Several studies have been published comparing low-carbohydrate, ketogenic diets with low-fat diets, mostly regarding the treatment of diabetes in overweight and obese participants. Prominent researchers in this field are Richard Feinman, Stephen Phinney, Mary Vernon, Jeff Volek, Eric Westman, and William Yancy—all supporters of low-carbohydrate dietary regimes.

In most of these studies, both low-carbohydrate diet and the low-fat control diet are calorie-restricted diets. Calorie-restricted diets, irrespective of the components of the diets, confound the results of these studies. Calorie-restricted diets tend to:

- lower body temperature—which lowers the energy requirements
- decrease triglycerides
- decrease serum cholesterol
- decrease insulin-like growth factor 1 (IGF-1)
- decrease inflammatory response
- decrease blood pressure
- decrease serum insulin and glucose
- reduce oxidative damage
- increase dehydroepiandrosterone (DHEA)— the most common human steroid, which decreases significantly as we age. DHEA helps combat the effects of stress.
- increase cortisol— a steroid that is associated with stress

Another point to consider is the nature of the control diet. Is the control diet a healthy diet? Does the label applied to the control diet adequately reflect the nature of the diet? The control diet may be described as low-fat or high-carbohydrate when in reality it is not. A frequently used criteria for a low-fat diet is less than 30% of calories from fat. *This is not a low-fat diet.*

> Ketogenic diet studies focus entirely on the fat, saturated fat, carbohydrate and protein components of the diet. Measuring the quality of a diet is much more complex than measuring the proportions of fat, carbohydrate and protein. If we simply measure carbohydrates, refined sugars are treated the same as fiber. The food we eat is a complex combination of many components— many different types of fat, carbohydrates, amino acids, and dietary fiber along with a multitude of phytonutrients including vitamins, minerals, carotenoids, and polyphenols. A whole-food, plant-based diet will contain approximately 80% carbohydrate, 10% fat and 10% protein. The goal, however, is not to meet a prescribed macro-nutrient profile.

Another short-coming is the selective reporting of bio-markers. Only those bio-markers that appear to support the ketogenic advantage are reported—and even these are rather optimistically reported.

A study published in the journal *Nutrition and Metabolism* with the lead author Eric Westman is frequently cited by low-carbohydrate, high-fat diet advocates as evidence that low-carbohydrate, ketogenic diets are effective. The editorial board of this journal contains a number of low-carbohydrate, high-fat diet researchers.

Funding for this study was obtained from the Robert C. Atkins Foundation. The study compared the results of participants on a low-carbohydrate, ketogenic diet with a low-glycemic diet.

Eighty-four community volunteers with obesity and type 2 diabetes were randomized to either a low-carbohydrate, ketogenic diet (<20 g of carbohydrate daily; LCKD) or a low-glycemic, reduced-calorie diet (500 kcal/day deficit from weight maintenance diet; LGID). Both groups received group meetings, nutritional supplementation, and an exercise recommendation. The main outcome was glycemic control, measured by hemoglobin A1c. Both groups received the "same nutritional supplements known to have a mild lowering effect on blood glucose level" and a "lay-press diet book and additional handouts" were used by a registered dietician to inform the participants of the dietary requirements.

		Low-glycemic diet			Ketogenic diet		
		Wk 0	**Wk 24**	**change**	**Wk 0**	**Wk 24**	**change**
African-American	%	50	52		37	24	
Completion rate	%		63.0			55.3	
Body weight	kg	105.2 ± 19.8	98.3 ± 20.3	-6.9	108.4 ± 20.5	97.3 ± 17.6	-11.1
BMI	kg/m2	38.5	37.9	-2.7	37.7	37.8	-3.9
Hemoglobin A1c	%	8.3	7.8	-0.5	8.8	7.3	-1.5
Fasting glucose	mmol/L	9.26	8.37	-0.89	9.89	8.78	-1.11
Total cholesterol	mmol/L	4.93	4.78	-0.15	4.95	4.84	-0.11
LDL cholesterol	mmol/L	2.94	2.87	-0.07	2.74	2.77	+0.03
HDL cholesterol	mmol/L	1.24	1.24	0.0	1.14	1.28	+0.14
Triglycerides	mmol/L	1.89	1.67	-0.22	2.38	1.61	-0.77

Both groups were extremely overweight at the beginning and end of the trial with an average BMI of approximately 38 at the end of the 22 weeks.

