Consumption Of A High Fat-Low Carbohydrate Diet For Weight Loss

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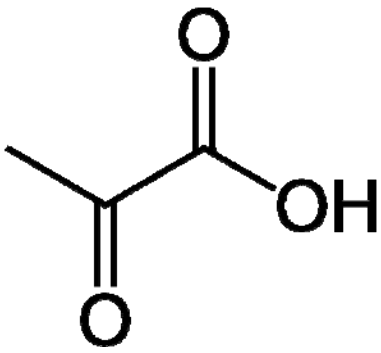
Abstract

It is well known that the new diet trend over the past five years has resembled a low-carbohydrate and high-protein consumption pattern among dieters. The diet, more formally known as the *Atkins Diet,* was developed in the 1960s and has recently flourished in popularity among a variety of dieters—from mothers to professional muscle builders. The low-carbohydrate, high-protein diet offers significant gains in weight loss and almost immediate noticeable results if followed properly. The body reacts immediately when we decrease our consumption of carbohydrates and "feeds off itself," therefore, offering quick results and ultimately resulting in weight loss. Although this sounds like a miracle diet and a quick fix for what resulted from irresponsible eating habits and decreased activity, the diet can have serious adverse biochemical effects on the body.

Introduction: What is the High-Protein, Low-Carbohydrate Diet?

The High-Protein, Low-Carbohydrate (HP-LC) diet offers immediate weight loss and maintenance while restricting the consumption of foods with carbohydrates, and promoting unlimited consumption of foods that are high in protein and full fat. Many argue that the reason for 56% of the adult population being overweight[1] is the increase in refined sugars, which are found in carbohydrates, and decreased activity. Many look to a High-protein, Low-Carbohydrate diet as an immediate fix for what has taken their body years to accumulate. Many dieters spend thousands of dollars on what are known as "fad" diets; among those, the HP-LC diet thrives. Researchers have estimated that 80% to 85% of dieters who lose weight will gain it back within 1 to 5 years. (*Modern nutrition in health and disease* , 1999)

Gluconeogenesis and the Carbohydrate



Pyruvic Acid

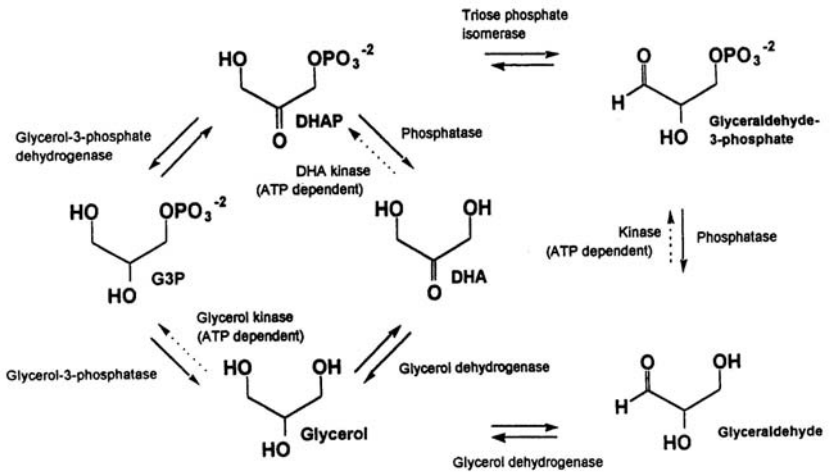
The diet has succeeded in popularity and has offered prompt results due directly to gluconeogenesis. Gluconeogenesis is when glucose is generated from a non-sugar carbon structure such as pyruvate or glycerol. The process takes place in the absence of glucose, which is ultimately starvation, fasting or high intensity exercise; the majority of gluconeogenesis takes place in the liver. Gluconeogenesis is often associated with ketosis, which is when the body converts fat into fatty acids and ketone bodies, offering energy for the body.

