Ketogenic Diet Therapy

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Evolution of the KD

460 BC
Hippocrates:
Fasting used to cure an epileptic

1920
Starvation with reduced seizures noted. KD developed at Mayo clinic

1990s
Charlie Foundation Dateline Story “First Do No Harm”

1000 AD
Biblical reference; Jesus heals a possessed child by fasting and prayer

1960s
Post WWII emergence of antiepileptic drugs
Biological Fuels on Ketogenic Diet

Protein

Fat

Carbohydrate
Biological Fuels

Fat:
- Tryglycerides
  - fatty acids
  - ketones

Protein
- amino acids and glucose

Carbohydrate
- glucose
Ketone Production

Liver During Fasting Conditions (Ketosis)

FASTING STATE

- Fat cell
  - Fatty acid
  - Decreased insulin
  - Glucagon
  - Pancreas

- Liver
  - Converted to ketones
  - Ketogenesis
  - Increased ketones in bloodstream

- Blood vessel
  - Increased ketone production
Serum Glucose and BHB

**Glucose Blood**

- **Graph Title**: Glucose Blood (mg/dL)
- **Y-Axis**: Glucose Blood (mg/dL)
- **X-Axis**: Months Jan 2005 to Oct 2006

**Ketogenic Diet Beta Hydroxybutyrate**

- **Graph Title**: Ketogenic Diet Beta Hydroxybutyrate (mmol/L)
- **Y-Axis**: Ketogenic Diet Beta Hydroxybutyrate (mmol/L)
- **X-Axis**: Months Jan 2005 to Oct 2006
Biological Fuels

FAT = Ketogenic

Carbohydrate Protein = Anti-ketogenic
Ketogenic Ratio 4:1

\[\text{Fat} \times 9\text{kcal} = 36\]
\[\text{Carb + Protein} \times 4\text{kcal} = 4\]

\[= 40\text{kcal} / \text{dietary unit}\]

\[1000\text{kcal} \div 40\text{kcal} / \text{dietary unit} = 25 \text{ dietary units}\]

\[25 \times 4 = 100\text{gm Fat}\]
## Comparison of 1000 kcal

<table>
<thead>
<tr>
<th>Diet</th>
<th>Ratio gm</th>
<th>Fat gm</th>
<th>Pro gm</th>
<th>Carb g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketogenic</td>
<td>4:1</td>
<td>100</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>3:1</td>
<td>97</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2:1</td>
<td>91</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>1:1</td>
<td>77</td>
<td>38-58</td>
<td>20-40</td>
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<tr>
<td>Mod Atkins</td>
<td>1:1</td>
<td>72</td>
<td>52-62</td>
<td>10-20</td>
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<tr>
<td>LGIT</td>
<td>1:1</td>
<td>70</td>
<td>40-60</td>
<td>40-60</td>
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<tr>
<td>MCT Diet</td>
<td>1:1</td>
<td>78</td>
<td>25</td>
<td>50</td>
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<tr>
<td>Regular diet</td>
<td>0.2:1</td>
<td>33</td>
<td>35</td>
<td>140</td>
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</tbody>
</table>
Ratio Affects Ketone Production

4:1 \quad 3:1 \quad 2:1 \quad 1:1

Strong ketones \quad \quad \quad \quad \quad \quad \quad weak ketones
Ketogenic Meals
Liquid Meals

Blender shakes:

- Cream or coconut milk
- Medium Chain Triglycerides
- Berries or cocoa
- Flaxseed (fiber and omega-3 fat)
- Chia seeds (protein and omega-3 fat)
- Hemp seeds (protein and omega-3 fat)
Carbohydrate Additives

- Corn syrup solids
- Cornstarch
- Dextrin
- Dextrose
- Disaccharide
- Fructose
- Glucose
- Glycerin
- High-fructose corn syrup
- Invert syrup
- Lactose
- Levulose
- Maltodextrin
- Maltose
- Mannitol
- Molasses
- Monosaccharide
- Polydextrose
- Polyethelyne glycol
- Polysaccaride
- Sorbitol
- Sorghum
- Starch
- Sucrose
- Sugarcane
- Syrup
- Xyloitol
- Xylose
Contraindications to the Keto Diet

Beta-oxidation defects
Carnitine deficiency
Porphyria
Pyruvate carboxylase deficiency
Adverse Effects

Constipation 
Acidosis 
Elevated lipids

All of these are can be prevented or minimized
Long term adverse effects – not significant
Disorders that May Benefit from KD

ALS
Alzheimer’s disease
Autism
Bipolar disorder
Certain cancers

Diabetes
Migraine
Narcolepsy
Parkinson’s disease
Stroke
Traumatic brain injury
Charlie at 5 years eating the ketogenic diet

Charlie at 15 years with dad, Jim Abrahams