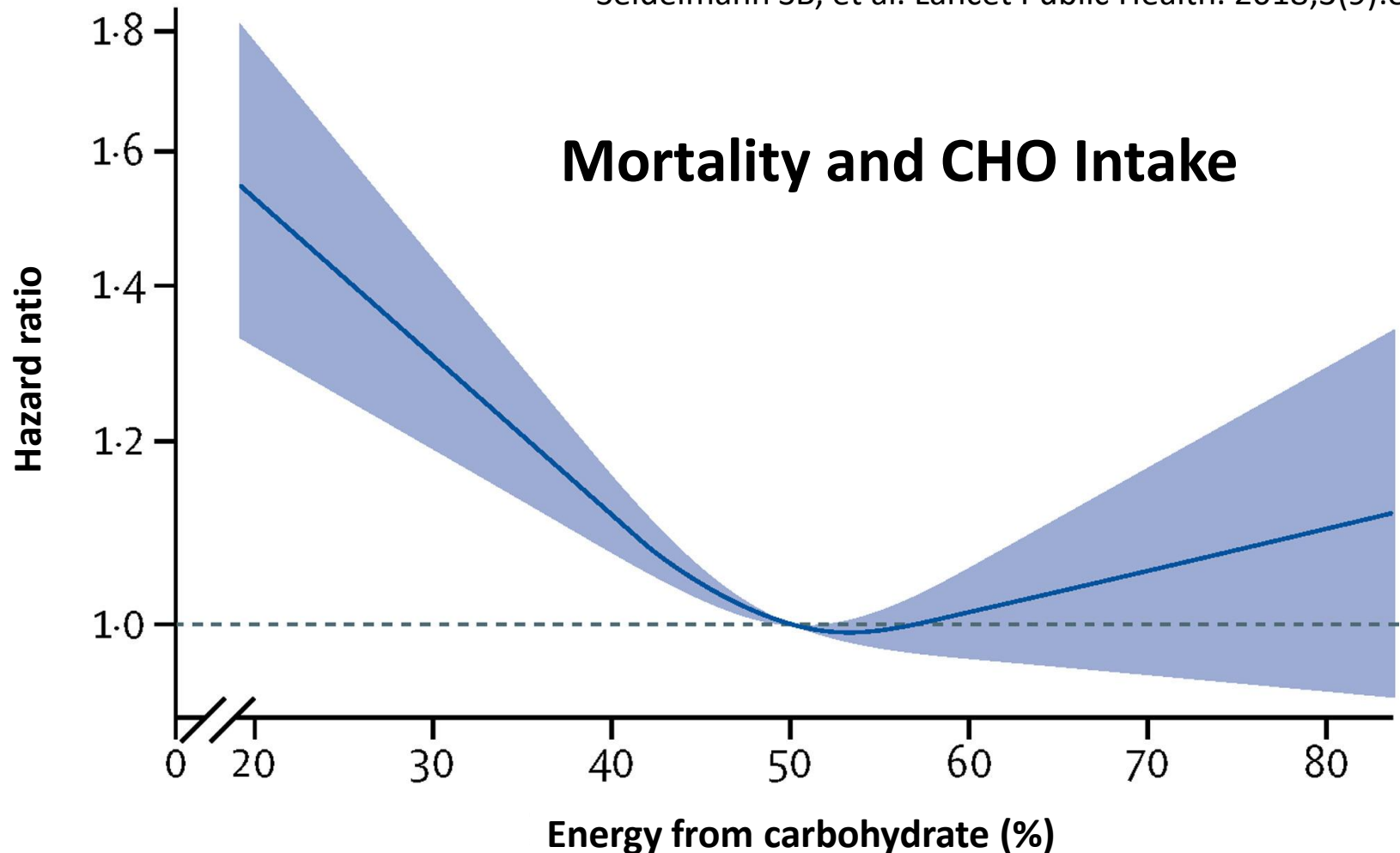
“...should provide physicians with an incentive to pay attention to the considerable potential adverse effects on health if such diets are implemented without considering the nature of the carbohydrates and the source of protein.”



CHO & Mortality Meta-analysis 2018

115,428 adults (45-64 yrs); median follow up 25 yrs; 6283 deaths

Seidelmann SB, et al. Lancet Public Health. 2018;3(9):e419-e428.



Meta-analysis 2018 Findings

- ▶ **Low CHO intake** – 32% increased mortality
- ▶ **High CHO** – 23% increased mortality
- ▶ **Lowest risk** – 50-55% CHO
- ▶ Mortality **increased** 18% when CHO was exchanged for animal-derived fat or protein.
- ▶ Mortality **decreased** 18% when substitutions were plant-based.
- ▶ High CHO diet risk was associated with refined CHO intake.

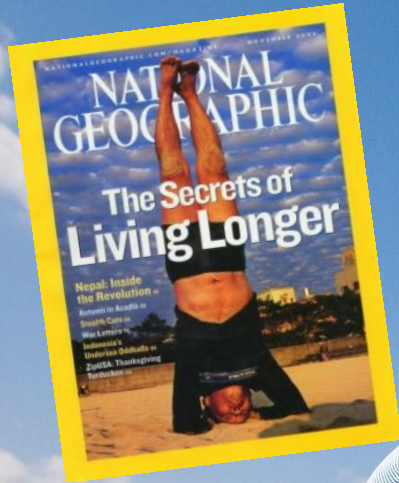


Conclusion

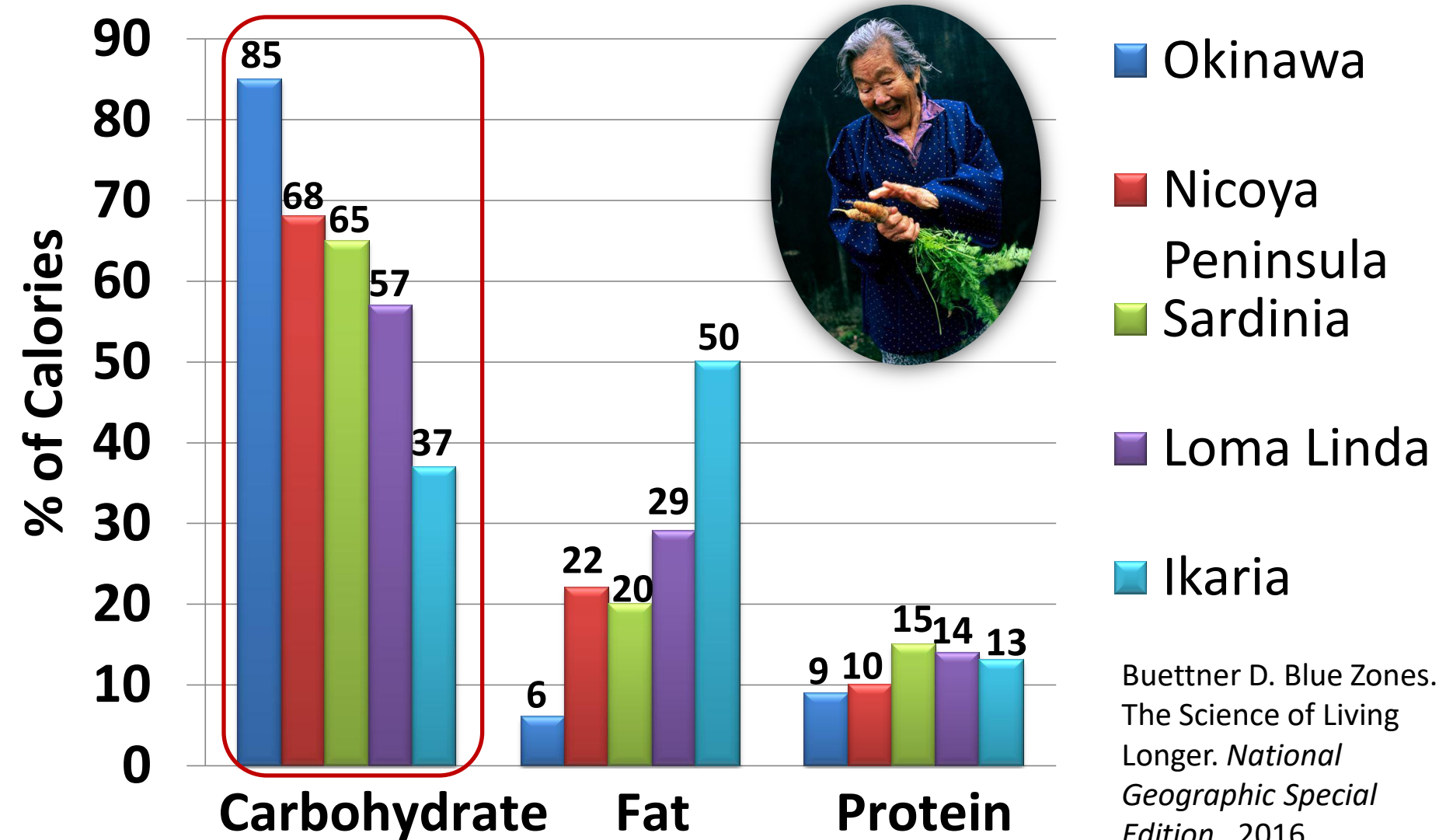
“These data provide further evidence that **animal-based low carbohydrate diets**, which are more prevalent in North American and European populations, **should be discouraged.**”



