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The Paleolithic Diet

So Easy a Caveman Can Do It?

Colin Kammeraad
HNR 499: Senior Thesis

If you are the type of person that browses magazines while waiting in the check-out line at the grocery store, you have most likely digested an unhealthy amount of dietary coaching. *Us Weekly* gave us the scoop on how Kourtney lost 44 pounds in just six months, *People* offered Al Roker's secret to slimming down, and *OK!* divulged our favorite celeb's "miracle bikini diets." The plethora of nutritional hodgepodge jumping off the newsstand trumpets our blatant obsession with looking and feeling healthy. Given the current state of America's health and wellness, it is of little wonder why so much of our media attention is devoted to this topic. The statistics are startling.

In a country of over 300 million, 70% of adults are considered either clinically obese or overweight and this percentage continues to rise ("Obesity and overweight" 2012). This translates to millions of Americans suffering from heart disease, stroke, type-2 diabetes, and various types of cancer linked to diet. Costs for treatment of these conditions alone totaled over \$147 billion in 2008 with obese patients spending an average of \$1,429 more per year on medical intervention than their non-obese counterparts ("Adult Obesity Facts" 2013). Despite this egregious spending, an estimated 280,000 deaths in the United States are attributable to obesity related health conditions every year (Cordain et al 2005)

While the proffered advice from check-out line gossip magazines may be disseminated with the best of intentions, it falls flat in offering a scientifically backed solution to our nation's ills. Thus we are left with the question: what diet will *actually* result in the slimmer waist, increased energy levels, and vitality into old age that so many fad diets promise all while standing up to rigors of scientific investigation? The answer to this question is highly contested

within the nutrition community; however a growing cohort of dieters claims it has found the dietary Holy Grail in the Paleolithic diet.

What is the Paleolithic diet?

Like any diet that attracts a sizable following, the Paleolithic or Caveman diet has many nuanced iterations. At its simplest however, the diet requires that adherents consume only foods that were readily available to human's Paleolithic ancestors before the dawn of modern agricultural practices 10,000 years ago. The staples of this regimen include lean meat with a strong preference toward grass-fed livestock, shellfish and other seafoods, vegetables, fruits, tubers (with only the rare consumption of white potatoes), eggs and nuts. Additionally, the diet requires the complete exclusion of cereal grains, dairy products, legumes, refined sugars, processed cooking oils, coffee, and alcohols (with the exception of red wine)(Lindeberg, 2005). The foremost authorities on the Paleolithic diet Loren Cordain and Robb Wolf encourage full-time adherence, but many plans make concessions and allow for 10% to 20% of food and drink consumption to be from off of the designated list.

While this diet plan does conform to many suggestions of the US Department of Agriculture and the American Dietetic Association's "myplate" recommendations for types of foods to consume, it eschews the notion that grains and dairy are necessary for a healthy, balanced diet. Additionally, the Paleolithic diet does not impose strict portion control guidelines, but rather supports an "eat until you're full" approach (Osterdahl et al 2008)(Lindeberg 2005).

What is the rationale behind the Paleolithic diet?

The argument behind the Paleolithic diet is rooted in the long evolutionary history of *Homo sapiens*. In its most basic form, evolution exists as a relationship between the genetics of a population and the environment in which said population exists. Through the process of natural selection the organisms with characteristics best suited to survival in that particular environment have a greater likelihood of reproducing and will pass on the selected trait to offspring. Conversely, organisms lacking this favorable trait will be less fecund and not pass on their genes with the same frequency (Jew et al 2009).

This pattern of reproductive success for some and reproductive bankruptcy for others results in the phenomena of stable selection. During periods of stable selection when environmental conditions are relatively constant the distribution of phenotypes within the population fall under a bell shaped curve. The selected traits are passed on at a high rate and occupy the middle of the bell curve, while the non-selected traits occupy the tails of the distribution (Cordain et al 2005).

