

KETOGENIC DIET

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INTRODUCTION





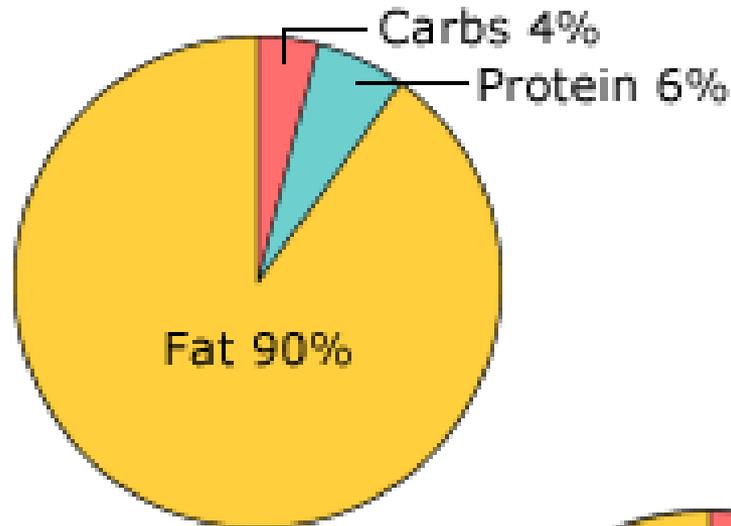
WHAT IS KETOGENIC DIET...????

KETOGENIC DIET

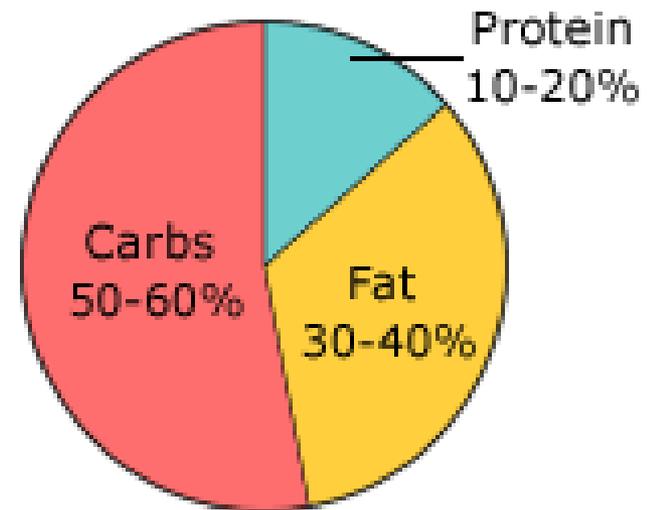
- The ketogenic diet (KD) is a diet that is high in fat, low in carbohydrate, and controlled in protein.
- The word 'ketogenic' means that chemicals, called ketones (b-hydroxybutyrate, acetoacetate, and acetone) are produced by the body by lipolysis .
- (keto = ketone, genic = producing).