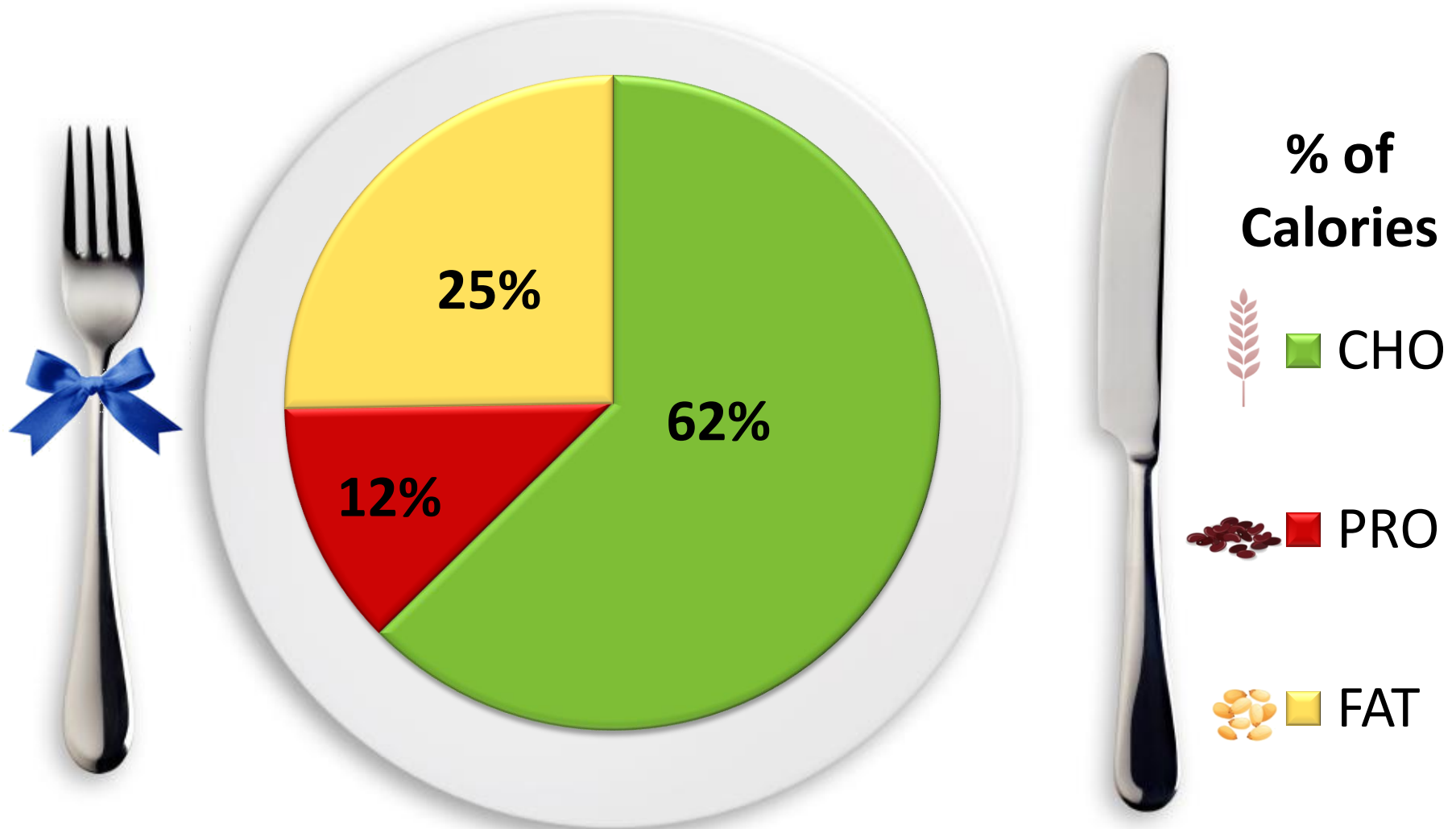
How much CHO do the world's healthiest people eat???



Blue Zone Macronutrient Intakes



Blue Zone Average Intakes



Tsimane Bolivia South America

- ▶ Tsimane in South America live a traditional hunter–gatherer lifestyle and have the lowest reported levels of chronic disease of any population.
- ▶ **Their diet?**
 - 14% protein
 - 14% fat
 - 72% carbohydrate



The Verdict



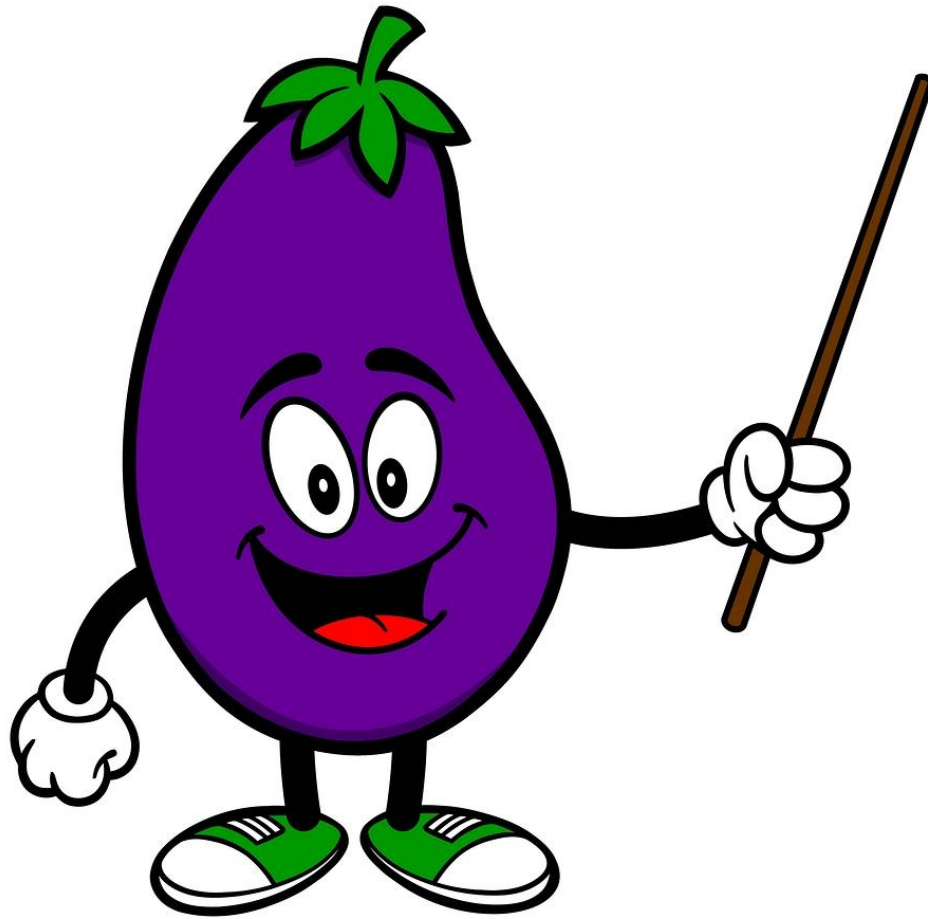
As far as longevity goes, Michael Pollan said it well:
“Eat food. Mostly plants. Not too much.”