Fortunately for evolution, which is driven by environmental chaos, environmental stability is not permanent. When a shift occurs in the environment, whether it is a natural disaster or the introduction of a new competitor, the trait that was once selected for may not be as favorable. This results in directional selection in which the majority of individuals within a population begin to possess a different phenotype that is better suited to survival in the environment (Jew et al 2009). When this shift occurs individuals in the population with the previously favorable trait are at a selective disadvantage, which manifests itself as greater susceptibility to disease or predation, premature death, and decreased fecundity (Jew et al 2009).

Proponents of the Paleolithic diet argue that the history of human nutrition has followed this exact trajectory. For the majority of hominin evolution, the available food sources have remained relatively constant. Regardless of locale and climate, early humans hunted and scavenged wild game, fruits, vegetables, and nuts (Lindeberg et al 2003). Their diet would have been devoid of grains and legumes as these require the use of either stone tools or fire to create a palatable food source. Similarly, early hominins would not have had access to non-human dairy due to the lack of domesticated livestock. These conditions remained constant across the course of early hominin evolution translating to high levels of stable selection. Therefore, the majority of ancestral humans had digestive, physiologic, and metabolic adaptations selected for conditions in which wild game and plants were consumed heavily and grains, legumes, and dairy were not (Lindeberg et al 2003).

Following this long period of stable selection an abrupt shift occurred in the diet of ancestral humans. Roughly ten thousand years ago (and by some estimates, up to thirty thousand years ago) agriculture began to take on a larger role in providing one of the main sources of human sustenance (Cordain et al 2005). Along with the domestication of once wild plants and animals, humans were also improving tools to process grains and legumes to make them digestible (Klonoff 2009). Processing of the products increased significantly through the following millennia and reached a pinnacle through the years of the Industrial Revolution two hundred years ago. During this brief period of time grains, legumes, and dairy have become staples in the western diet and comprise as much 70% of total food intake for the average American or European (Klonoff 2009).

Researchers suggest that the relatively short evolutionary time between human's ancestral diet and the current western diet creates an evolutionary mismatch. They propose that the human digestive tract, metabolism, and physiology were selected for and forged over the course of human's long evolutionary history. Consequently, the human body is not able to function optimally while consuming foods (grains, legumes, dairy) that were not readily available during Paleolithic times (Boyd et al 2002). Research done in recent years hints that the lack of compatibility between the food consumed and human's metabolic capabilities has resulted in chronic diseases of civilization such as type-2 diabetes, cardiovascular disease, stroke, obesity, and diet-related cancers (Jonsson et al 2009). To thwart the onset of such diseases, some dietary experts recommend a whole Paleolithic diet or an augmented one (Jonsson et al. 2010).

Positive Outcomes of Adherence to the Paleolithic Diet

While it only takes a quick Google search to reveal thousands of anecdotes and before and after pictures supporting the efficacy of the Paleolithic diet, only a small corpus of scientific research exists to verify these claims. Despite the small amount of scholarly work, researchers have been able to uncover compelling evidence for the powerful effects an ancestral diet could have on human health in both healthy individuals and those living with diseases of civilization.

The seminal work done on hunter-gatherer diets in relation to positive health outcomes was Staffan Lindeberg's study (2005) of the residents of the island of Kitava. Kitavans subsist on a diet high in plant material and wild game with little to no consumption of grains, dairy, or legumes. Lindeberg found that Kitavans lived life free from many of the diseases of civilization common in the western world. During his time on the island he observed few individuals

exhibiting signs of stroke, type-2 diabetes, obesity, ischemic heart disease, atherosclerosis or hypertension (Lindeberg 2005).

Two recent studies regarding the Paleolithic diet done in sedentary individuals with no diagnosed diseases related to metabolic disorders found that a brief Paleolithic intervention significantly improves health. Osterdahl et al (2007) found that subjects conferred a significant reduction in weight, BMI, systolic and diastolic blood pressure, and LDL cholesterol following 3 weeks on an ancestral diet. Subjects also increased the intake levels of antioxidants, vitamins C and E, and potassium. Perhaps the most marked change occurred in the distribution and overall intake of kilocalories. Researchers observed a decrease in overall caloric intake of 36%. This was accompanied by a percentage increase in kilocalories from fat and protein (roughly 10% increases for both) and a decrease in percentage of kilocalories from carbohydrates. Osterdahl suggests that the decreased intake of calories could be due to the Paleolithic diet's high degree of satiety (Osterdahl et al 2007).

