EVIDENCE-BASED KETO DIET

MAY 2021

Nutrient Deficiencies on a Ketogenic Diet

CHRIS MASTERJOHN, PH.D

Roberts, T. (2021) Nutrient deficiencies on a Ketogenic Diet: an interview with Chris Masterjohn, Ph.D. Evidence Based Keto Diet Research. Spearhead Certifications.

[1]Department of Community Research, Spearhead Certifications, El Salvador.
[2]Department of Standards, Spearhead Certifications, Encinitas, CA

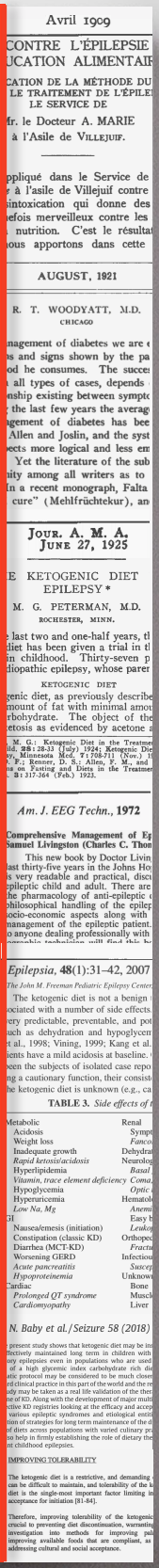
CORRESPONDENCE

[1]Email: tobias@paleofoundation.org
[2]Email: karen@paleofoundation.com

KEYWORDS

Keto Diet
Nutrient Deficiencies
Long-Term Keto Diet
Food Group Abstinence

SPEARHEAD


Avril 1909

CONTRE L'ÉPILEPSIE
UCATION ALIMENTAI

CATION DE LA MÉTHODE DU
LE TRAITEMENT DE L'ÉPILE
LE SERVICE DE

Mr. le Docteur A. MARIE
à l'Asile de Villejuif.

pliqué dans le Service de
à l'asile de Villejuif contre
intoxication qui donne des
efois merveilleux contre les
nutrition. C'est le résulta
ous apportons dans cette

AUGUST, 1921

R. T. WOODYATT, M.D.
CHICAGO

nagement of diabetes we are
s and signs shown by the pa
od he consumes. The succe
all types of cases, depends
nship existing between sympt
the last few years the averag
gement of diabetes has bee
Allen and Joslin, and the syst
ects more logical and less em
Yet the literature of the sub
ity among all writers as to
n a recent monograph, Falta
cure" (Mehlfrüchtekur), an

JOUR. A. M. A.
JUNE 27, 1925

E KETOGENIC DIET
EPILEPSY *

M. G. PETERMAN, M.D.
ROCHESTER, MINN.

last two and one-half years, t
diet has been given a trial in t
in childhood. Thirty-seven p
diopathic epilepsy, whose parer

KETOGENIC DIET

genic diet, as previously describe
mount of fat with minimal amou
rbohydrate. The object of the
etosis as evidenced by acetone

M. G.: Ketogenic Diet in the Treatme
ild. 28:28-33 (July) 1924; Ketogenic Die
ov., Minnesota Med. 7:708-711 (Nov.)
F.; Renner, D. S.; Allen, F. M., and
ns on Fasting and Diets in the Treatmer
21:317-364 (Feb.) 1922.

Am. J. EEG Techn., **1972**

Comprehensive Management of Ep
Samuel Livingston (Charles C. Thon

This new book by Doctor Livin
ast thirty-five years in the Johns Ho
s very readable and practical, disc
epileptic child and adult. There are
he pharmacology of anti-epileptic
hilosophical handling of the epilep
ocio-economic aspects along with
nanagement of the epileptic patient.
o anyone dealing professionally with

Epilepsia, **48**(1):31–42, 2007

The John M. Freeman Pediatric Epilepsy Center

The ketogenic diet is not a benign
ociated with a number of side effects
ery predictable, preventable, and pot
uch as dehydration and hypoglycem
t al., 1998; Vining, 1999; Kang et al.
ients have a mild acidosis at baseline.
een the subjects of isolated case repo
ng a cautionary function, their consis
he ketogenic diet is unknown (e.g., ca

TABLE 3. *Side effects of t*

Metabolic	Renal
Acidosis	Sympt
Weight loss	*Fanco*
Inadequate growth	Dehydra
Rapid ketosis/acidosis	Neurolo
Hyperlipidemia	*Basal*
Vitamin, trace element deficiency	*Coma,*
Hypoglycemia	*Optic*
Hyperuricemia	Hematol
Low Na, Mg	*Anemi*
GI	Easy b
Nausea/emesis (initiation)	*Leuko*
Constipation (classic KD)	Orthope
Diarrhea (MCT-KD)	*Fractu*
Worsening GERD	Infectiou
Acute pancreatitis	*Suscep*
Hypoproteinemia	Unknow
Cardiac	Bone
Prolonged QT syndrome	Muscl
Cardiomyopathy	Liver