The Verdict



As far as longevity goes, Michael Pollan said it well:
“Eat food. Mostly plants. Not too much.”

Summary



Keto Benefits

- ▶ Epileptic seizure reduction
- ▶ Decreased energy intakes
- ▶ Weight loss
- ▶ Improved blood sugar
- ▶ Decreased triglycerides; increased HDL



Risks... Short Term

- ▶ Increased LDL-cholesterol
- ▶ Impaired glucose tolerance
- ▶ Worsening kidney function
- ▶ Reduced athletic performance
- ▶ Bone loss
- ▶ Vitamin and mineral deficiencies
- ▶ Constipation
- ▶ Weakness, fatigue
- ▶ Bad breath
- ▶ Muscle cramps
- ▶ Headaches



Gupta L, et al. *J Postgrad Med.* 2017;63(4):242-251.

Paoli A. *Int J Environ Res Public Health.* 2014;11(2):2092-107.

Czyżewska-Majchrzak Ł, et al. *Ann Agric Environ Med.* 2014;21(2):320-6.

Risks... Long Term

- ▶ Increased all cause mortality
- ▶ Increased exposure to POPs that induce metabolic disorders and increase risk of birth defects
- ▶ Impaired artery function
- ▶ Increased total and LDL-C
- ▶ Kidney stones
- ▶ Nutrient deficiencies
- ▶ NAFLD, hepatic steatosis



Noto H et al. *PLoS One*. 2013;8:e55030.

Li S, et al. *J Am Heart Assoc*. 2014;3(5):e001169.

Ruzzin J. *BMC Pub Health*. 2012;12:298.

Desrosiers TA. *Birth Defects Res*. 2018;110:901-909.

Schwingshackl L. *Br J Nutr*. 2013;110:969-970.

Fleming RM. *Angiology*. 2000;51:817-826.

Ornish D. *Ann Intern Med*. 2004;141:738.

Gupta L, et al. *J Postgrad Med*. 2017;63(4):242-251.

Digging Deeper: PALEO



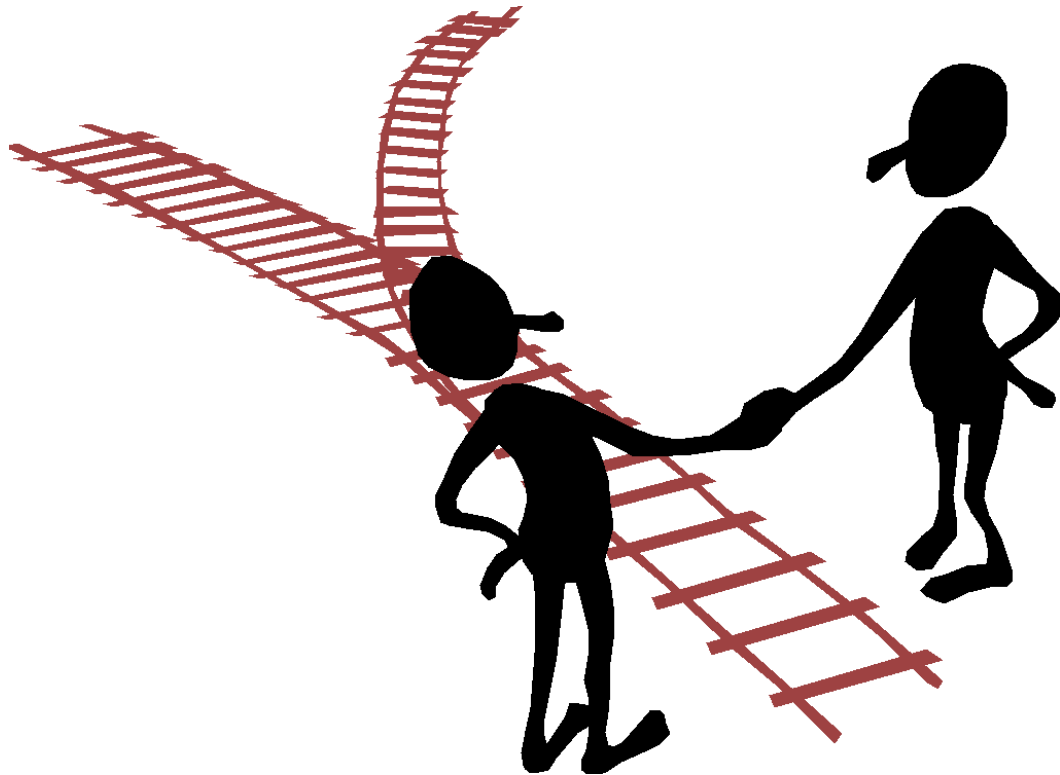
The Claims

“ When people start eating Paleo, they often lose weight, feel less hungry, and have fewer cravings for sugar. Their skin clears up, they have more energy, and they find that muscles start appearing where there had only been flab for years. This way of eating can literally reverse diabetes, reduce your chances of getting cancer, and reduce inflammation in your joints. It can help you avoid heart disease...

many people even get to come off of their antidepressants and other medications.”



What we know is that our native diet supported early humans through a 2 to 4 decade life. Regardless, let's assume it is a good idea to eat like our ancestors.



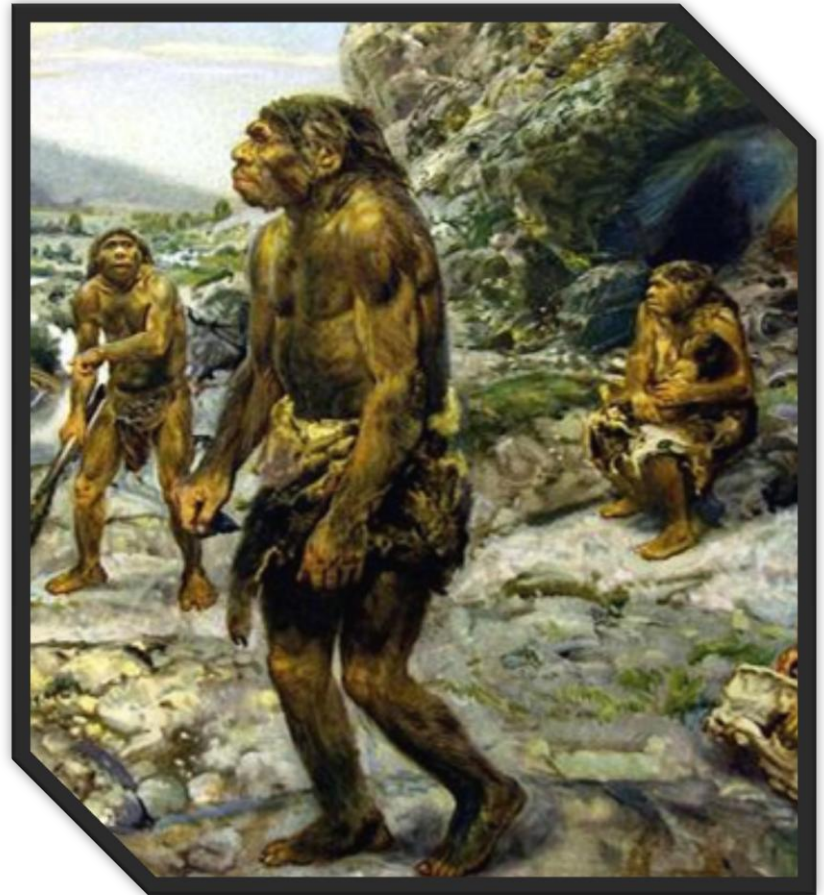
What did our ancestors eat?

Pre-agricultural people ate wild plants, animals, fish and insects. The balance of these foods varied with timeframe, location, season, gathering and hunting skills, tools and culture.



Changes over Time

- ▶ During the first 80% of the Paleolithic period, humans were predominately vegetarian.
- ▶ During the last 20%, humans ate a hunter/gatherer diet.



What didn't they eat?

- ▶ Packaged foods – anything from a box or bag
- ▶ Deep fried foods or fast foods
- ▶ Refined fats, oils, sugar or salt
- ▶ Milk of other mammals, or products made from milk
- ▶ Bacon, ham, salami, sausage or other processed meats
- ▶ Alcohol



Do New Paleo Diets = True Paleolithic Diets?



