

REVIEW

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Natural environments, ancestral diets, and microbial ecology: is there a modern “paleo-deficit disorder”? Part I

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Abstract

Famed microbiologist René J. Dubos (1901–1982) was an early pioneer in the developmental origins of health and disease (DOHaD) construct. In the 1960s, he conducted groundbreaking experimental research concerning the ways in which early-life experience with nutrition, microbiota, stress, and other environmental variables could influence later-life health outcomes. He also wrote extensively on potential health consequences of a progressive loss of contact with natural environments (now referred to as green or blue space), arguing that Paleolithic experiences have created needs, particularly in the mental realm, that might not be met in the context of rapid global urbanization. He posited that humans would certainly adapt to modern urban landscapes and high technology, but there might be a toll to be paid in the form of higher psychological distress (symptoms of anxiety and depression) and diminished quality of life. In particular, there might be an erosion of humanness, exemplified by declines in altruism/empathy. Here in the first of a two-part review, we examine contemporary research related to natural environments and question to what extent Dubos might have been correct in some of his 50-year-old assertions.

Greatest Differences Between Paleolithic and Modern Diet

- Modern diet contains abundant acellular carbohydrates (carbohydrate densities greater than 23%). Grains, cereals, beans, lentils, and large amounts of processed foods made from these foods. Paleolithic diets contained less than 1% in the form of wild grains that were foraged.
- Paleolithic Humans consumed more than 7000 mg of potassium per day on average. Modern populations largely fail to meet modest RDAs ranging from 2300 to 3400mg.
- Paleolithic foods contained no refined oils or sugars. Fats and less complex carbohydrates were always contained within a food matrix.
- Iron and zinc levels are dramatically lower in the modern diet (approximately 20% of what Paleolithic Humans consumed).
- Macronutrient composition shifted with the seasons but protein levels were typically within 30-35% of kcal. More than 200g per day. Modern recommendations of 0.8g/kg body weight provide less than 1/3 of that value.

Additional contrasts with consequences

- Modern humans consume chemical additives, artificial sweeteners, and non-biologically compatible fortified vitamins daily.
- Paleolithic human diets contained less than 10% of the omega 6 fatty acid content of the average modern diet
- Paleolithic plant foods provided upwards of 100 grams of largely fermentable fiber per day throughout much of the year.
- Many foods were only available seasonally in the Paleolithic era, providing biologically compatible influences on human physiology.
- Animal foods were entirely wild, grass-fed, and contained abundant fatty acids that are comparatively absent from most modern diets.