N. Baby et al. / Seizure 58 (2018)

present study shows that ketogenic diet may be in
ffectively maintained long term in children with
ory epilepsies even in populations who are used
of a high glycemic index carbohydrate rich di
tic protocol may be considered to be much closer
ed clinical practice in this part of the world and the re
udy may be taken as a real life validation of the ther
ne of KD. Along with the development of major multi
ective KD registries looking at the efficacy and accep
various epileptic syndromes and etiological entiti
tion of strategies for long term maintenance of the d
of diets across populations with varied culinary pr
lso help in firmly establishing the role of dietary the
nt childhood epilepsies.

IMPROVING TOLERABILITY

The ketogenic diet is a restrictive, and demanding
can be difficult to maintain, and tolerability of the k
diet is the single-most important factor limiting in
acceptance for initiation [81–84].

Therefore, improving tolerability of the ketogenic
crucial to preventing diet discontinuation, warranting
investigation into methods for improving pal
improving available foods that are compliant, as
addressing cultural and social acceptance.

COMMENTARY

Nutrient Deficiencies and Strict Low-Carb Diets

Chris Masterjohn, Ph.D discusses the issues with total abstinence from food groups as well as some of the key vulnerabilities associated with the long term and strict adherence to the Ketogenic Diet with Spearhead Director of Community Research Tobias Roberts.

Restrictive diets have certainly been one of the most popular dietary trends during the past decades. From restricting calories to restricting fats, to restricting carbohydrates, people from all walks of life have been attracted to the idea that eliminating some element from their daily eating habits offers a guaranteed pathway towards weight loss or other health goals. Perhaps part of the magnetism of this nutritional approach is its tendency towards reducing the complexity of the issue at hand. Transitioning towards cooking and eating natural, wholesome meals and developing the routine of regular exercise often requires fundamental changes in lifestyle and behavior, something not easy for people who live time-crunched existence. In this sense, eliminating grains or meticulously counting carbs might be perceived as a more straightforward approach towards better nutrition and health.

In recent years, the ketogenic diet (Keto, for short) has enjoyed immense and growing popularity, due in part to the general appeal of restrictive diets. Keto has easily been the "most Googled diet" for several years in a row and received an incredible 25.4 million searches in 2020, or the equivalent of 69,682 online searches each day.

Despite this popularity, many researchers, nutritionists, and medical professionals have expressed concern over some of the potential health pitfalls that come with severely restricting certain food groups such as grains, legumes, and other foods that threaten to push people over a carbohydrate plateau that is capped at somewhere between 20 and 50 grams per day.

Many critiques of the Keto diet center on the prospective health risks that stem from increasing saturated fat consumption, higher LDL cholesterol levels, and increasing the total number of apoB containing lipoproteins linked to higher cardiovascular risk. However, nutrient deficiency is another latent problem that may come with strict, restrictive diets such as Keto. A diet lacking in a diverse array of vegetables, fruits, legumes, and whole-grain may put your body at risk for deficiencies in micronutrients, including selenium, magnesium, phosphorus, and vitamins B and C.

We recently sat down to talk with Dr. Chris Masterjohn, who is currently conducting independent research, consulting, working on information products, collaborating on information and technology products,

© 2021 Spearhead Certifications

and producing tons of free content to help people gain better health. Dr. Masterjohn earned his Ph.D. in Nutritional Sciences from the University of Connecticut. He served as a postdoctoral research associate in the Comparative Biosciences department of the College of Veterinary Medicine at the University of Illinois. He was also an Assistant Professor of Health and Nutrition Sciences at Brooklyn College.

DR. CHRIS MASTERJOHN

His Ph.D. work was in the role of dietary antioxidants, as well as glutathione, an antioxidant that we make from protein, in preventing the accumulation of methylglyoxal, a potentially toxic byproduct of energy metabolism that contributes to diabetes and many of its complications. After doing postdoctoral research on the interaction between fat-soluble vitamins and serving as a university professor for just under three years, his primary focus today is on educating people about the importance of vitamins and minerals.

WHY FOCUS ON VITAMINS AND MINERALS?

The trendy, fad diets of recent years have mostly eschewed the importance of vitamins and minerals in favor of a more restrictive approach. Instead of focusing on diverse, wholesome nutrition as part of a healthier lifestyle that ensures adequate consumption of the vitamins and minerals essential for wholesome health, many fad diets are more centered on specific, tangible, and observable goals such as weight loss.