Nutritional Anthropology



European Journal of Clinical Nutrition (1997) 51, 207-216
© 1997 Stockton Press. All rights reserved 0954-3007/97 \$12.00

Review

Paleolithic nutrition revisited: A twelve-year retrospective on its nature and implications

SB Eaton,^{1,2} SB Eaton III⁴ and MJ Konner^{1,3}

¹Department of Anthropology, Emory University; ²Department of Radiology, ³Department of Psychiatry, Emory University School of Medicine; and ⁴Department of Education, Marshall University

Descriptors: human evolution; nutritional anthropology; evolutionary medicine; nutritional requirements; paleolithic nutrition

Paleolithic Nutrition

Twenty-Five Years Later

Melvin Konner, MD, PhD¹; and S. Boyd Eaton, MD²

Nutrition in Clinical Practice
Volume 25 Number 6
December 2010 594-602
© 2010 American Society for
Parenteral and Enteral Nutrition
10.1177/0884533610385702
<http://ncp.sagepub.com>
hosted at
<http://online.sagepub.com>

- ▶ Early ancestral diets were overwhelmingly plant-based, with some insects and very small amounts of animal flesh.
- ▶ Reliance on meat increased in later ancestral diets as hunting skills improved.
- ▶ However, "... much proof points to continued significant (if not predominant) dependence on plant foods".



Paleolithic Diet: Macronutrients

	DRI	Paleolithic 1997	Revised 2010**
Energy (cal/d)	2,200–2,900	3,000	—
Protein (%)	10–35	30	25-30
Carbohydrate (%)	45–65	45–50	35-65
Fat (%)	20–35	20	20-35
Saturated fat (%)	<10	6	7.5-12
Cholesterol (mg)	No RDA or AI No dietary requirement.	480	500+
n-6: n-3		1:1-4:1	2:1
Fiber (g/d)	Minimum 25–38	104	70-150+

*Based on intakes estimated by Eaton and Konner 1997.

**Based on intakes estimated by Konner and Eaton 2010.

Paleolithic Diet: Micronutrients

	DRI	Paleolithic Diet * 1997	Revised Paleolithic 2010**
Vitamins			
Riboflavin (mg)	1.3–1.7	6.5	—
Thiamin (mg)	1.1–1.2	3.9	—
Vitamin C (mg)	75–90	604	500
Vitamin A (mcg RAE)	700–900	3,797	—
Vitamin E (mg)	15	32.8	—
Minerals			
Iron (mg)	8–18	87.4	—
Zinc (mg)	8–11	43.4	—
Calcium (mg)	1,000–1,200	1,956	1,000-1,500
Sodium (mg)	<2,300	768	<1,000
Potassium (mg)	4,700	10,500	7,600
Na:K		>10:1	>5:1

What is closer to a true Paleolithic diet: **Paleo** or **100% plant-based**?



Recommended Paleo Menu



Meal	Wednesday	Thursday	Friday
Breakfast	Eggs and salsa	Breakfast smoothie	Roasted pepper and sausage omelet
Lunch	Turkey burger (no bun) Mixed greens, dressing	Crock pot pork loin	Pepper steak
Snack	Berries and almond butter	Meat jerky and veggies	Fruit salad with cinnamon and optional nuts
Dinner	Crock pot pork loin (with cauliflower, tomatoes and zucchini)	Pepper steak (with carrots, peppers and onions)	Crusty chicken with chard and cashews

<http://www.paleoplan.com/resources/sampler-menu-meal-plan/Wed-Fri>,

adjusted to 3000 kcal Food Processor ESHA Research

Recommended 100% Plant-based Menu



	Wednesday	Thursday	Friday
Breakfast	Wholegrain cereal, raspberries, fortified soymilk	Wholegrain toast, tahini, blackstrap molasses, calcium-fortified OJ	Whole grain cereal with nuts, fruit and hemp smoothie
Lunch	Lentil soup, rye wafers, raw vegetables, fresh fruit	Black bean, vegetable taco, fortified almond milk	Vegan turkey sandwich on whole grain bread, with veggies
Snack	Chocolate/banana shake	Figs, orange, almond milk, pumpkin seeds,	Trail mix, fortified non-dairy milk
Dinner	Tofu/vegetable stir fry, brown rice, fortified soymilk	Huge salad, tempeh, cooked quinoa, dressing	Chili, baked potato, baked squash, broccoli

Becoming Vegan: Comprehensive Edition (2014), Based 3 days of menus; adjusted to 3000 kcal)

Macronutrients

	DRI	New Paleo	True Paleo*	Vegan
Energy (kcal/d)	2,000-2,200	3,000	3,000	3,000
Protein (%)	10-35	32	25-30	15
Carbohydrate (%)	45-65	15	35-65	57
Fat (%)	15-30	53	20-35	29
Saturated fat (%)	<10	19	6/7.5-12	6
Cholesterol (mg)	No RDA or AI; No dietary requirement.	1,308	500	0
Ratio of n-6: n-3		11:1	2:1	4:1
Fiber (g/d)	25-38+	31	70-150+	70

*Based on intakes estimated by Konner et al 2010 and Eaton et al 1997.

Micronutrients

	DRI	New Paleo	True Paleo	Vegan
Vitamins				
Riboflavin (mg)	1.3–1.7	2.6	6.5	2.7
Thiamin (mg)	1.1–1.2	2.7	3.9	4.6
Vitamin C (mg)	75–90	226	500	417
Vitamin E (mg)	15	24	32.8	31.3
Vitamin A (mcg RAE)	700–900	2,436	3,797	1,513
Minerals				
Zinc (mg)	8–11	33	43.4	23
Iron (mg)	8–18	25	87.4	32.3
Calcium (mg)	1,000–1,200	643	1,000-1,500	1,847
Sodium (mg)	<2,300	4,193	768	2,005
Potassium (mg)	4,700	4,762	7,000	6,724

*Based on intakes estimated by Konner et al 2010 and Eaton et al 1997.

Paleo Summary

The Paleo diet came closer to a true Paleolithic diet for **4 nutrients**:

1. Protein
2. Cholesterol
3. Zinc
4. Vitamin A



Plant-based Summary

The plant-based diet came closer to the true Paleolithic diet for **13 nutrients**:

- | | |
|------------------|---------------|
| 1. Carbohydrates | 8. Vitamin C |
| 2. Total fat | 9. Vitamin E |
| 3. Saturated fat | 10. Iron |
| 4. EFA ratio | 11. Calcium |
| 5. Fiber | 12. Potassium |
| 6. Riboflavin | 13. Sodium |
| 7. Thiamin | |



Macronutrient Discrepancies...

“Paleo” vs True Paleolithic

Fat

- **Total fat** – double estimated Paleolithic (53% vs 20-35%)
- **Saturated fat** – 2-3x Paleolithic (19% vs 6-12%)
- **Cholesterol** – 2.5x Paleolithic (~1300 mg + vs 500 mg)

Carbohydrate

- **Total** - 1/4-1/2 Paleolithic
(15% vs 35-65%)

Fiber

- About 1/3 Paleolithic
(30 g vs 70-150+ g)



Why the Discrepancy?

- ▶ Paleo focus is on achieving protein intakes of Paleolithic people; less concern about matching other nutrients.
- ▶ Hence the emphasis on meat, as opposed to plant foods that would be necessary to achieve the 70-150+ g fiber, 7,000+ mg potassium, or 500+ mg vitamin C.



Wild Foods ≠ Farmed Foods

- ▶ Meat and vegetables consumed today were not available in Paleolithic times and bear little resemblance to those eaten by pre-agricultural populations.
- ▶ Oil and salt were used in recipes.



Wild Meat vs Domestic Meat

Meat from wild animals is:

- Much lower in fat – ~ 6-16% of energy vs 30-60% in farmed animals .
- Much lower in saturated fat; higher in omega-3s.
- Free of antibiotics and added hormones, and in Paleolithic times, of environmental contaminants.