Niacin as a tracer for processed flour

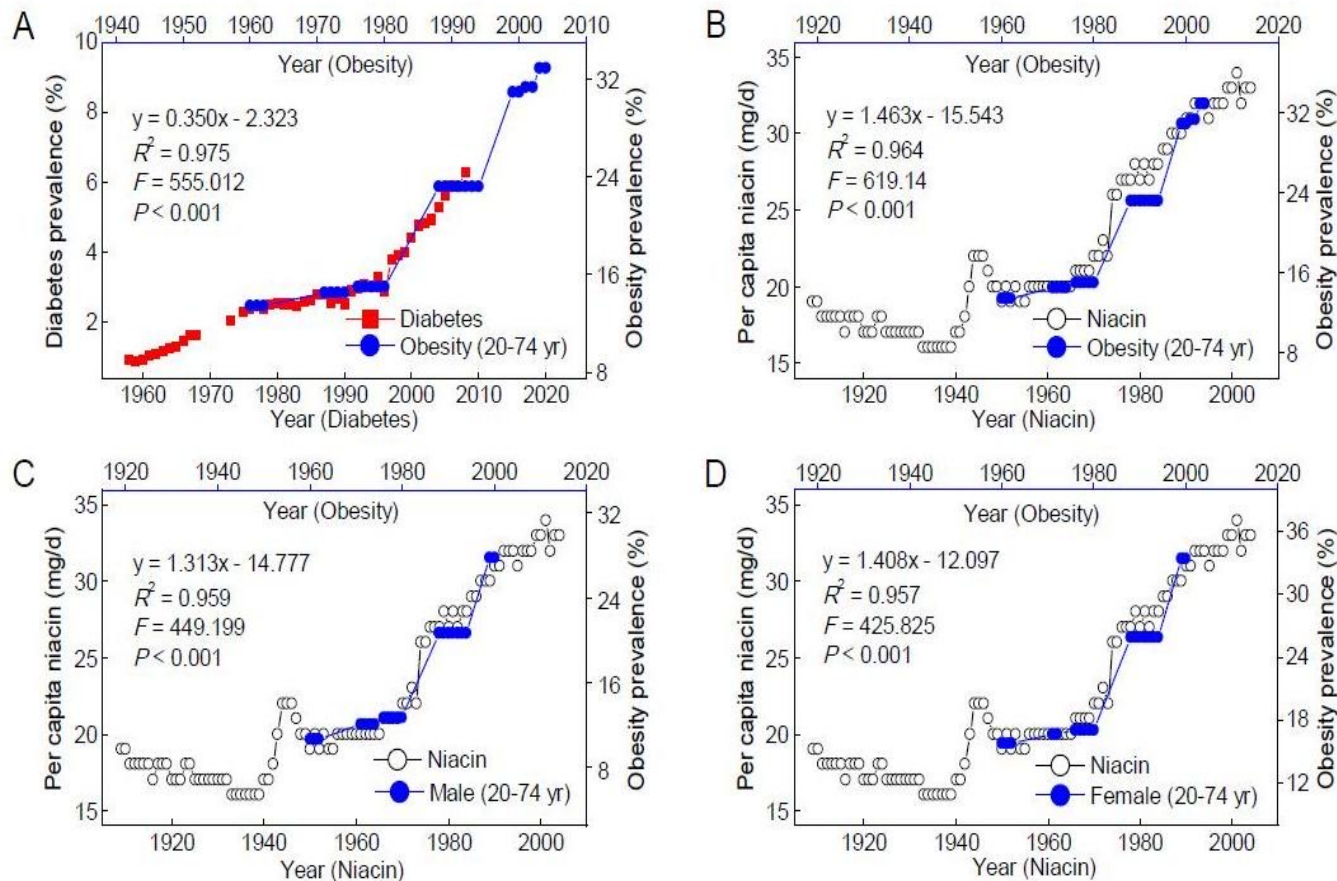


Figure 3 The correlations between the niacin consumption and the obesity prevalence in US adults. A: Trends of prevalence of obesity and diabetes in the US. B: The trends in the per capita niacin consumption (Ref. [23]) and in the obesity prevalence (Ref. [30]). The 10-year lag regression result is presented in the panel. C and D: showing the similar associations in both sexes. The obesity prevalence data are derived from Ref. [31]. The lag regression results are presented in each panel.



Widely Available Paleolithic Foods

- Coconut
- Grass-fed Bison
- Wild Salmon
- Sardines/Mackerel
- Lamb/Goat
- Oysters/Clams/Mussels
- Lobster/Crabs/Shrimp
- Purple/Okinawan Sweet Potatoes
- Plantains
- Hazelnuts
- Watercress
- Dandelion greens
- Claytonia
- Nettles
- Blackberries
- Raspberries
- Pistachios
- Lamb's Quarters
- Cassava or Yuca
- Kumquats
- Raw Honey



Clinical Evidence of What's Possible....

Participants consumed a paleolithic type diet comprising fruits, vegetables, nuts, seeds, and lean sources of animal protein, and excluding nonpaleolithic type foods, for 10 days.

In all measured variables, 100% of participants had identical directional responses when switched to paleolithic type diet, that is, consistently significant improved status of circulatory, carbohydrate and lipid metabolism/physiology.”

Frassetto LA, Schloetter M, Mietus-Synder M, Morris RC Jr, Sebastian A. Metabolic and physiologic improvements from consuming a paleolithic, hunter-gatherer type diet. *Eur J Clin Nutr*. 2009 Aug;63(8):947-55. [doi: 10.1038/ejcn.2009.4](https://doi.org/10.1038/ejcn.2009.4).

Health Benefits of a Paleo diet LA Fassetto *et al*

Table 3 Effect of the Paleolithic diet on metabolic variables

Category	Variable	S.A.D. Usual Diet (low sat fat; high carb)	Paleo Diet (low sat fat; high carb) --no grains --no legumes --no dairy	% Change	P-value
Lipids	HDL	50 mg/dl (1.3 mmol/L)	50 mg/d (1.3 mmol/L)	+ 4%	NS
	TG	80 mg/dl (0.9 mmol/L)	53 mg/dl (0.6 mmol/L)	- 35%	0.01
	LDL	116 mg/dl (3.0 mmol/L)	89 mg/dl (0.6 mmol/L) (implies more buoyant, less sdLDL)	- 22%	0.003
Metabolic Metrics	Fasting Insulin	9.6 mIU/L (69 pmol/L)	2.9 mIU/L (21 pmol/L)	- 68%	0.07
	Fasting Glucose	324 mg/dl (? 18 mmol/l)	306 mg/dl (? 17 mmol/L)	- 5%	NS
	Insulin AUC (pmol x h/L)	533	361	- 39%	0.006
	HOMA	3.2	1.0	- 72%	0.07