Frassetto et al (2009) likewise found that a three week Paleolithic intervention reduced risk factors associated with metabolic disorders. Data collection revealed that participants had improved arterial distensibility and decreased systolic and diastolic blood pressure, low-density lipoprotein (LDL) levels, and serum triglyceride levels. Subjects also displayed significantly improved regulation of the intake and output of micronutrients such as sodium, calcium, and potassium. These improvements have been associated with a long-term reduction in the risk of developing cardiovascular disease. Similarly, researchers saw diminished fasting glucose plasma levels and insulin resistance, which are both risk factors for type-2 diabetes. These two studies

suggest that an ancestral diet can show significant improvements in the health of individuals without diagnosed diseases of civilization.

In populations of individuals who are affected by diagnosed diseases of civilization and metabolic syndrome the Paleolithic diet has produced promising results as well. Individuals suffering from both ischemic heart disease and either type-2 diabetes or glucose intolerance have been shown to have improved glucose tolerance and insulin sensitivity following an intervention of the Paleolithic diet (Lindeberg et al 2007)(Klonoff 2009)(Jonsson et al 2009). In many cases, glucose tolerance fell from pathological levels and returned to within a normal range (Klonoff 2009). Studies done on subjects with pathologies of civilization also confirmed the results seen in previous studies. Participants showed a significant reduction in average weight, BMI, waist circumference, systolic and diastolic blood pressure, and cholesterol, and in some cases higher levels of HDL cholesterol were seen (Lindeberg et al 2007)(Jonsson et al 2009). The findings associated with this research suggest that a Paleolithic diet or a similar regimen may have potential clinical implications on the management of chronic metabolic diseases.

Additionally researchers have found that the Paleolithic diet is more highly satiating and nutrient rich than a diet high in carbohydrates from grains. The satiating nature of the diet results in less food and fewer calories consumed, which lends itself to weight loss, decreased BMI, and reduced waist circumference. Researchers do not know what specifically causes the increased satiety of the Paleolithic diet, although some believe it is either the high ratio of protein to carbohydrates or the decreased energy density relative to a western diet (Jonsson et al 2010).

Opposition to the Paleolithic diet

The majority of nutritionists will agree that eliminating highly processed foods from the diet in favor of nutritious meats and plant materials will have beneficial effects on overall health and wellness; however there are certainly well-founded arguments against the Paleolithic diet.

The chief complaint surrounding the Paleolithic diet is that it falls short in meeting the recommended daily values of calcium and vitamin D as set by the FDA due to the lack of dairy consumption. In many of the studies reviewed previously, subjects commonly came in below the suggested level of 1000 mg unless they supplemented with calcium and vitamin D pills or chewables (Osterdahl et al 2007). Decreased availability of calcium in the body can lead to long-term difficulties with osteoporosis and other bone related conditions (Bronner 1994).

Proponents of the Paleolithic diet counter that calcium is easily available in high levels if adherents consume foods naturally rich in calcium such as turnips, kale, cabbage, and broccoli (Eaton et al 2002). Additionally, proponents suggest that a Paleolithic diet results in better regulation of internal calcium levels. They argue that the western diet results in a net acid load in the human body. Calcium (bonded to a carbonate ion) is used as a chemical base to neutralize free acids within the body. Consuming a diet that will not produce a net acid load decreases the amount of calcium used to neutralize protons and subsequently reduces the necessary level of calcium intake to maintain a constant body pH (Jonsson et al 2009).

Another common counterargument against the Paleolithic diet is that humans currently live longer and are therefore more likely to acquire a disease of civilization in advanced age. The reason that human's Paleolithic ancestors show no signs of common, current pathologies is that

they did not live long enough to develop these illnesses (Eaton et al 2002). Therefore eliminating grains, dairy, and legumes from the diet is based on an unfounded assertion that human's forbearers were immune from metabolic disorders. Researchers in favor of an ancestral diet suggest that diseases of affluence may have been possible for Paleolithic hominins to acquire, however these diseases are presenting much more often and have premature onset age in current populations (Eaton et al 2002). As such, people should take steps to emulate a diet free from processed foods that contain compounds, proteins, and fats that humans are not suited to digest and can lead to metabolic disorders.