Carbohydrates are a much simpler structure than proteins and lipids; therefore, it is much easier for the body to metabolize carbohydrates. In absence of carbohydrates, the body must resort to metabolizing available proteins and lipids, which are the primary ingredients of the Atkins diet, a HP-LC diet. The fact that the body metabolizes proteins and lipids much slower than carbohydrates is the primary reason why the diet offers such incentives as "staying full longer." A HP-LC diet will give the dieter a feeling of satisfaction of no hunger and less of a desire to eat more.

Now many consumers may wonder—why are there chocolate candies, artificial sweetners and basically "calorie free sugars?" The simplest of all answers is *glycerol.* Also known as a sugar alcohol to consumers, glycerol is a precursor of triacylglycerols and phospholipids, which are metabolized through gluconeogenesis. Glycerol and fatty acids are released into one's bloodstream when the body must metabolize stored fat as a

source of energy. Glycerol then enters gluconeogenesis but it must first be converted into glyceraldehyde 3-phosphate, in order to be metabolized. The conversion of glycerol to glceraldehyde 3-phosphate takes place in the following steps:

FIG.1



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Scientific evidence regarding Safety and Effectiveness of this Diet

Although a HP-LC diet may seem like a fast, friendly fix with many options to accommodate even the pickiest of all eaters, many questions arise regarding the concern for safety pertaining to this diet. The biggest concern is that a HP-LC diet may lead to potential heart disease, as the diet promotes higher fat diets which ultimately raise an individual's cholesterol levels. An article published by *Havard Women's Health Watch* in November of 2003 stated that although we don't have many years of research regarding the Atkins Diet (the most popular form of a HP-LC diet), common sense leads us to believe that by restricting fruits, vegetables and whole-hearty grains can be detrimental to our overall health.

> What we do know, from years of research, is that people on diets lose weight because they eat fewer calories, not because they stick to some special combination of nutrients. Atkins dieters are no different. But why they eat fewer calories isn't clear. It may be that protein and fat keep hunger at bay longer, or

> that the prohibition against carbohydrates keeps calorie-laden snack foods and sodas off pantry shelves. Also, Atkins dieters may simply grow bored with eating. Restricting the kinds of food you eat, whether it's carbohydrates, fats, or something else, may help you eat less because you tire of eating the same things over and over. (*Harvard Women's Health Watch,* 2003)

When participants of a HP-LC diet stick to the "rules" of the diet, they lose weight very quickly and notice results. Many dieters may accomplish their desired weight and then resort back to normal eating habits, including refined carbohydrates, etc. Once the dieter goes back to a "normal" eating schedule, they will noticeably gain the weight back. Many dieters often "flip-flop" between staying on the diet and then going off, on, then off. This is extremely detrimental to their overall health level and puts them more at risk for heart disease. Not only is it not healthy for your body, but it may be harder to lose the weight a second time around. "Furthermore, these studies have produced variable results with no consistent detrimental effects of high-fat diets on insulin sensitivity over a broad range of dietary fat content, including several randomized studies using the hyperinsulinemic glucose clamp technique or frequently sampled iv glucose tolerance test (fsIVGTT) to quantify insulin sensitivity." (*Diet, insulin resistance, and obesity: Zoning in on data for atkins dieters living in south beach,* 2004)

When comparing the safety and effectiveness behind low-fat, low-carb diets, it is known that many more dieters drop out of the low-carb dieting, due to restriction of food intake. There's only so much of a protein variety that you can stick to until it takes over you. "In fact, in 24-week, six-month, and one-year comparisons with patients on traditional low-fat diets, patients on low-carbohydrate diets had lower triglyceride levels, higher high-density lipoprotein (HDL) cholesterol levels, similar low-density lipoprotein cholesterol levels, and lower A1C levels." (*Low-carbohydrate diets,* 2006) You can

safely stay on a low-fat diet your whole life and remain healthy; a low-carb diet still lacks the necessary scientific evidence to deem it "dangerous," but inclinations of heart disease and increased long term effects are enough for most potential dieters to not stick with it on a long term basis. "…lipid levels are not a patient-oriented outcome, and diets high in fat have been associated with serious medical problems, including breast cancer and heart disease." (*Low-carbohydrate diets,* 2006)