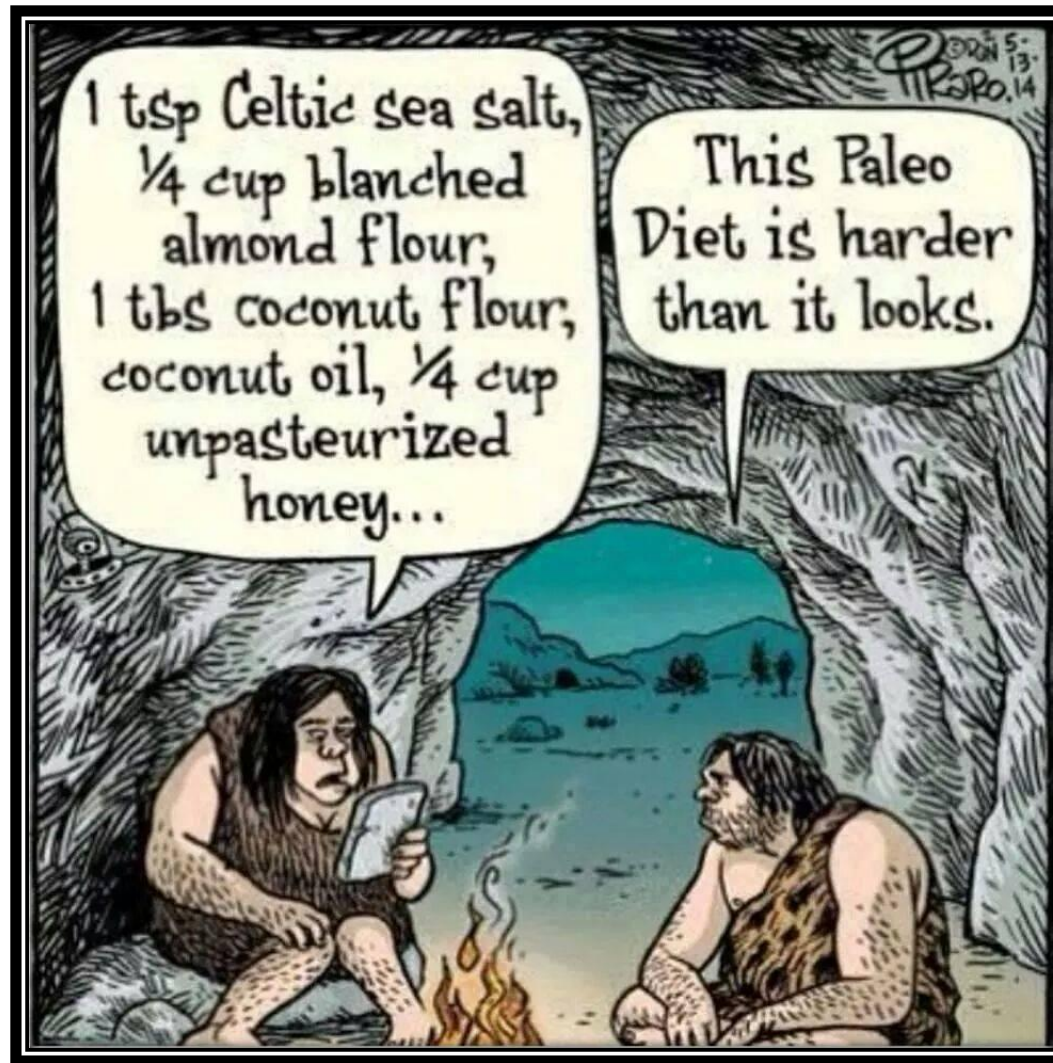
Wild versus Domestic Plants

Cultivated vegetables and fruits have been bred for appearance, palatability, transportability, digestibility and yield. Wild plants:



- Deliver over 3x the fiber of commercial plants (13.3 g/100 g vs 4.2 g/100 g).
- Are more concentrated in vitamins, minerals and protein.
- Are lower in sugar.

Paleo Diet ≠ True Paleolithic Diet



Reduced Disease Risk?

Impressive short term improvements reported in clinical trials:

- Reduced body weight
- Increased satiety
- Improved lipid profiles
- Lower blood glucose
- Better insulin sensitivity
- Less inflammation
- Decreased blood pressure



Otten J. *Diabetes Metab Res Rev*. 2016 May 27.

Genoni A. *Nutrients*. 2016;8(8).

Masharani U. *Eur J Clin Nutr*. 2015;69(8):944-8.

Jönsson T. *Nutr J*. 2013;12:105

Larsson C. *J Intern Med*. 2013;274(1):67-76.

Frassetto LA. *Eur J Clin Nutr*. 2013;67(9):899-903.

Why the Favorable Results?

Paleo diets significantly reduce foods that are strongly linked to the obesity epidemic and chronic disease:

- Refined grains
- Refined sugars
- Refined fats and oils
- Fast foods
- Fried foods
- Processed meat
- High fat dairy products
- Alcohol



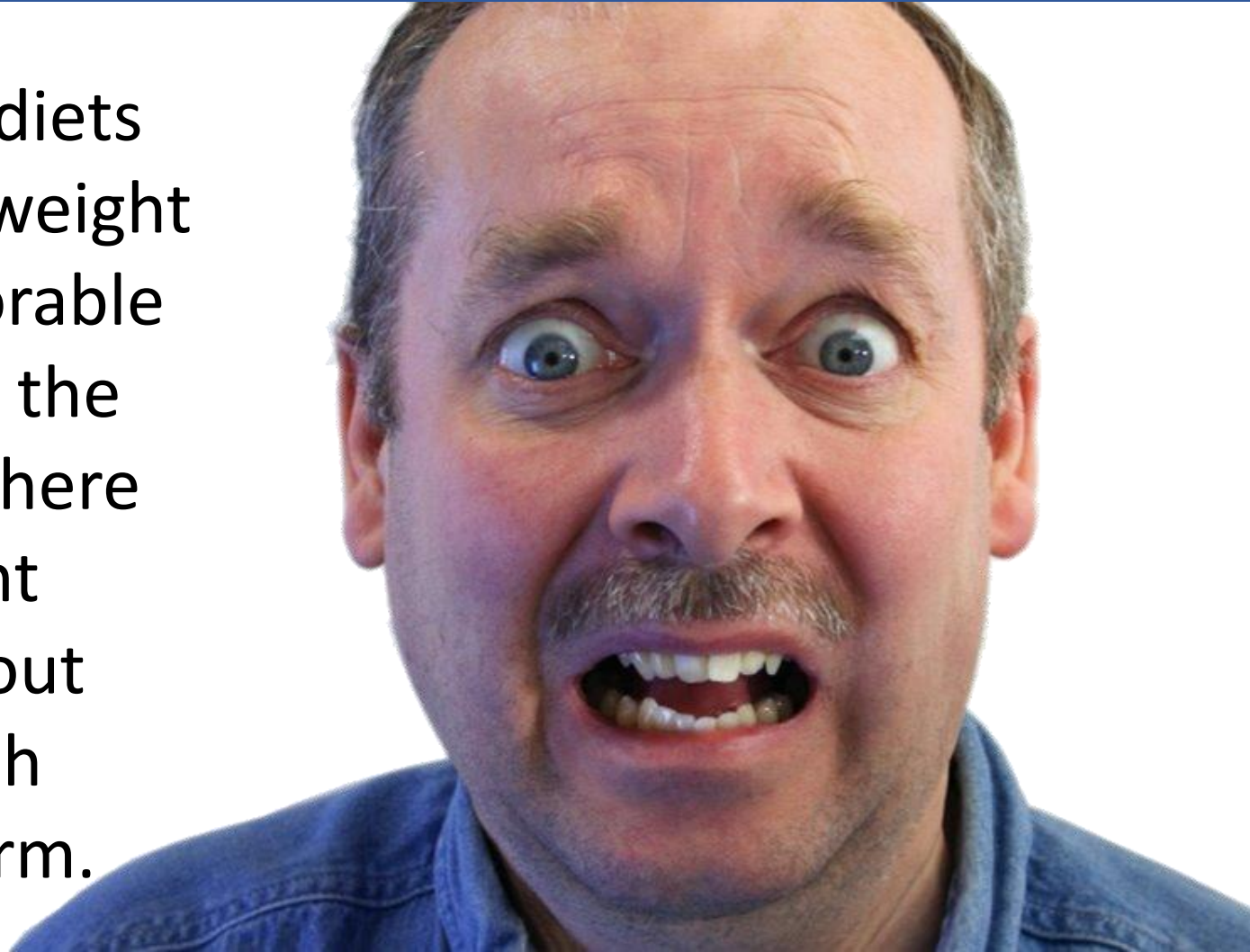
Clinical Trial Paleo Diets ≠ Popular Paleo Diets!