Insulin conversion (pmol/L divided 7.175 = mIU/L)

Glucose conversion (mmol/L * 18 = mg/dL)

HOMA = homeostatic assessment = (fasting insulin x fasting glucose)/22.4

Many Examples of Bad Dietary Advice:

U.S. FOOD CONSUMPTION AS A % OF CALORIES

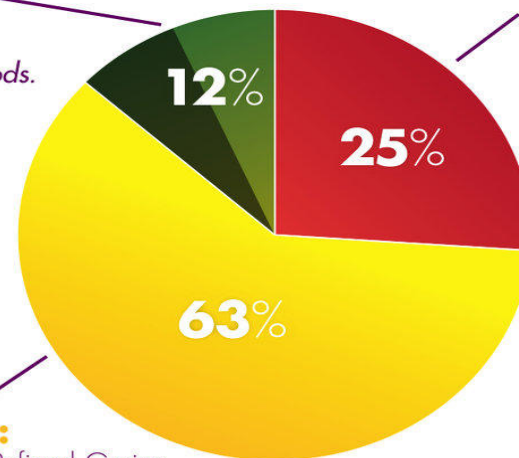
PLANT FOOD:

Vegetables, Fruits, Legumes,
Nuts & Seeds, Whole Grains
Fiber is only found in plant foods.

NOTE: Up to half of this category
may be processed, for example
almonds in candy bars, apples in
apple pies or spinach in frozen
spinach soufflé, and of course these
would not be healthy choices. The
focus should be on whole unprocessed
vegetables, fruits, legumes, nuts and
seeds and whole grains.

PROCESSED FOOD:

Added Fats & Oils, Sugars, Refined Grains



ANIMAL FOOD:

Meat, Dairy, Eggs, Fish, Seafood
Cholesterol is only found in
animal foods. Animal foods are the
PRIMARY source of saturated fat.

GUIDE TO HEALTHY EATING:

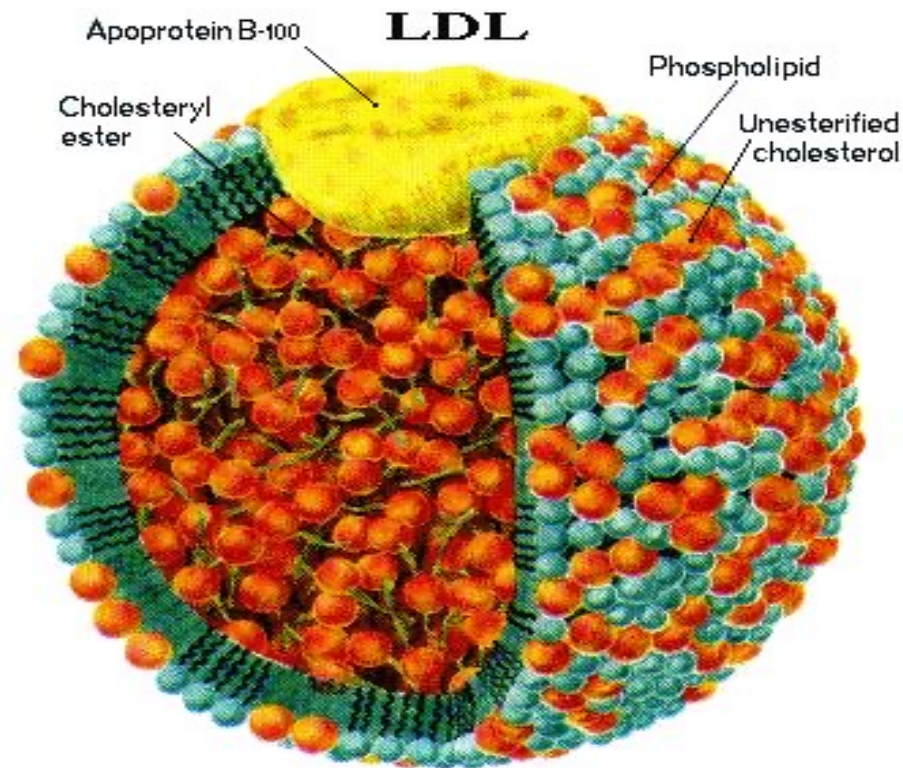
Much easier to understand than the
USDA Food Pyramid, with no food
industry influence.