Biochemical reasoning behind a high-protein, low-carbohydrate Weight Loss Diet

Although HP-LC diets restrict the amount of carbohydrate intake, they also restrict the amount of caloric intake by restricting carbs. Caloric intake is reduced tremendously and only allows about 20% of daily calories to be from carbohydrates. The typical American diet allows about 2,200 calories per day, on average. The first phase of the Atkins diet restricts caloric intake to about 1,152 calories per day, allows only 13 grams (or 5% of daily caloric intake), 102 grams of protein (or 35% of daily caloric intake), and a whopping 75 grams of fat (or 59% of daily caloric intake). This is phase one; during the last phase of the Atkins diet, the fat intake is increased to about 114 grams of fat (or 59% of daily caloric intake). This is an absurd amount of fat in a regular daily diet and the scientific reasoning behind a HP-LC diet is enough to scare all potential dieters astray.

Those who promote the HP-LC diet suggest that a diet high in carbohydrates triggers the pancreas to overproduce insulin, due to carbohydrates causing abnormal glucose levels. Recent studies have proved results that are quite different from previous what researchers have tried to prove. "Studies have shown, however, that hormonal

abnormalities rarely cause obesity (although it may lead to abnormal hormone levels). (*Modern nutrition in health disease,* 1999)

As we have studied, protein is the main factor that stimulates insulin secretion. Hence, this is the reason why a sedentary, unhealthy lifestyle may lead to diabetes. A diet high in protein is rich in purine, which is then metabolized into uric acid. "…ketogenic diets typically contain more than twice the recommended levels of protein…excessive uric acid levels may also contribute to gout in susceptible individuals." (*Should you recommend a low-carb, high protein diet?,* 2002) Overall, it is easy to see that the biochemical effects of a HP-LC diet differ from each individual; however, these effects should not be taken lightly and potential dieters should consult with their primary care provider or a dietician to receive full and complete information regarding the benefits and risks associated with a HP-LC diet.

Adverse side effects of a prolonged a High-protein, low-carbohydrate Weight Loss Diet

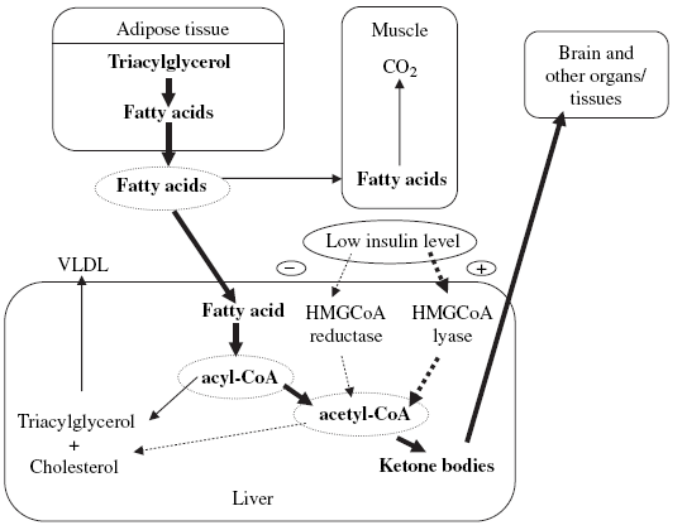
Although the high-protein, low-carb diet has been around for decades, the research to back up the scientific findings is extremely limited. There are many advocates and opponents to the diet, therefore, restricting the amount of unbiased research conducted. What we do know is that with low-carbohydrate consumption, our body resorts to gluconeogenesis, which is ultimately starvation of the body. Energy levels decrease and participants of the HP-LC diet are not receiving adequate nutrition.