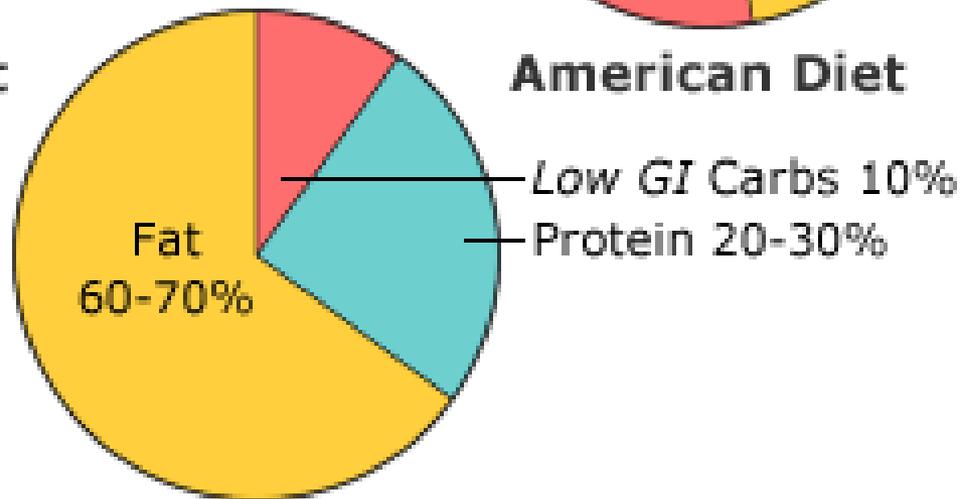
KETOGENIC DIET VS REGULAR DIET



Ketogenic Diet



American Diet

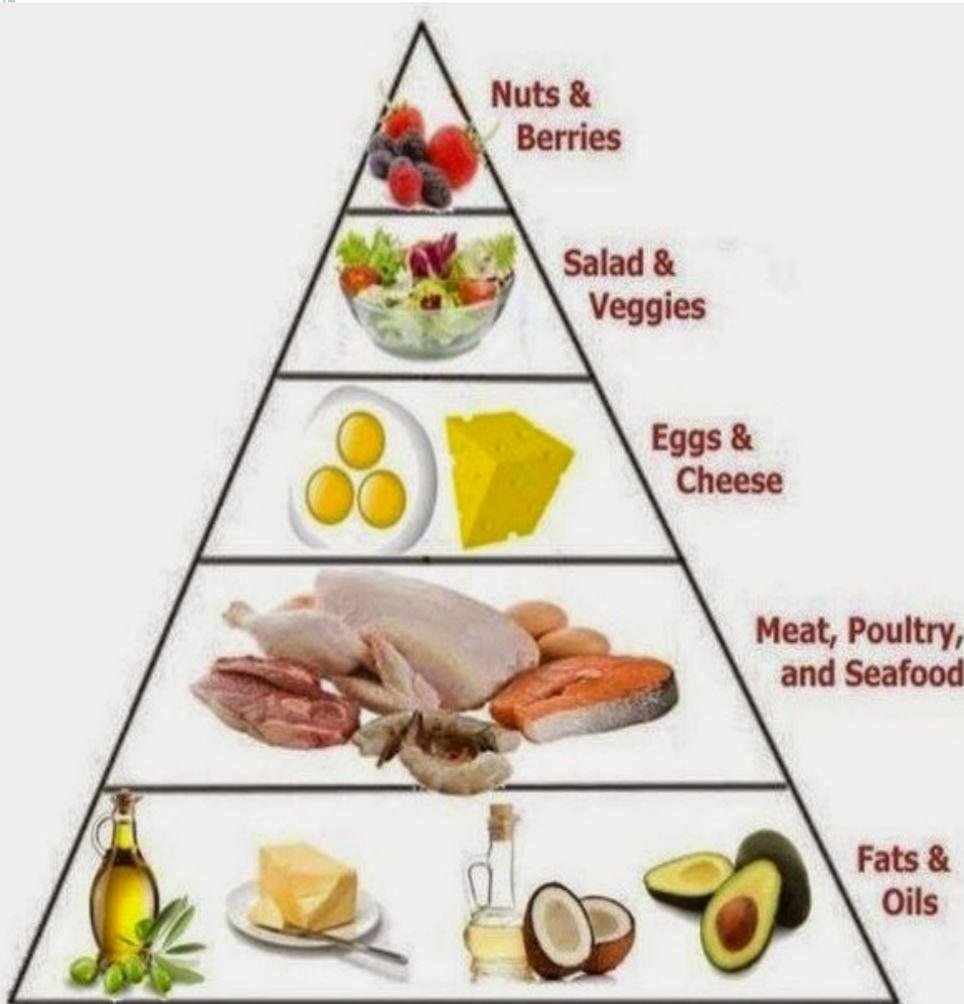


Low Glycemic Index Treatment

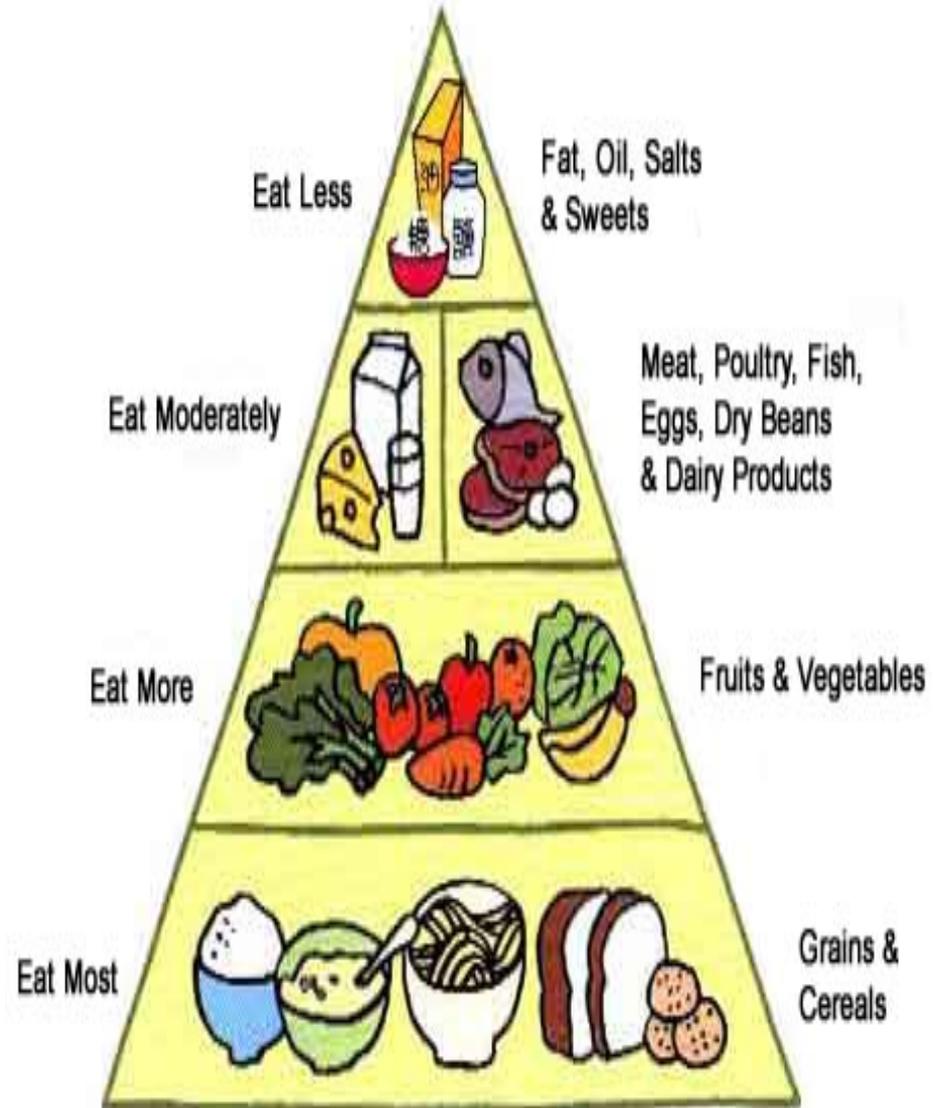
KETOGENIC DIET FOOD PYRAMID

VS

REGULAR DIET FOOD PYRAMID



Use this Food Pyramid as HIGH FAT basis of your LCHF lifestyle



- Ketogenic or very - low carbohydrate diet (VLCKD) have been used since the 1920's as a therapy for epilepsy and can, in some cases, completely remove the need for medication.
- From the 1960s onwards they have become widely known as one of the most common methods for obesity treatment.



- Recent work over the last decade or so has proved evidence of therapeutic potential of ketogenic diets in many pathological conditions, *such as:*
 - Diabetes.
 - Weight reduction
 - Cardiovascular disease -risk factors.
 - Epilepsy.
 - Pyruvate dehydrogenase deficiency.



EMERGING EVIDENCE

- Acne.
- Polycystic ovary syndrome.
- Cancer.
- Neurological Diseases, such as, Alzheimer, Parkinson's.
- Brain trauma.



WHAT IS KETOSIS.....???

- Insulin activates key enzymes in pathways, which stores energy derived from carbohydrates (CHO).
- when there is an absence or scarcity of dietary CHO ... *insulin level decreased....*
lipogenesis and fat accumulation reduced....



- After a few days of fasting, or of drastically reduced CHO consumption (below 50 g/day).....

Glucose reserves become insufficient both for normal fat oxidation via the supply of oxaloacetate in the krebs cycle ' and

for the supply of glucose to the central nervous system (CNS).



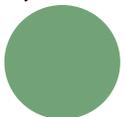
- The CNS cannot use fat as energy source
- After 3 – 4 days without CHO consumption the CNS is ‘forced’ to Derived from Acetyl coenzyme A (CoA).