Detractors of the Paleolithic diet also contend that while 10,000 years is a relatively brief amount of time for evolution to produce adaptations allowing humans to consume grains, dairy, and legumes in a highly efficient manner, it is certainly possible. Populations with ancestry rooted in northern Europe have shown this as they have developed lactose tolerance over many generations (Eaton et al 2002). Detractors also point to epigenetics for the potential source of these acquired adaptations and argue that the ability to consume dairy, grains and legumes may rely simply on the expression of a gene that can be turned on or off (Park, Friso, & Choi 2012). Little research has been done on the genetics and epigenetics related to food consumption and its relationship to chronic metabolic diseases, so the Paleolithic community cannot provide a backed argument against this.

Perhaps the most powerful criticism of the Paleolithic diet is the idea that human's incredible success as a species lies in their innate ability to be generalists. As such, humans can survive by eating a wide variety of foods that are not directly determined by evolution (Eaton et al 2002). For natural selection to be a heavy determinant of diet, consuming foods that humans

are maladapted to would need to result in a loss of sexual fitness. The observation that humans survive beyond sexual maturity while subsisting on a western diet challenges the Paleolithic diet's evolutionary foundation. Pro-Paleolithic researchers contend that biological organisms are healthiest when their life circumstances are in step with the conditions for which their genes were selected. Because the current world is one in which humans can expect to live longer more attention should be given to a diet that will improve the overall quality of life.

Economics of the Paleolithic Diet

One potential difficulty the Paleolithic diet presents is the expense of adherence. Often prices for produce and meat are higher than those of grains and dairy, which contributes to the high level of consumption of these foods in western society, particularly in lower-income areas (Metzger et al 2011). Metzger et al (2011) set out to determine whether it was feasible for individuals living at 130% of the poverty line or below to subsist on a diet that met the parameters of an ancestral diet and cost less than \$3.91 per day. Following the USDA's Thrifty Food Plan Model, the researchers determined that a Paleolithic diet that met all recommended daily values for macro and micronutrients was not feasible given the time restraints. Only when compromising the intake iron, calcium, and vitamin were the researchers able to fit plan that fell within the dietary restraints (Metzger et al 2011). The dietary plan created by this research team relied heavily on the consumption of starchy fruits and vegetables, which are not as nutrient rich as other fruits, vegetables, and meats. This economic insight shows that a Paleolithic diet is attainable for everyone only if certain micronutrients are lacking.

Guinea Pig Phase

Like any inquiring mind I could not simply take previously published works on the Paleolithic diet at their word, so I set out to do some experimenting of my own. The rules were simple: I had to religiously adhere to the Paleolithic diet for one month's time (November 1 – 30) and record weight, heart rate, and blood pressure measurements every four days. To control for potentially confounding variables I kept my exercise regimen (running 5 days a week for 30-40 minutes) and sleep schedule (7 hours per night) as consistent as possible.

From the outset I was slightly nervous about the prospect of eliminating grains, dairy, legumes, refined oils and sugar, and added salt from my diet. Prior to administering the Paleolithic diet my diet consisted heavily of grains, fruits, and vegetables with only the occasional consumption of meat. In short, I like cereal and bread. Accordingly, my initial thoughts were that it would be difficult to adhere fully to the dietary plan based solely on the restrictive nature of this diet.

After removing all the offending foods from my cupboard I set out to Meijer to equip myself for a month of Paleolithic eating. What I found is that it is rather difficult to come by the foods recommended by Loren Cordain and other Paleolithic gurus at a non-specialty grocery. This was particularly apparent in the lack of grass-fed/free-range meat and organic produce options. So from day 1 I had to concede a small defeat in purchasing pesticide-protected, hormone-enriched meats and veggies. Despite this minor setback I returned home with a cart full of chicken breasts, pork chops, ground beef, eggs, salad mix, spinach, sweet potatoes, green peppers, broccoli, bananas, apples, dried cranberries, and almonds.