- ▶ Clinical trials attempt to replicate true Paleolithic intakes using very lean free range meat, poultry and fish, and include generous servings of vegetables and fruits.
- ▶ Paleo menus are often less rigid, including processed meats, oil and salt and are less reflective of true Paleolithic diets.



Short Term Gain; Long Term Pain?

While paleo diets may induce weight loss and favorable lab results in the short term, there are significant concerns about adopting such diets long term.



Paleo = High Meat Diets

- ▶ Animal protein
- ▶ Agrochemicals
- ▶ Carnitine → TMAO
- ▶ Endotoxins
- ▶ Environmental contaminants – POPs
- ▶ Heme iron
- ▶ Neu5Gc
- ▶ Nitrosamines
- ▶ Products of oxidation
- ▶ Saturated fat; cholesterol
- ▶ Up-regulation of cancer-promoting genes



How Much Meat?

Typical recommendations 30% protein:



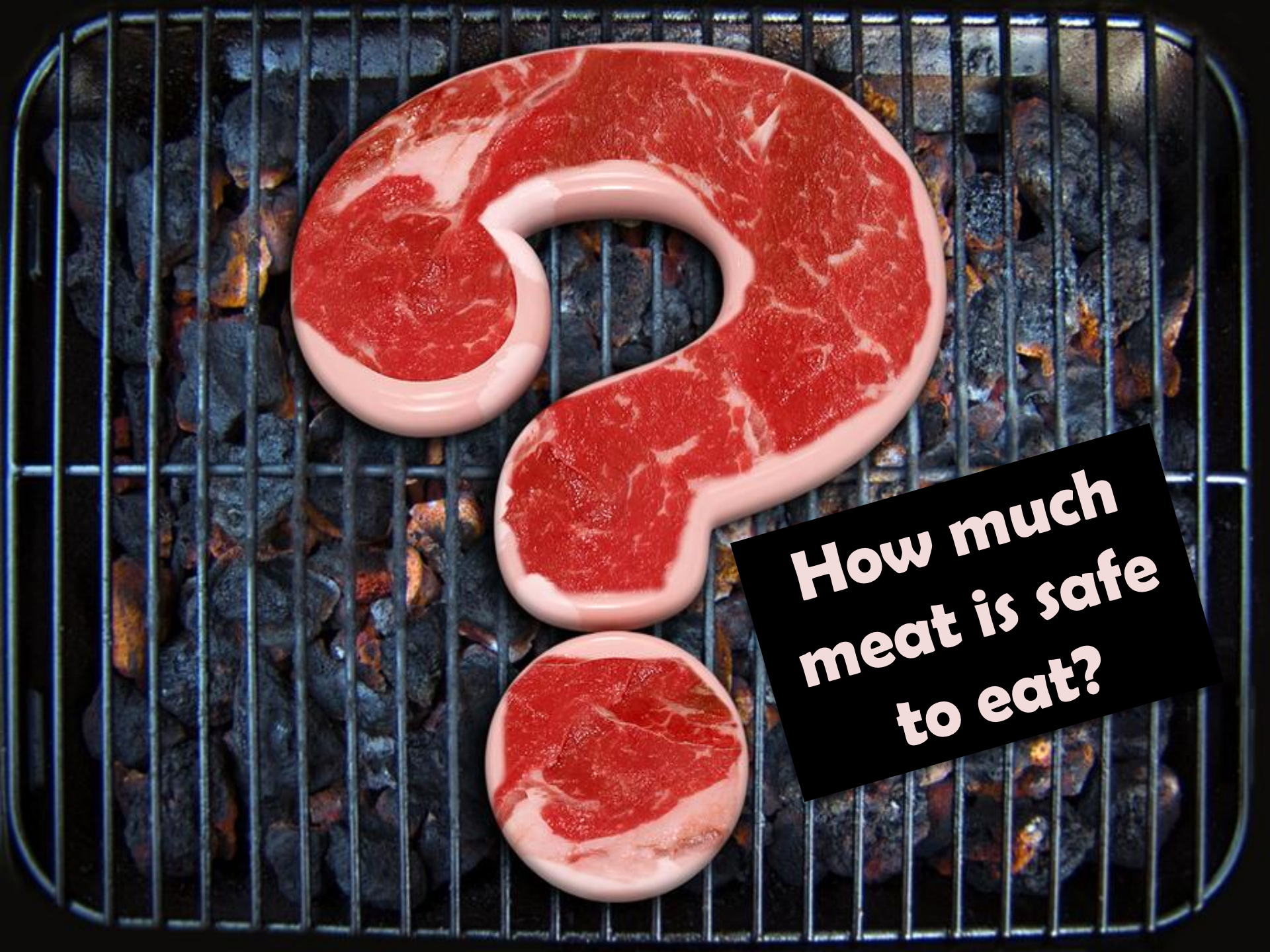
- 2000 calorie diet = 150 g protein
- 2800 calorie diet = 210 g protein



Assuming 80% of protein from meat:

- 16 oz meat/day in a 2000 calorie diet
- 22 oz meat/day in a 2800 calorie diet

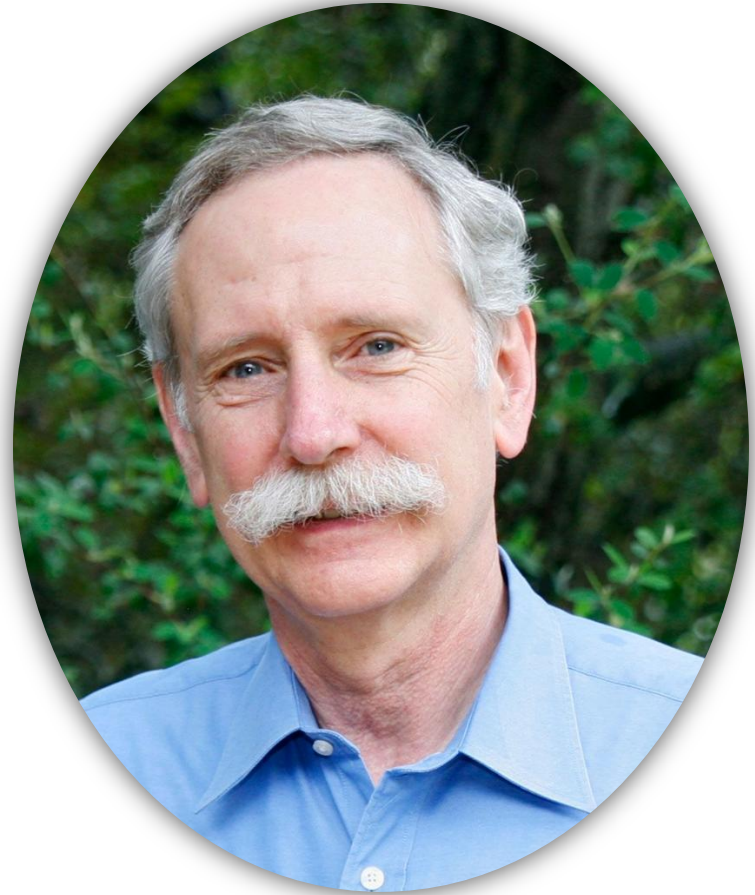




**How much
meat is safe
to eat?**

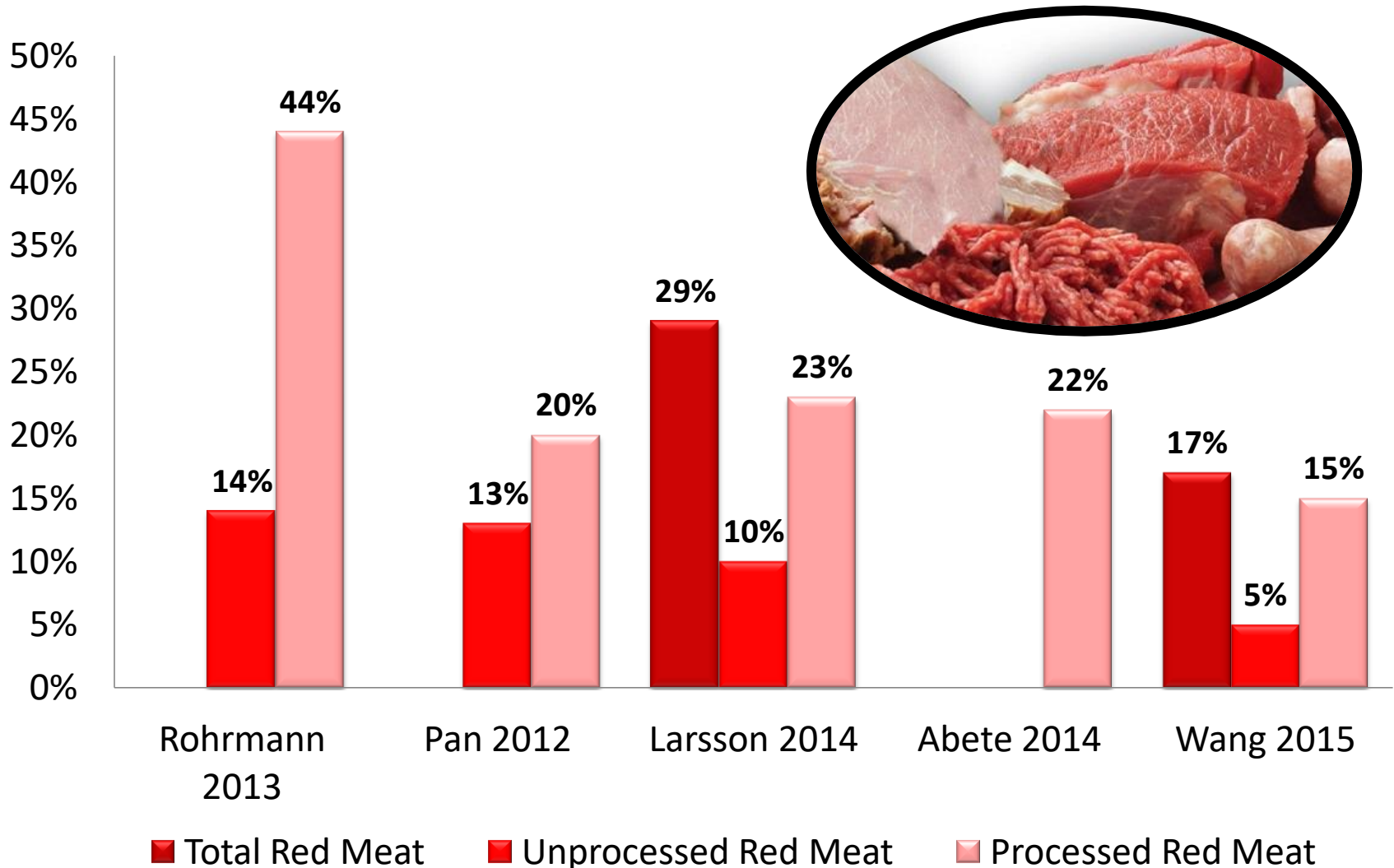
Walter Willet's Answer

“If you step back and look at the data, the optimum amount of red meat you eat should be zero.”



HARVARD
SCHOOL OF PUBLIC HEALTH

Red Meat and Mortality



High Protein and Mortality

- ▶ 6,381 participants aged 50+, 18 yr follow up.
- ▶ **Protein Intakes >20% (50-65 yrs):**
 - mortality ↑74%
 - cancer deaths ↑433%
 - diabetes risk ↑393%

Associations abolished or greatly attenuated with plant protein.



Animal vs Plant Protein

Harvard Health Professionals Study 2016

131,342 participants followed for 27-32 yrs.

Replacing only 3% of calories from animal protein with plant protein reduced risk of death.

Protein Source		Reduction in risk of death when replaced with plant protein	
Processed red meat		34%	
Eggs		19%	
Unprocessed red meat		12%	
Dairy		8%	
Poultry or fish		6%	

Song M et al. *JAMA Intern Med* 2016;176(10):1453-1463.

2015 - WHO declares processed meat a group 1 human carcinogen; red meat a group 2A or probable human carcinogen.

Processed meats rank alongside smoking as cancer causes – WHO

UN health body says bacon, sausages and ham among most carcinogenic substances along with cigarettes, alcohol, asbestos and arsenic



Salami, Parma ham and chorizo have cancer risks, according to the WHO.

Press release No 240
Oct. 26/ 2015



World Health Organization

Plant-based VS Paleo/Keto

CAVEMENTIMES



Clear Consistent Evidence

- ▶ Whole plant foods are protective to health.
- ▶ Heavily processed foods, fast foods and fried foods with added fat, sugar and salt are damaging to health.
- ▶ Meat, and especially processed meat, and red meat increases risk of disease.



National and International Dietary Guidelines



WHO: 12 Steps to Healthy Eating

1. “Eat a nutritious diet based on a variety of foods originating mainly from plants, rather than animals.”



FAO: Plates, Pyramids and Planets

International leaders highlight that a largely plant-based diet has advantages for health and for the environment.

- ▶ **Germany:** “Choose mostly **plant-based foods**”.
- ▶ **Brazil:** “Eat foods mainly of **plant origin**”.
- ▶ **Qatar:** “Emphasize a **plant-based diet**, including vegetables, fruit, whole grain cereals, legumes, nuts and seeds”.
- ▶ **UK:** “Eat more **plant based foods**, including at least five portions of fruit and vegetables a day”.



Cancer Organizations

- ▶ Eat a healthy diet, with an emphasis on **plant foods**.
- ▶ Eat mostly foods of **plant origin**.
- ▶ Choose mostly **plant foods** such as vegetables, fruits, and whole grains, and cut sugary drinks.



Dietary Guidelines for Americans Scientific Advisory Committee 2015

...a dietary pattern that is higher in **plant-based foods**, such as vegetables, fruits, whole grains, legumes, nuts, and seeds, and lower in animal-based foods is more health promoting and is associated with lesser environmental impact than is the current average U.S. diet.



New Canada Food Guide

Spring 2019



New Food Guide's 'foundational statements' may emphasize veggies, plant-based food over meat



CBC

Food Guide revamp encouraging plant-based, low-meat diet is good for people and the planet

Canada's Surprising New Proposed Health Guide Favors Plant-Based Foods and Ignores Industry Input





Why plant-based diets?

Plant-based Diets

Minimize pathogenic dietary components.



Maximize protective dietary components.