This seen in

- *Fasting*
- *Type 1 DM*
- *High-fat, Low CHO diets.*

Leads to the production of ketone Bodies (ketogenesis)

(Ketonemia and ketonuria)



KETONE BODIES IN THE BLOOD..

- Normal condition less than 0.3 mmol/l.
- Be used as energy source 4mmol/l and more.
- Dose not go higher 7-8 mmol/l...? In ketogenic diet.
- May reach 20mmol/l in diabetic ketoacidosis.

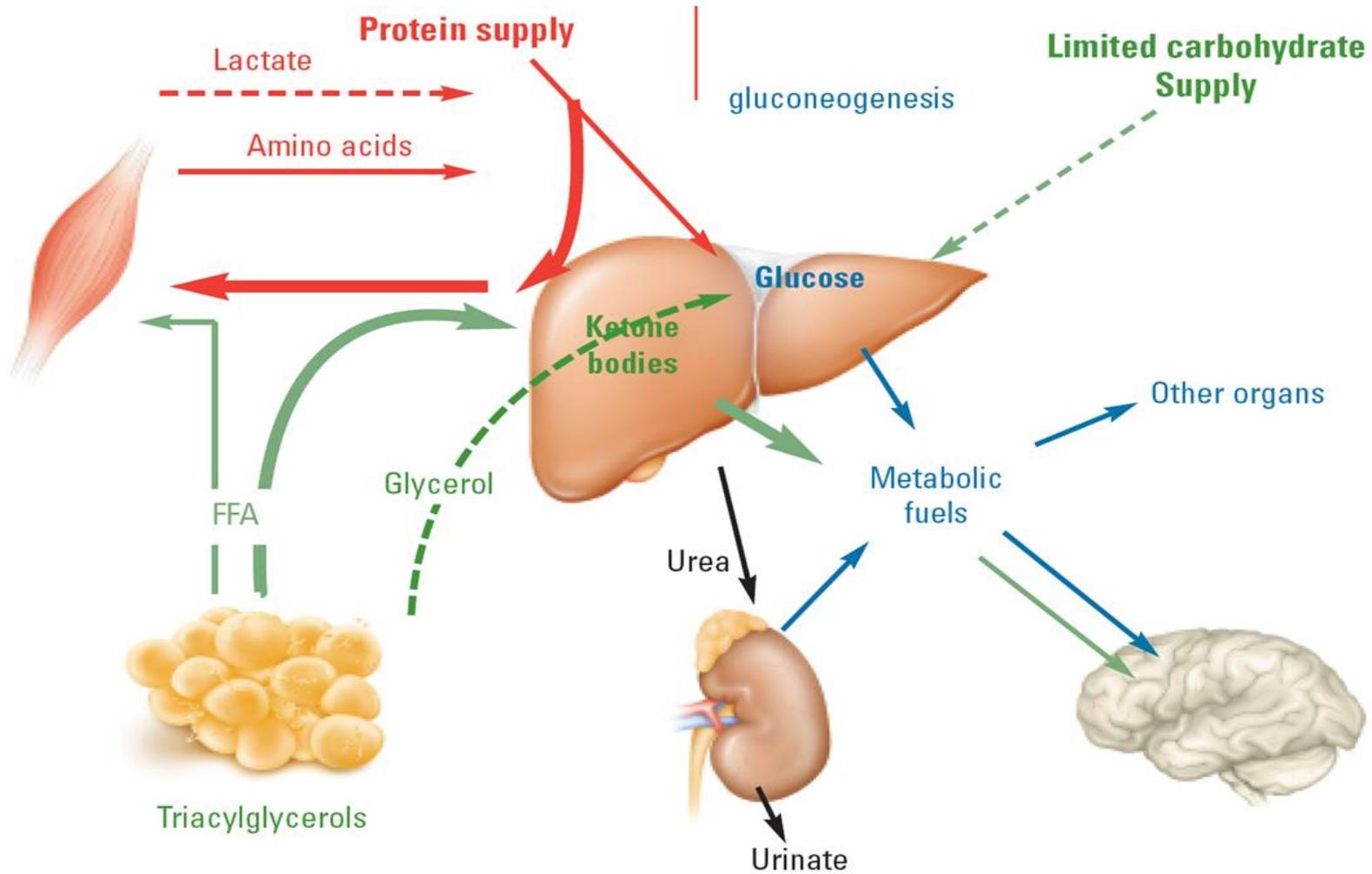
○ *PHYSIOLOGICA....*

VS.