Dr. Masterjohn´s work, however, focuses explicitly on incorporating sufficient vitamins and minerals for thriving health. "Dietary surveys show that a whopping 93 percent of Americans fail to consume enough of at least one nutrient, and even though we only have comprehensive blood testing data for eight nutrients when there are more than 30 that we need, blood testing shows that 31 percent of us are deficient in at least one of those eight nutrients and 6 percent of us are deficient in more than one," Dr. Masterjohn tell us. "If we had comprehensive blood testing data, these numbers would look worse. So at least a third of us have at least one serious nutrient deficiency, and almost all of us could do a better job getting our nutrients in. To me, that means these nutrients deserve a lot of attention."

THE KETO DIET AND THE RISKS OF VITAMIN AND MINERAL DEFICIENCIES

So how exactly do Keto and other low-carb diets fit into the overwhelming trend of nutrient deficiency affecting the overall population? Dr. Masterjohn does believe that low-carb diets can bring some health benefits. "They are one tool among many that can be used effectively for weight loss," he says. "They also help naturally restrict a lot of sugary junk food, and they can help stabilize blood sugar for some people, which can be especially helpful in

© 2021 Spearhead Certifications

diabetes and various neurological disorders."

However, given the popularity of Keto and other low-carb diets, Dr. Masterjohn worries that strict adherence to these types of diets might lead to particular vitamin and mineral deficiencies. "It depends how you are doing it. Low-carb diets raise your needs for riboflavin and pantothenic acid, but if you're doing it right, you can meet the increased need," he believes. "Low-carb diets actually lower your need for thiamin, yet there are case reports of ketogenic diets causing thiamin deficiency. A low-carb diet that includes organ meats and high volumes of low-carb veggies is going to be more nutritionally secure than one that's just steak and butter."

Unfortunately, many of us probably know of a friend, acquaintance, or family member who was attracted to the keto diet due to the promise that he or she could "eat all the bacon I want." In our meat-centric culinary culture, part of the meteoric rise in popularity of the Keto diet is its insistence on allowing people to eat as much meat and fats as they can.

However, many adherents to low-carb diets do not put enough consideration on the type of meats that they should be consuming or the potential problems that come with eliminating plant-based proteins. "A low-carb paleo diet that restricts legumes is going to run deficient in molybdenum unless it includes liver," Dr. Masterjohn says. "Carnivore diets are a strict variant of low-carb paleo that also have high risks of vitamin C and folate deficiencies, and have to be well designed not to run deficient in manganese, magnesium, vitamin K, potassium," he adds.

"KETO MYTHS" AND A LACK OF SCIENTIFIC EVIDENCE FOR LOW CARB DIETS

Low carb dietary trends have certainly had some success in helping people drop weight quickly. This characteristic is part of the motivation for its growing popularity. However, there is significantly less scientific evidence to prove that Keto is a sustainable weight loss diet, nor that it is any more effective than low-fat diets for long-term, sustainable weight loss goals.

Hall et al.[i], in a study conducted in a metabolic inpatient unit exposed two groups of obese male patients to either an isocaloric low-fat diet or a low-carbohydrate diet. The study or experiment determined that the energy loss (in Kcal per day) induced by the two diets was the same. The low-carb diet could not be shown to induce a greater body fat loss than the low-fat diet.

Dr. Masterjohn similarly believes that the lack of scientific evidence is one of the inadequacies and limitations of low-carb diets. "I would regard them as experimental for everything except epilepsy," he states. "They can certainly be used for weight loss but aren't any kind of uniquely magical ticket to weight loss. They are promising for, and deserve study for, many neurological issues beyond epilepsy, but I think it will be a while before we understand their utility there. There are a lot of questions about their role in cancer, and I do think it can be dangerous to assume they will help in that case. Even in the case of epilepsy, it is not clear how much help comes from ketones and how much comes from having more stable glucose levels. Medically, the only proven use of ketones is for exogenous ketones to suppress fat-burning in fatty acid oxidation disorders. In every other application, it isn't clear how important it is to chase ketones."

Despite this lack of scientific evidence, Dr. Masterjohn does not necessarily discourage people from continuing

© 2021 Spearhead Certifications

to experiment with the health benefits of the keto diet. "I think people into self-experimentation should certainly test their ketones and see how they correlate with health outcomes they are interested in to see if chasing those ketones proves beneficial. For most people, though, getting stuck on their ketone level is probably a distraction. For example, if you're using the diet for weight loss, your metrics should be weight loss and fat loss, not blood ketones or urine ketones," he believes.

THE PROBLEM WITH TOTAL ABSTINENCE FROM FOOD GROUPS

Many dieticians who promote the keto diet call for complete abstinence from grains and legumes. If you need to drop to, say, 30 grams of carbohydrates per day to ensure that you enter and stay in ketosis, these advocates tend to recommend getting those carbs from leafy greens and certain fruits instead of grains or legumes.