Eat **LESS** from the animal and processed
food groups and **MORE** whole foods
from the plant food group.

In general, food from the animal and
processed food group contribute to
disease, while **WHOLE** foods from the
plant group contribute to good health.

Source: USDA Economic Research Service, 2009; www.ers.usda.gov/publications/EIB33; www.ers.usda.gov/Data/FoodConsumption/FoodGuideIndex.htm#calories
New York Coalition for Healthy School Food * www.healthyschoolfood.org
Special thanks to Joel Fuhrman, MD, author of *Disease Proof Your Child: Feeding Kids Right* * Graphics by MichelleBanda.com
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A Paleolithic Diet Changes LDL Qualities



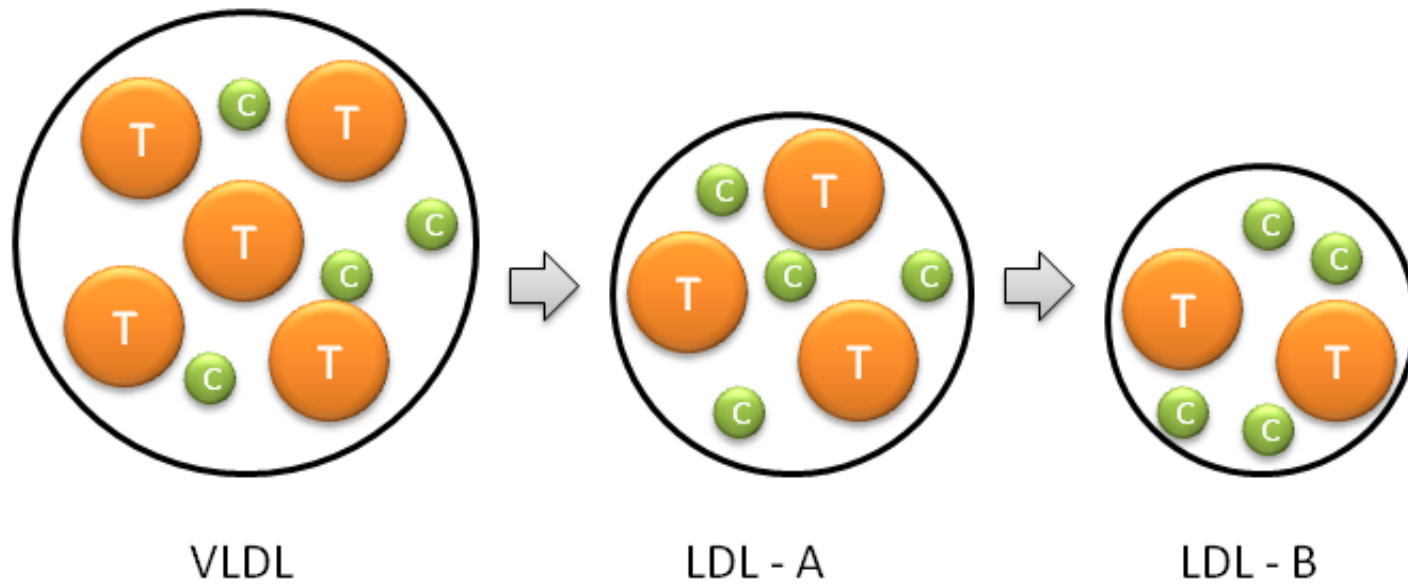




Figure 1 Paleo-deficit disorder?

Compared to our ancestors depicted, a modern urban dweller may experience:

- ↓ Natural light; daytime blue portion in particular
- ↓ Darkness at night
- ↓ Physical activity in natural environments
- ↓ Visual contact with features of diverse natural environments
- ↓ Auditory processing of natural sounds reflective of biodiversity
- ↓ Intake of relatively unprocessed foods; phytochemicals
- ↓ Contact with non-pathogenic microbial diversity
- ↓ Natural olfactory stimulants; phytoncides
- ↓ Tactile contact components of natural environments
- ↓ Opportunity for privacy, solitude
- ↓ Opportunity to function/sleep in electromagnetic environments that remain unaltered by human intervention
- ↓ Relative amounts of negatively charged air ions

Reclaiming and maintaining **our metabolic flexibility** (ie. *mitochondrial health*)



**Circadian
rhythm**



Sleep



Light exposure



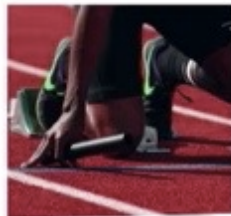
Gut health



**Meaningful
relationships**



Lift weights



Go fast



Go slow



**Novel
experiences**



Courtesy Jeff Leach PhD

Jared
Diamond

Pulitzer Prize-winning and bestselling author of
COLLAPSE and GUNS, GERMS, AND STEEL

**THE WORLD
UNTIL YESTERDAY**

What Can We Learn from Traditional Societies?