PATHOLOGICAL KETOSIS



PHYSIOLOGY



Physiological mechanism of phases 1-2 of the Eurodiet method

Therapeutic Roles of Ketogenic Diet



Therapeutic uses of ketogenic diets

Adapted from original figure by A Paoli *et al*

Paoli, A., Rubini, A., Volek, J.S., & Grimaldi, K.A. (2013). "Beyond weight loss: a review of the therapeutic uses of very-low-carbohydrate (ketogenic) diets." European Journal of Clinical Nutrition: 1-8.

Strong evidence

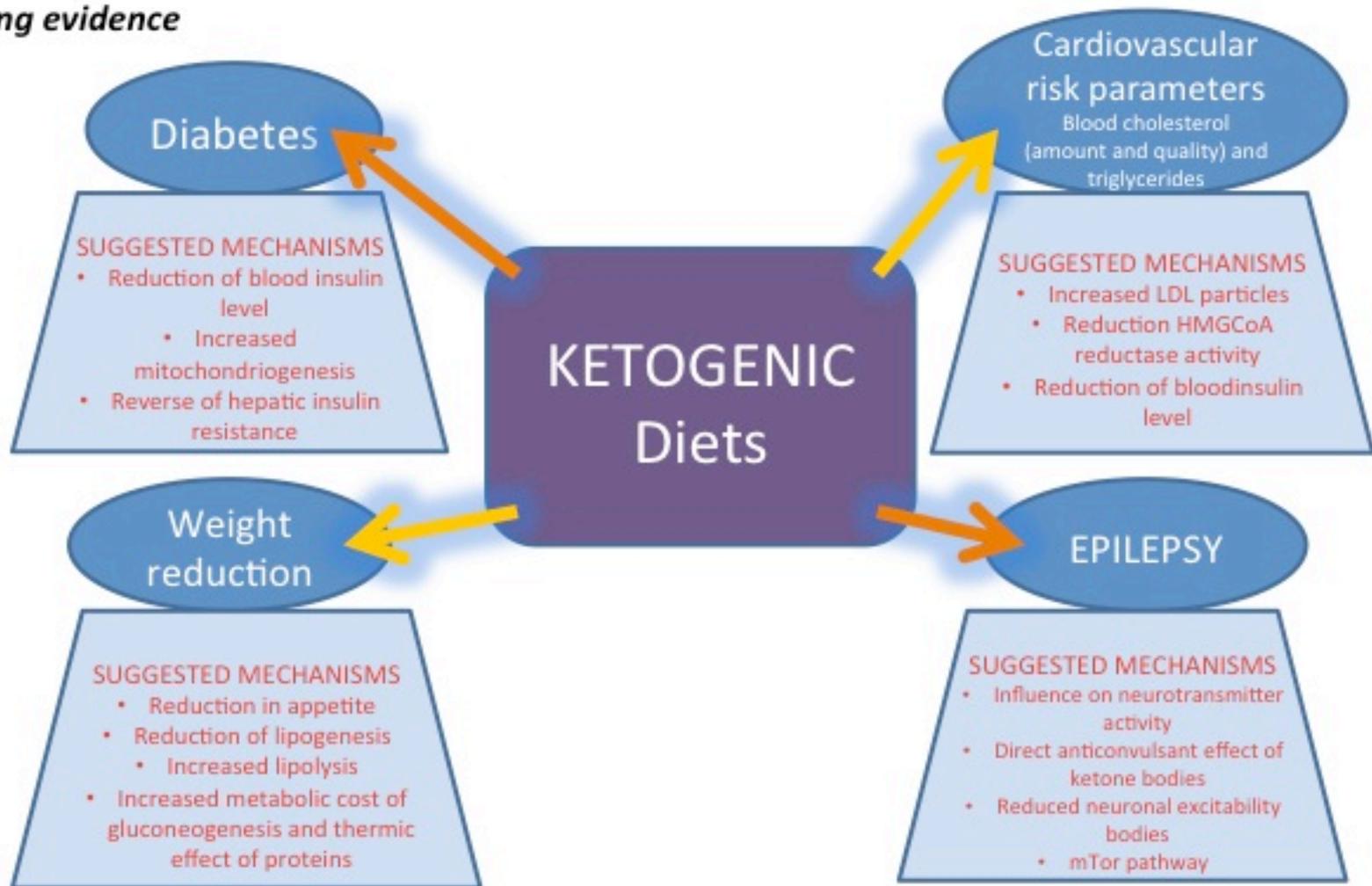


Figure .1. Suggested mechanisms for the therapeutic action of ketogenic diets in pathologies for which there exists strong evidence.