However, there is significant evidence in the scientific literature that strict restrictions on fiber intake (from food groups like grains and legumes) may only serve to exacerbate the trends of increased cholesterol, LDL, VLDL, triglycerides, and total apoB. Dr. Masterjohn also controverts this tendency towards total abstinence from whole food groups.

"I look at food groups kind of like asset classes in a financial portfolio. If you're not an expert, you should probably diversify across asset classes to protect yourself from risk. If you really know what you are doing, you might hit the jackpot by putting all your eggs in one basket, but you're also taking on the risk of financial ruin," he compares.

"With food, diversification of food groups protects you from the risk of deficiencies and the risk of accumulation of any one specific type of toxin. If you really know what you're doing, you can restrict whole food groups, but doing so increases risk and requires more micromanaging," he adds.

However, Dr. Masterjohn also believes that contextual differences amongst individuals also need to be taken into account when determining which diet and nutrition-related decisions are taken. "Everyone is different, and some people don't do well with grains and legumes. From a vitamin and mineral perspective, cutting out legumes is riskier than cutting out grains. It puts you at risk of deficiencies of folate and molybdenum. Molybdenum can be made up for with four to eight ounces of liver per week, and lots of green veggies can make up for the folate," he recommends. "So, my position is: by default, diversify across food groups; when you restrict food groups, acknowledge that you are assuming risk and take action to manage that risk."

" So, my position is: by default, diversify across food groups; when you restrict food groups, acknowledge that you are assuming risk and take action to manage that risk. "

HYPOTHETICAL VULNERABILITIES ASSOCIATED WITH LONG TERM AND STRICT ADHERENCE TO THE KETO DIET

The nutrient deficiencies that could arise from eating bacon and cheese every day are certainly one potential risk associated with low-carb diets like Keto. However, Dr. Masterjohn also thinks that there are hypothetical risks that need more study in the future.

© 2021 Spearhead Certifications

One of the prospective health hazards he identifies is related to cortisol levels, which is a steroid hormone made by your adrenal glands that helps your body respond to stress, regulate blood sugar, and fight infections.

"I think keto diets that are too weakly ketogenic to raise blood ketone levels high, yet leave blood glucose rather low, are likely to raise cortisol levels, and if they are chronically elevated, that can pose a risk," he states.

Other potential risks warrant further study as well. "I think long-term decreases inactive thyroid hormone and glutathione levels are a potential risk," he says. "I also think ketogenic diets are partial mimics of the fasting state, and perpetual fasting signals are not good for the body. We really want to cycle between the fasting state, where we have more breaking down of old tissues (for example, autophagy and mitophagy), and the fed state, when we have more regeneration of tissues (for example, mitochondrial biogenesis and myelin regeneration) and more antioxidant support (for example, glutathione synthesis). So I am skeptical that keto diets should be perpetual rather than cyclical. All of this, however, needs much more research."

As a researcher and professional with a Ph.D. in nutritional science, Dr. Masterjohn´s work is helping people to find ways to pursue a well-balanced and nutritionally adequate diet. With this type of diet, he hopes people "use it for a purpose where my confidence the goal will be reached is proportional to the evidence supporting that effect." In this sense, Dr. Masterjohn believes that a nutritionally adequate low-carb diet would include organ meats, especially 4-8 ounces of liver per week, a diversity of shellfish if they are tolerated, and a large volume of diverse low-carb vegetables.

"Matching confidence to evidence would be, for example, using it with relatively high confidence in refractory epilepsy but, when using it for weight loss, being conscious that you'll only lose weight if it helps you successfully sustain a caloric deficit," he states.

Tobias Roberts, BSc. Department of Community Research, El Salvador.

For people interested in learning more about Dr. Masterjohn´s nutritional focus on the importance of vitamin and mineral consumption, you can purchase "The Vitamins and Minerals 101 Cliff Notes" **here**:

This concise introduction to the importance of vitamins and minerals in any diet or nutrition approach can help people discover the signs you need more of a nutrient, or have too much, which foods to use to make sure you get what you need, which forms of supplements are best, and which dose you need to take, and anything else you need to balance the supplements.

REFERENCES

[i] K.D. Hall, K.Y. Chen, J. Guo, Y.Y. Lam, R.L. Leibel, L.E. Mayer, M.L. Reitman, M. Rosenbaum, S.R. Smith, B.T. Walsh, E. Ravussin, Energy expenditure and body composition changes after an isocaloric ketogenic diet in overweight and obese men, Am. J. Clin. Nutr. 104 (2016) 324–333, https://doi.org/10.3945/ajcn.116.133561

© 2021 Spearhead Certifications