There were significantly more African-American participants in the low-glycemic group. African-Americans are more susceptible to diabetes than the white American population so this factor distorts the results in favor of the ketogenic group.

Overall, the completion rate was not high. Completion rate was greater for the low-glycemic group. Only 55% of the participants were able to complete the low-carbohydrate, high-fat ketogenic diet compared with 63% on the low-glycemic diet. Given the health consequences of the participants continuing their same behavior, a greater commitment could be expected.

There was a greater decrease in triglycerides on the ketogenic diet but the starting value was significantly greater—this will again distort the results in favor of the ketogenic diet. The end

results for both groups were similar.

Participants were instructed to drink “bouillon dissolved in water was recommended 2–3 times a day during the first two weeks to reduce possible side effects.” This is to supply sodium and potassium to treat the side-effects of the ketogenic diet.

Headaches, constipation, diarrhea, and insomnia were reported for both groups with a greater prevalence occurring in the ketogenic diet group. The paper stated that there was no significant difference between to two groups but the data supplied indicated otherwise.

Below is a table showing the components of the two diets.

Component	At start	Low GI	Ketogenic
Calories	2128	1335	1550
Carbohydrates	46%	44%	13%
Fat	36%	36%	59%
Protein	18%	20%	28%

Both groups were on a starvation diet and felt miserable. The benefits of a diet cannot be measured only in terms of the proportion of fat, protein and carbohydrates. The low GI diet is even higher in the proportion of fat and protein than the standard unhealthy western diet.

AND this was a study funded by Robert C. Atkins Foundation that supports a high-fat, ketogenic diet.

At the end of the study, both groups were overweight, diabetic and feeling miserable. Both diets have nothing to recommend in terms of health and palatability.

A true low-fat, high-carbohydrate diet has been shown to have significantly better outcomes than either of these two diets.

McDougall [1] showed significant improvement in diabetic and cardiovascular markers after seven days on a low-fat, plant-based diet. Carbohydrate intake was approximately 80% of total energy with fat representing 10% or less.

Barnard [2] compared a low-fat, plant-based diet to an American Diabetes Association diet. The plant-based diet out performed that ADA diet and showed a significant improvement in all

markers measured over the 22 weeks of the trial. Note that 16 of the 49 vegan-group participants did not strictly adhere to their diet. Their cholesterol intake was reduced from an average of 291 mg/day to 24 mg/day. The ADA group reduced their intake from an average 317 mg/day to 189 mg/day. A vegan diet contains no cholesterol.

Meckling [3] evaluates the outcomes of a number of trials that compared low-fat diets with low-carbohydrate diets. This study included the Westman study which is discussed previously.

The tables below are derived from the papers by Meckling and Barnard.

Dietary components		Low-fat diets		Low-carb diets		Plant-based diet	
		Start	End	Start	End	Start	End
Energy	kJ	8617	6077	9616	6421	7365	5965
Protein	g	82.4	70.9	88.6	100.6	77	51
Protein	% energy	16	19.5	15.4	26.2	18	14
Fat total	g	80.9	28.8	90.8	94.6	72	30
Fat	% energy	36.4	17.8	35.6	55.5	36	18
SFAs	g	29.2	9	30.3	33.9	23	6
MUFAs	g	28.6	9.5	32.6	37.3		
PUFAs	g	13.4	5.9	16.8	13.7		
Cholesterol	mg	293	162	308	556	291	24
Carbohydrate	g	251	225	287	59	205	251
Carbohydrate	% energy	49	61.9	50	15.4	47	68
Sugars	g	23.8	20.5	22.6	1.4		
Fiber	g	17.8	20.3	19.8	8.9	18.8	36.3

Note the ratio for fat, carbohydrate, and protein in the plant-base diet group—18:68:14— and the large increase in the amount of fiber to 36 g.