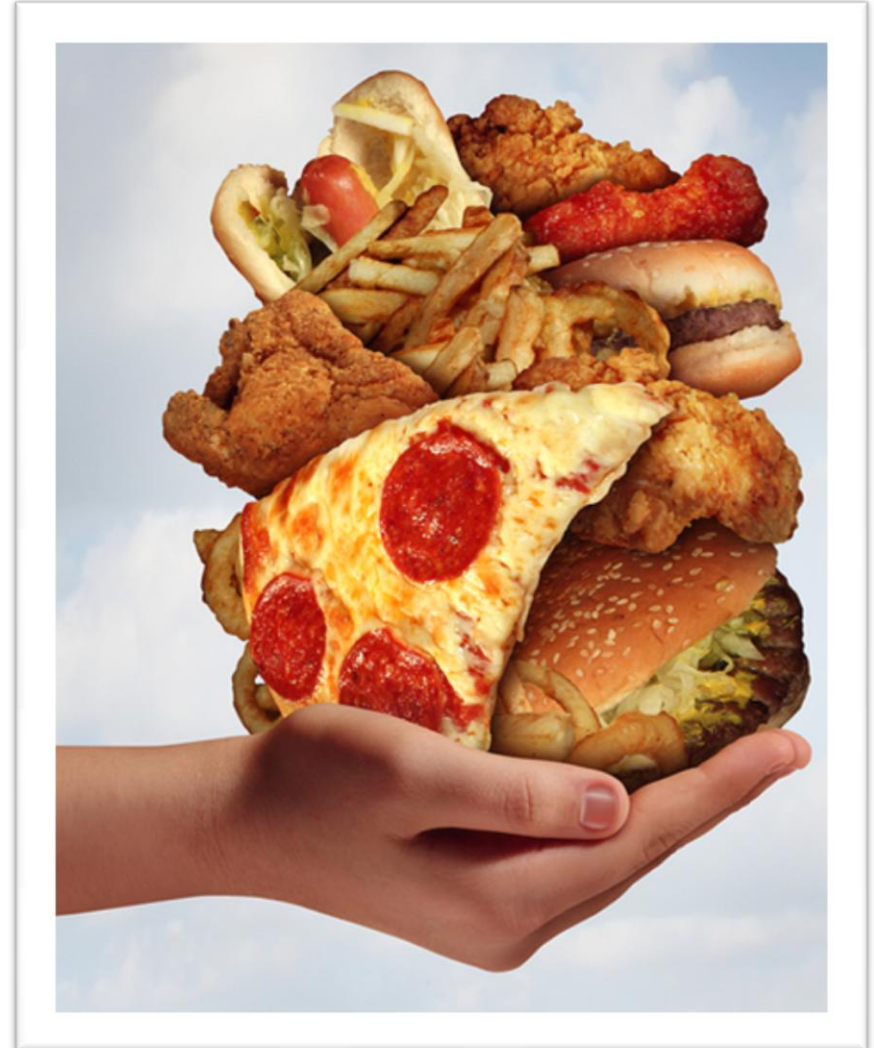
Protective Factors

- ✓ Fiber
- ✓ Phytochemicals
- ✓ Plant enzymes
- ✓ Antioxidants
- ✓ Anti-inflammatory agents
- ✓ Pre- and probiotics
- ✓ Macronutrients from plants
- ✓ Micronutrients



Pathogenic Factors

- ✓ Trans fatty acids
- ✓ Excessive saturated fat
- ✓ Refined carbohydrates
- ✓ Excessive sodium
- ✓ Neu5Gc
- ✓ Chemical contaminants
- ✓ Products of ↑ temp cooking
- ✓ Pro-oxidants (e.g. heme Fe)
- ✓ TMAO
- ✓ Endotoxins





**Most of what
we eat is a
threat to
health!**

The Good, The Bad & The Ugly



The Good

- ▶ Eliminates refined carbohydrates – starches (e.g. white flour products) and sugars (e.g. soda).
- ▶ Eliminates many highly processed foods.



The Bad



- High in fat, saturated fat and cholesterol.
- High in pro-oxidants and chemical contaminants.
- Low in fiber, phytochemicals and antioxidants.
- Potential nutrition shortfalls (especially with Keto):



Minerals

- Potassium
- Magnesium
- Calcium
- Iodine



Vitamins

- Folate
- Vitamin A
- Vitamin C
- Vitamin K

The Ugly

Low carb diets are high animal food diets – they are both ecologically unsustainable and ethically unjustifiable.



Ecologically Sustainable?



*Eat More
Kale*

Low carb diets downplay the ecological crisis that makes eating lower on the food chain an ecological imperative.

If our entire population ate a low carb diet, our planet's dwindling resources would quickly run dry.





If We All Ate Paleo



**We would need an estimated 15
planet earths to sustain the
current population...**





**...and an estimated 26 planet earths
to sustain population by 2100.**



Proceedings of the National Academy of Sciences 2016

By 2050, greenhouse gas emissions would be reduced by:

- ▶ 29% if we all followed global dietary guidelines (eat more fruits and vegetables; eat less meat, sugar and calories)
- ▶ **70% if we all ate a vegan diet**



→ Global shift to a plant-based diet strongly urged.

Reducing our Food Footprint

“A typical steak and shrimp cocktail dinner would burden the atmosphere with 816 kg CO₂e. This is the same as what would be produced by driving a fuel-efficient automobile from LA to New York City.”



Ethically Justifiable?



For People

If everyone ate plant-based, the global calorie supply would increase by an estimated 50% which could effectively wipe out hunger.



... And For Animals



It makes no sense to cause pain, suffering and death in other living beings when it is absolutely unnecessary.



70 billion land animals are slaughtered for food every year. Most are raised in CAFOs.



The ultimate question is this: How can humans best adapt to their current environment to sustain a growing population on a shrinking planet?



We have a choice.

When we consider the consequences of our food choices not just for ourselves but beyond ourselves, a plant-based diet simply makes sense.

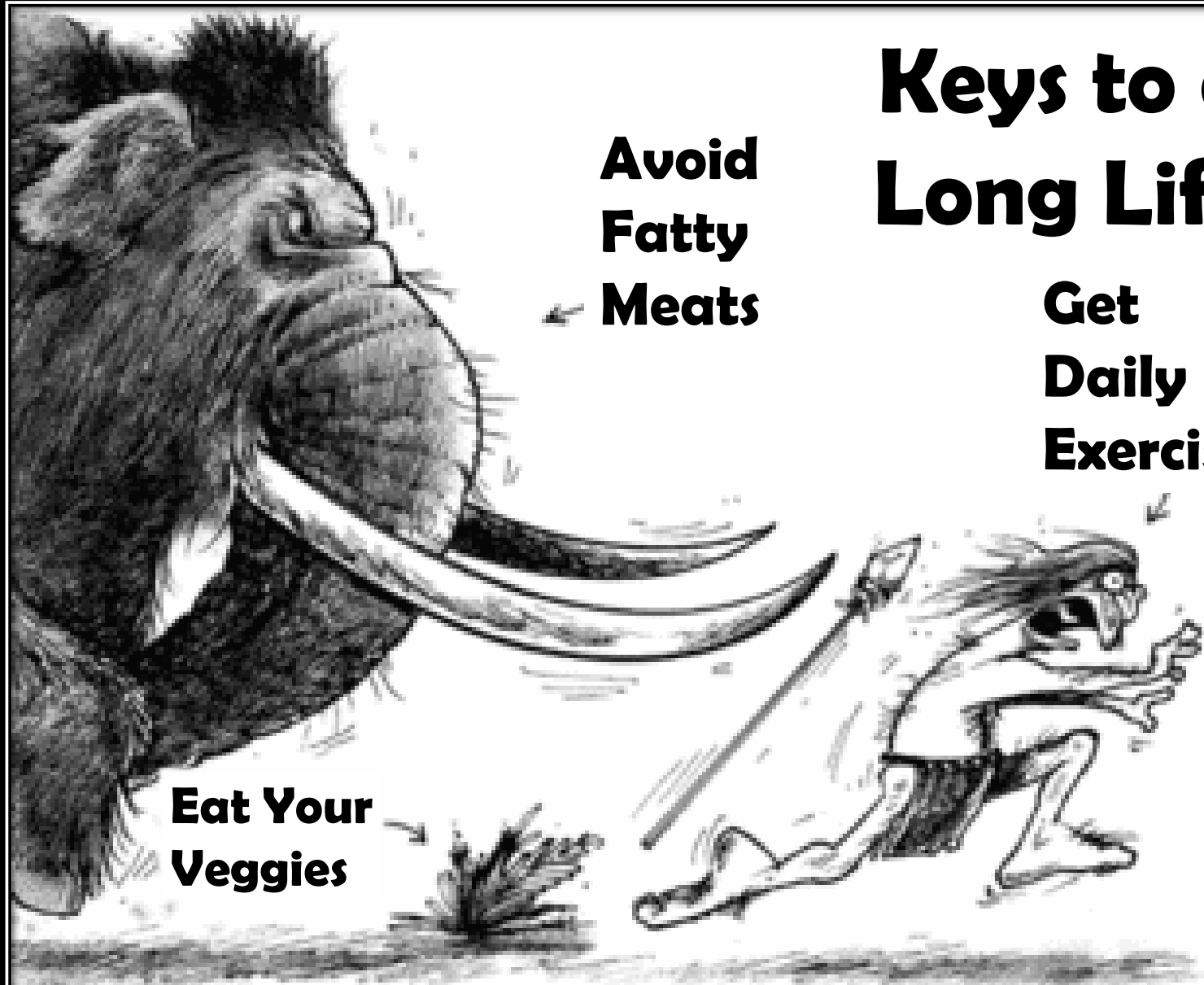


Keys to a Long Life

**Avoid
Fatty
Meats**

**Get
Daily
Exercise**

**Eat Your
Veggies**



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Thank you!