“About 75% of the food in the Western diet is of limited or no benefit to the microbiota in the lower gut. Most is comprised specifically of refined carbohydrates, is readily absorbed in the upper GI tract, and what eventually reaches the large intestine is of limited value, as it contains only small amounts of the minerals, fiber, and other nutrients necessary for maintenance of the microbiota.”

Nutrients 2013. 5, 162-207



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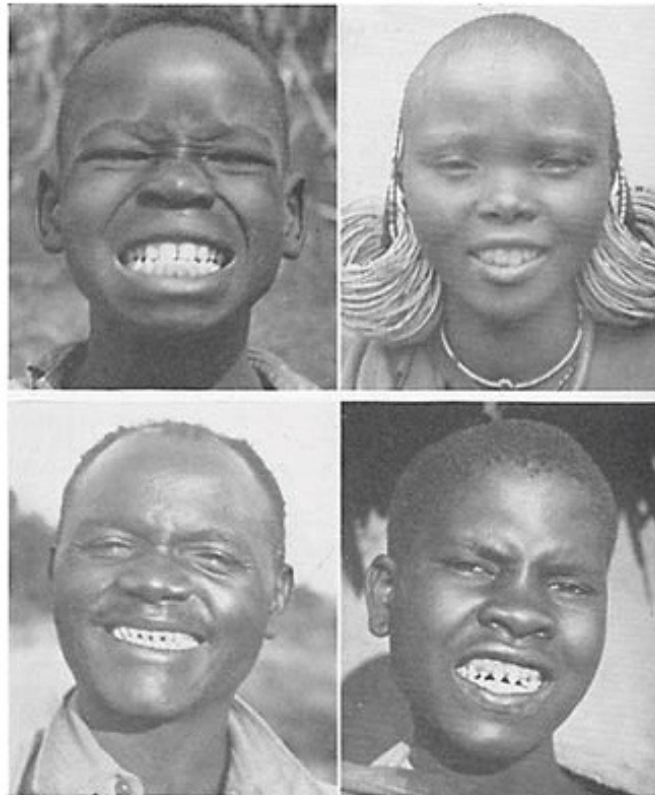


FIG. 41. The development of the faces and dental arches in many African tribes is superb. The girl at the upper right is wearing several earrings in the lobe of each ear. The Wakamba tribe points the teeth as shown below. This does not cause tooth decay while they live on their native food.

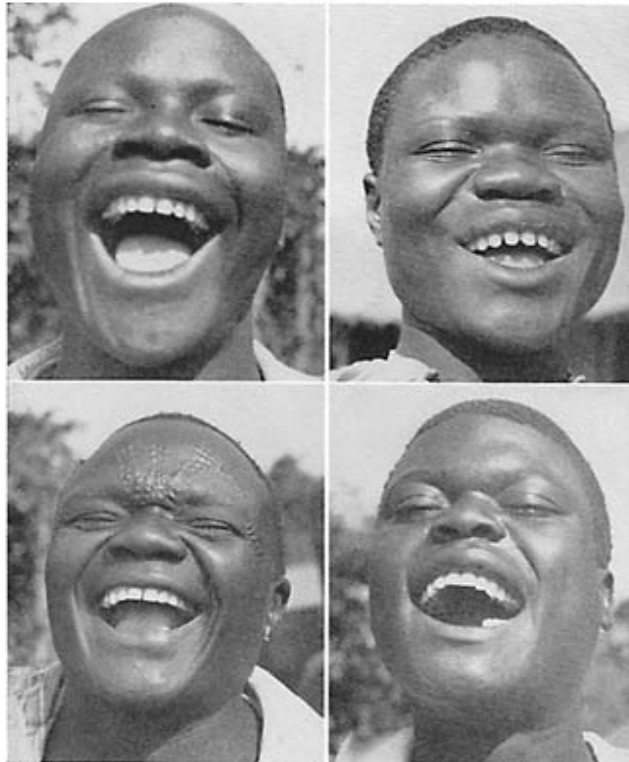


FIG. 42. The reward of obeying nature's laws of nutrition is illustrated in this west Nile tribe in Belgian Congo. Note the breadth of the dental arches and the finely proportioned features. Their bodies are as well built as their heads. Exceedingly few teeth have been attacked by dental caries while on their native foods.