Metabolic factors		Low-fat		Low-carb		ADA diet		Plant-based	
		Start	End	Start	End	Start	End	Start	End
HbA1c	%	8.3	7.8	8.8	7.3	7.9	7.4	8.0	7.1
Glucose	mmol/L	9.26	8.37	9.88	8.77	8.88	6.94	9.05	7.11
Blood pressure									
• Systolic	mmHg	140	130	144	127	122	119	123	120
• Diastolic	mmHg	84	78	83	75	80	77	78	73
Cholesterol	mmol/L	4.91	4.76	4.94	4.84	5.12	4.50	4.86	4.11
LDL-cholesterol	mmol/L	2.92	2.87	2.72	2.78	3.05	2.66	2.67	2.28
HDL-cholesterol	mmol/L	1.34	1.14	1.27	1.41	1.35	1.22	1.29	1.21
Triglycerides	mmol/L	1.51	1.13	1.54	1.08	1.78	1.50	1.67	1.35

It is difficult to obtain an accurate comparison between different studies because of different durations of the trials, the medications that the participants are taking often changes, and the initial state of health. Ketogenic trials focus on diabetes and obesity with the majority of participants being female and very overweight.

There are, however, several common features.

- LDL-cholesterol typically rises on ketogenic diets.
- HDL-cholesterol also increases. This is not as beneficial as supporters will have us believe.
- Serum cortisol increases which is associated with an increase in stress.
- The decrease in serum glucose is much greater on the ADA diet and plant-based diet than the “low-fat” diets and low-carbohydrate, ketogenic diets. Remember that the Westman study participants were taking nutritional supplements that decreased serum glucose.
- Completion rates are very low with “almost half of the studies included in our meta-analysis had completion rates less than 70%.” [4]

Ketosis occurs during starvation. It is not a normal, healthy condition. No animal species or human society normally lives in a state of ketosis. Ketosis occurs when fat in the body is utilized to obtain energy in the absence of glucose. Glucose is normally obtained from the digestion of carbohydrates. Ketosis results in the production of ketones—acetone being one

of the three types of ketones produced during ketosis. Blood acidity rises with an increase in ketones.

During pregnancy, ketosis has been linked to adverse outcomes for the unborn child.

Ketogenic diet trials almost invariable compare a ketogenic diet with a mislabeled “low-fat, high-carbohydrate” diet. Both the control diet and the ketogenic diet are not healthy diets—the participants are far from healthy at the start of the trial or at the conclusion.

The ketogenic trials appear to assume that the only criteria for a healthy diet is the ratio of fat, carbohydrate, and protein. Many other components are important for health such as fiber, refined sugars, phytonutrients, and protein sources.

A 2013 review of 17 studies involving 272,216 people showed that low-carbohydrate diets significantly elevated the risk of all-cause mortality. [5]

A 2014 Harvard study examined the effects of diet on patients who survived a heart attack. Animal-based low-carbohydrate diets were associated with higher all-cause mortality and cardiovascular mortality. However, an increase in adherence to a plant-based low-carbohydrate diets was not associated with lower all-cause or cardiovascular mortality. It is important to note that the comparisons are being made to an unhealthy American diet – one that created the heart attacks in the first place. [6]

Seventh-day Adventist's Studies (and many others) have shown vegans have a much lower incidence of many ailments including obesity and diabetes. [7]

Dr Katharine Milton field of expertise is the dietary ecology of primates, including human ancestors and modern humans. Professor Milton's conclusion is:

> It is prudent for modern-day humans to remember their long evolutionary heritage as anthropoid primates and heed current recommendations to increase the number and variety of fresh fruit and vegetables in their diets rather than increase their intake of domesticated animal fat and protein. [8]

Related articles

The Ketogenic Disadvantage
The Evidence against Eric Westman and William Yancy

Footnotes

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3. Meckling, K. A. et al. (2004) Comparison of a Low-Fat Diet to a Low-Carbohydrate Diet on Weight Loss, Body Composition, and Risk Factors for Diabetes and Cardiovascular Disease in Free-Living, Overweight Men and Women. *The Journal of Clinical Endocrinology & Metabolism*. 89 (6), 2717–2723.
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6. Li, S. et al. (2014) Low carbohydrate diet from plant or animal sources and mortality among myocardial infarction survivors. *Journal of the American Heart Association*. 3 (5), e001169–e001169.
7. Le, L. & Sabate, J. (2014) Beyond Meatless, the Health Effects of Vegan Diets: Findings from the Adventist Cohorts. *Nutrients*. 6 (6), 2131–2147.
8. Milton, K. (2000) Hunter-gatherer diets – a different perspective. 667.