According to the United States Department of Agriculture (USDA), the requirements for a healthy diet include: an emphasis on fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products, lean meats, poultry, fish, beans, eggs, and nuts, and is low in saturated fats, trans fats, cholesterol, salt and added sugars. The whole

reasoning behind a HP-LC diet disregards all elements previously listed. A HP-LC diet only touches on 2/5 of what our daily dietary intake should include. Many participants of the Atkins diet are also advised to take a daily dietary supplement to provide nutrients that are lacking in the diet. If your overall goal is to increase your health by decreasing your body weight, then why are all of these health concerns being ignored?

> Many investigators state that a high percentage of total energy consumed in the form of fat may lead to overweight and may increase points of regulatory significance in the pathway of ketone body formation during a low-carbohydrate diet. Studies in experimental animals have shown that prolonged elevated fat intakes potentially may lead to insulin resistance. Rodents appear to be particularly susceptible for developing insulin resistance in response to high-saturated fat diets. Although chronically increased saturated fatty acids intakes are consistently associated with high insulin resistance, monounsaturated fatty acids and polyunsaturated fatty acid intake, without increasing total fat intake, seems to improve insulin sensitivity. (*Low carbohydrate diets: Nutritional and physiological aspects*, 2005)

The side effects of studies shown include high-cholesterol, decreased production of ketone bodies, adverse effects on the liver, brain and other organs, tissues, low insulin levels, and many other serious adverse effects. If a dieter chooses to participate in a HP-LC diet, these side effects are more than likely to occur.



(shown left) Branch points of regulatory significance in the pathway of ketone body formation during a low-carbohydrate diet. The branch points are encircled. (*Low carbohydrate diets: Nutritonal and physiological aspects*, 2006)

"A well balanced diet in hand with exercise" out the Window?

Perhaps the biggest debate in the dieting world over the past three decades has been low-carb vs. low-fat. Advocates of a low-fat diet convey that their diet offers long term health benefits and is easier to follow. Advocates of a low-carb diet argue that their diet offers quick and reliable results and lets you eat your hearty red meat items and all the full-fat, low-carb products you'd like. Both of the diets have proven results in the past, but which one is the best for our bodies? Are dieters more concerned with their long term health or do they just want quick results?

As we all know, if your daily consumption is low in fat and we exercise 2-3 times a week consistently, you are most likely in a healthy shape. However, can this general knowledge statement be applied to a diet that is low in carbohydrates? Can we say: if your diet is low in carbohydrates and full in fat, you are most likely in a healthy shape? Probably not. There is no fighting the fact that in order to be healthy, we need to include regular exercise habits in our life. No diet offers a fast fix and most "fast fix" diets have further adverse effects than the temporary beneficial effects on weight loss. It's up to the dieter to weigh out what means more to them: a better body image quickly or a long healthy life.

So many dieters want to know: why do you lose so much weight on a HP-LC diet? As we have learned, most of the weight loss at the start of the diet is from water loss. When you stop consuming carbohydrates and eating more protein, your body resorts to ketosis, taking what is needed to sustain nutritional energy from its reserve carbs that are located in your muscles. When your body stores carbs, they contain large

amounts of water; therefore, when your body uses those stored carbs, the water that was within the carbs is lost. (*Should you recommend a high protein, low carb diet?,* 2002)

Although the HP-LC diet offers prompt results if followed properly, your storage of carbohydrates is depleting and your body can only maintain adequacy for a period of time before it starts taking a toll on your body. Overall, nothing can compete with a healthy diet recommended by the USDA that includes a balance of nutrients from *all* food groups in equal amounts, not including fats. The USDA still recommends that fats should be limited and that mono- and poly- unsaturated fats are still heart healthy fats. With a proper diet and proper exercise, you will surely be on your way to weight loss and long term health benefits. A quick fix of a HP-LC diet may seem enticing, but your overall health will diminish.