While we are on the subject of purchasing food I must present my first qualm with the Paleolithic diet: it is expensive. Throughout the month I spent just over \$180 dollars at the

grocery store, which is roughly \$80 dollars more than I normally spend in a given month.

Despite my best efforts to be frugal and hunt for sales I consistently paid more than I would have liked. Granted, I did not emulate my grandfather's college experience in which he "ate potatoes everyday because they were cheap" and I splurged to have a wider variety of food. That being said, I do think it is possible to eat a Paleolithic diet on a "normal" food budget (say \$100-\$120 a month), it would simply require a lack of variety in food choice.

While expense was certainly a difficulty I encountered during my Paleolithic month, food preparation was my greatest nemesis. Due the lack of processed foods, almost all Paleolithic meals require some form of preparation. This meant that any time I wanted a substantial meal (i.e. more than a handful of almonds or a banana) I would have to fire up the stove. While this process made me feel more invested in my food and taught me to never take frozen pizza or toaster waffles for granted, I grew tired of the monotony of food preparation early on in the month. By the time the last weeks of November rolled in I found myself forgoing cooking in favor eating raw fruits and veggies for meals. Perhaps my food preparation apathy was due to my own personal laziness, but what it did reveal is that commitment to food preparation and having the time to do so are of the utmost importance to religiously following the Paleolithic diet.

It may sound like I only have complaints about my experience with the Paleolithic diet, but there were certainly some interesting perks to following this diet plan. Chief among these perks was the structure it applied to my diet. I no longer had to worry about what I was eating and whether or not it was considered healthy; if the food item met the Paleolithic criteria, then

it was healthy and I could eat it. I think the “healthy or not” conundrum is one that many people face in regard to dieting and having a set structure removes any dietary doubt.

The health-related results of following the Paleolithic diet for a month were varied. My goal was to test the findings of peer-reviewed research on ancestral diet intervention, particularly as it pertains to measurements of weight, pulse, and blood pressure. Each study I encountered found that weight and blood pressure decreased following intervention of a Paleolithic diet, though none broached the topic of pulse. Despite my already svelte build I lost 6 pounds (4.3% reduction in weight) throughout the month. While the reduction in weight did align with the results found in previous studies, pulse and blood pressure underwent no significant change. This is likely due to the fact that the baseline rates for both measurements were already in a relative low range.

Table 1: Weight, Pulse, and Blood Pressure Measurements During Paleolithic Diet Intervention

Date	Weight (lb)	Pulse (BPM)	Blood Pressure
11/1	139	51	112/74
11/5	138	53	110/74
11/9	138	54	112/78
11/13	135	52	118/74
11/17	133	52	114/76
11/21	132	53	112/74
11/25	133	52	114/74
11/29	Did not record data	Did not record data	Did not record data

The other interesting health implication that a month on the Paleolithic diet had was on satiety. Through the first week of intervention I had a voracious appetite that Paleolithic prescribed foods could not seem to appease. However after the first week my hunger quelled. I found that not only was I hungry less often, but also that I ate less when I was hungry. This change in appetite was likely the leading contributor to the weight loss I experienced over the course of the intervention.

Conclusion

Our Paleolithic ancestors gave us stone tools, fire, and the wheel, but did they give us the diet that we should all be consuming today? While it is difficult to deny that many individuals in western society suffer from chronic disease of civilization and would benefit from an altered diet, the Paleolithic diet should not be the first one the list. This ancestral diet does offer escape from processed foods and excess salt, however falls short in many other areas. Adherent to the Paleolithic diet face a rather difficult task in acquiring a dietary plan that falls within the purview of the rules and also offers the variety necessary to appease the human taste buds. Additionally, the diet fails to meet recommended daily allowances for calcium and vitamin D and spurns the health boons that whole grains and dairy products offer. Paleolithic hominins survived on such a diet for thousands of years; however modern day humans considering the Paleolithic diet should take these suggestions with a grain of salt. Only metaphorically, of course.

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