WEIGHT LOSS:

- Its effect seems to be caused by:
 - Reduction in appetite due to higher satiety effect of proteins, effects of appetite control hormones, and appetite-suppressant action of KBs.
 - Reduction in lipogenesis and increased lipolysis.



- Reduction in the resting respiratory quotient and , therefore, great metabolic efficiency in consuming fat.
- Increased in metabolic costs of gluconeogenesis and the thermal effect of protein.



POTENTIAL RISK FOR KD WITH HIGH PROTEIN

- *Is ketogenic diet with high protein considered as a risk factor for kidney damage???*

many researcher proposed that high protein diet do not damage normal functioning kidneys.....but great risk is for those with renal functions impairment.



CARDIOVASCULAR DISEASES

- VLCKD has the following benefits:
 - Decrease Triglycerides.
 - Reduction of total cholesterol.
 - Increase the size and volume of LDL-cholesterol.
 - Increase HDL-cholesterol.



HOW DECREASE CHOLESTEROL SYNTHESIS.....????

- A key Enzyme in cholesterol synthesis.....the target of (statins).

3- hydroxy- 3-methylglutaryl- CoA reductase
(HMG-CoA)

Which is activated by Insulin.....



TYPE 2 DIABETES.....

- In insulin resistance is more CHO converted to fat as opposed to being oxidized for energy in muscles. Most of this fat is saturated fat, therefore, increase the risk for heart disease.



- When CHO is restricted to a level below which it is not significantly converted to fat (a threshold varies from person to person), signs and symptoms of insulin resistance improve or often disappear completely.



- Many studies indicated that....

individuals with :

metabolic syndrome.

insulin resistance.

Type 2 DM.

and



- All diseases with CHO intolerance are likely to see symptoms as well as objective improvements in biomarkers of disease risk (Fasting Blood Sugar, HA1c, and blood lipid profile) if they follow a well formulated low CHO diet.
- Glucose control improves not only because there is less glucose coming in, but also because systemic insulin sensitivity improves as well.



BLOOD LEVELS DURING A NORMAL DIET, KETOGENIC DIET, AND DIABETIC DIET:

Blood level	Normal Diet	Ketogenic Diet	Diabetic Diat
Glucose	80 – 120	65 – 80	More than 300
Insulin	6-23	6.6 – 9.4	Nearly 0
KB	0.1	7 – 8	More than 25
Ph	7.4	7.4	Less than 7.3



EPILEPSY

- The ketogenic diet has its origin in the observation that fasting reduces seizures. This observation is old since Hippocrates used fasting to treat seizures, and the Bible mentions fasting as a treatment for seizures.



EPILEPSY

- Since 1920, the ketogenic diet has been recognized as an effective tool in the treatment of severe childhood epilepsy.
- Following the introduction of anticonvulsant drugs, the interest in ketogenic diet decreased until the 1990s.



HYPOTHESESMECHANISM OF ACTION

- Direct anticonvulsant effect of KBs.
- Reduced neuronal excitability induced by KBs.

But the exact mechanism of action is not clear.....???



- Ketogenic diet shift body towards ketosis , and the theory shows that Ketosis appears to alter certain amino acids in the brain and to increase levels of the neurotransmitter gamma aminobutyric acid (GABA), which helps prevent nerve cells from over-firing.



- The ketogenic diet is now considered an established part of an integrative approach, along with drug therapy, in the major epilepsy centres worldwide.

- *The important benefit is ...*

reduction of drugs used and concomitant reduction in severe side effects associated with antiepileptic agents.



- Other potential benefits of the diet include a increased alertness, and improved behavior even if seizure control is not improved



- However, interest has increased recently because 30-40% of epileptic children have seizures that are resistant to antiepileptic drugs.
- The introduction of several new antiepileptic drugs has not changed the proportion of epileptic children with difficult to control seizures.