Conclusion

While a high-protein, low-carbohydrate diet can offer significant weight loss, it requires you to surrender your overall body health. Through gluconeogenesis and the consumption of glycerol (mostly found in sugar alcohols that contribute to a HP-LC diet), your body resorts to "starvation" mode, as if it is receiving no nutritional adequacy what so ever. A diet that is low in fat and meets the nutritional requirements as presented by the USDA is the optimal diet plan that should be followed by potential participants seeking to lose weight and improve their overall health. We should pair a proper diet with proper exercise to receive the full benefits of a healthy lifestyle and long lived life.

Many researchers have avoided this heated topic of discussion in efforts to restore the credibility to the HP-LC diet. There are many advocates and opponents of the HP-LC diet that will continue to do research; however, the general public only sees what they are

commercially drawn to. Whether it's their next door neighbor or their sister who are participating in the HP-LC diet, the public is not receiving enough scientific evidence supporting the pros and cons of participating in the HP-LC diet.

Overall, nothing beats a healthy diet, as recommended by the USDA. Our bodies are temples, not experiments to see if the latest fad diet will work for us. If anyone is to participate in any form of a diet, they need to take the full health benefits and adverse effects into consideration and speak with a dietician or consultant before dieting. Throughout the diet, their weight should be monitored, as well as cholesterol and glucose levels. With proper education and motivation, participants will surely be on their way to obtain total overall health.

References/Appendix of Top 5 PubMed Citations

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Lara-Castro C, Garvey WT. Diet, insulin resistance and obesity: Zoning in on data for atkins dieters living on south beach. Journal of Clinical Endocrinology and Metabolism. 2004;89(9):4197-205.

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Tapper-Gardzina Y, Cotugna N, Vickery CE. Should you recommend a low-carb, high-protein diet? The Nurse Practitioner. 2002 Apr;27(4)52-3, 55-6, 58-9.

Top 5 PubMed Citations

Lara-Castro C, Garvey WT. Diet, insulin resistance and obesity: Zoning in on data for atkins dieters living on south beach. Journal of Clinical Endocrinology and Metabolism. 2004;89(9):4197-205.

This article was extremely helpful because it offered an insight to what researchers are presenting to the general public. It offered facts and findings that would pertain to anyone interested in participating in the diet. I primarily found numbers to reinforce my statements.

Tapper-Gardzina Y, Cotugna N, Vickery CE. Should you recommend a low-carb, high-protein diet? The Nurse Practitioner. 2002 Apr;27(4)52-3, 55-6, 58-9.

This article was written by nurse practitioners and was intended for a general audience of other nurse practitioners. This article was extremely helpful and it answered many of my questions that were pondered before even getting started on this project. The article provided a legitimate foundation for most of my work.

Nair RV, Payne MS, Trimbur DE, Valle F. Transformed microorganisms and genes useful in the production of glycerol and 1,3-propanediol. Wilmington: E.I. du Pont de Nemours and Company. 2006.

This article was extremely helpful to me because it cited a lot of the biochemical citings that I listed in my project. Many of the pictures that were available in this article were helpful for me to comprehend the actual synthesis of pathways that were discussed.

Mokdad AH, Bowman BA, Ford ES. The continuing epidemics of obesity and diabetes in the United States. Journal of the American Medical Association. 2001;286:1195-200.

This article reinforced my nutritional background knowledge and offered an insight to what America perceives as healthy. When comparing a low-carb vs. low-fat diet, this article offered extremely helpful information and touched on the fact that HP-LC diets are still apart of ongoing research.

Kinzig KP, Hargrave SL, Hyun J, Moran TH. Energy balance and hypothalamic effects of a high-protein/low-carbohydrate diet. Journal of Physiological Behavior. 2007 Oct 22;92(3):454-60.

This article really helped me understand the adverse effects of a high-protein, low-carbohydrate diet. It explained the effects in detail and helped me understand the biochemical reasoning behind their findings. Although I didn't cite this journal word for word, it was helpful by providing tons of background information.