A KETOGENIC DIET “RATIO”

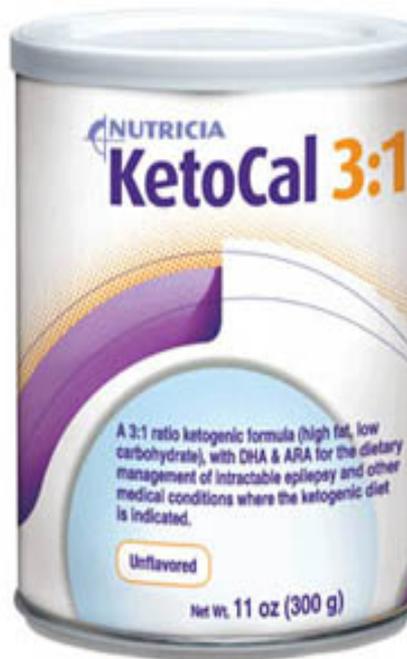
- Is the ratio of fat to carbohydrate and protein grams combined.
- A 4:1 ratio is more strict than a 3:1 ratio, and is typically used for most children.
- A 3:1 ratio is typically used for infants, adolescents, and children who require higher amounts of protein or carbohydrate for some other reason.



KETOGENIC FORMULA

- For infants or enterally fed patients

Powder formula



liquid formula



EXAMPLES OF FOOD HIGH IN FAT FOR PEOPLE ABLE TO EAT ORALLY



WHEN TO BE USED????

- Dietary treatments for epilepsy must only be followed with the support of an experienced epilepsy specialist and dietitian (food specialist).
- It is not a first line of treatment because it is difficult to implement and maintain, and the long-term effects are not well studied.



MONITORING

- Child's growth (height and weight),
- General health.
- Check that the diet is producing ketones by checking the ketones level in blood and urine.



HOURS NEEDED TO PRODUCE KETONES

- According to the Johns Hopkins Medical Institutions the recommendation is fasting for at least 1-2 days, which often is long enough to produce ketosis.



PERIOD OF EFFECTIVENESS

- It usually takes at least three months to see whether the diet is effective.
- Because the seizures take 3-4 months to show an improvements , the diet should be evaluated to be effective or not after at least 3 months



EFFICACY OF DIET ON EPILEPSY

- It can be effective in children with multiple seizure.
- About 1/3 of children have a >90% reduction in seizures with 5% becoming seizure free at 6-12 months.



- Another 1/3 have a 50-90% reduction in seizure frequency at 6-12 months with the remainder having no significant improvement.



SIDE EFFECTS OF DIET

- Constipation is common due to lack of fiber .
- Kidney stones.
- Dehydration
- Slowed growth or weight gain
- Bone fractures



CONTRAINDICATION

- Some antiepileptic drugs can potentially exacerbate some of the adverse effects of the ketogenic diet, and these drugs require careful use when combined with the diet.
- These antiepileptic drugs include acetazolamide, topiramate, and zonisamide, which all can cause acidosis and kidney stones.
- Another antiepileptic drug requiring careful monitoring in children on the diet is (valproate).

DISCONTINUE KETOGENIC DIET

- If seizures have been well controlled for some time, usually 2 years, the doctor might suggest going off the diet.
- Usually, the patient is gradually taken off the diet over several months or even longer. Seizures may worsen if the ketogenic diet is stopped all at once.



- Children usually continue to take seizure medicines after they go off the diet.
- In many situations, the diet has led to significant, but not total, seizure control. Families may choose to remain on the ketogenic diet for many years in these situations.



CONCLUSION

- The role of ketogenic diets is well established in case of :
 - Epilepsy.
 - Energy metabolic error, pyruvate dehydrogenase deficiency (lactic acidosis).
 - Weight loss.
 - Cardiovascular diseases
 - Type 2 DM.



- Researches demonstrated an improvement in many risk factors Weight, blood lipids, inflammation and other biomarkers.



Finally, further studies are warranted to investigate more detail the potential therapeutic mechanisms, its effectiveness, and safety.



The hidden face of the ketogenic diet :

.....Its Broader Therapeutic Action...



TAKE HOME MESSAGE

The possibility that modifying food intake can be useful for reducing or eliminating pharmaceutical methods of treatment, which are often lifelong with significant side effects, calls for serious investigation is needed.



REFERENCES

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