

Basic Concept Research

- Supervisor said to look at basic as possible
 - Baseline of a topic, and read up on that
- Research the basic foundations of Keto, fasting

Endogenous

Calories

- The Calorie (kilocalorie) is the unit used in nutrition or body and is the amount of heat needed to raise 1kg of water by 1C and is about 4.18 joules of energy
- Calorie and calorie is different
 - There are 1000 calories in 1 Calorie also known as the kilocalorie which is what we use to describe energy intake in our daily lives
- Unit used to measure how much energy can be provided by foods and macronutrients
- Cannot be used to estimate or rather does not directly correlate to weight gain or loss as the excess energy does not (necessarily) get converted into fats and lipid, but instead are removed or get converted into something else idk
- 1 gram of carbs provide 4 calories
- 1 gram of fat provides 9 calories
- 1 gram of carbs provides 4 calories
- Proves as an ineffective method of measuring what you eat and what you intake
 - Different types and categories of macronutrients (calories) serve different purposes and work in different ways
 - Calories is a good measurement and only a measurement of the amount of energy intake, it is not equivalent to mass
 - Misconception by a lot of people who try to calorie restriction
 - It makes sense to burn more energy than ingested to eat away at stores
 - However, you burn carbs, and not fat
 - If you eat fat, and not carbs, you don't have to limit and can burn fats instead
 - Calories are also difficult to measure as it is accounted for at a cellular level, and we are just unable to measure that precisely
 - Our bodies, also interact with macronutrients in different ways and there can be miscalculations there as well
- Calorie restriction
 - Body burns calories on regular basis regardless of exercise

- Intaking less calories, and less food than body needs will change body's metabolic rate
- It does not do anything to actually lose weight, it just changes the pace at which the body consumes energy
- Results in no change as no extra fat or energy is actually being used up
- Unhealthy to change metabolic rate of body (ruin way body burns calories)

While most other low carb diets have a mix of protein and fats, ketogenic diets focus more purely on fats instead of proteins

Source	Relevant Quotes
<p>Macronutrients and Micronutrients in Nutrition</p> <p>Esen Taşğın</p>	<p>Contents</p> <p>1. Introduction 10</p> <p>1.1. Macronutrients 11</p> <p>1.1.1. Carbohydrates 11</p> <p>1.1.2. Proteins 13</p> <p>1.1.3. Fats 13</p> <p>1.2. Micronutrients 14</p> <p>1.2.1. Vitamins 14</p> <p>1.2.2. Minerals 14</p> <p>1.3. Water 14</p> <p>2. Conclusion 15</p> <p>References 15</p> <ul style="list-style-type: none"> - Nutrients are required by body to maintain and improve quality of life - Nutrition is ability to take essential nutrients at adequate rates and use them in the body in order to fulfil basic function such as energy generation, growth, reproduction, development, and maintain a healthy life - Nutrients: Chemical components of foods - When any items are under or over taken than necessary, it results in malnutrition occurs <ul style="list-style-type: none"> - Growth and development are prevented - Health deteriorates - Food consumed is absorbed by intestine and digestive system, then transported to tissues or organ - All foods eaten contain mixture of macro and micro nutrients - Different foods are composed of different nutrients and so it is important to have a variety of foods in order to meet the body's requirements for nutrients - Fresh foods contain more micronutrients than processed foods - Processed (high-calorie) foods are high in macronutrients

Macronutrients

- Nutrients required in large quantities
- Energy comes from the breaking of chemical bonds which is converted into cellular energy
- Carbs provide daily energy source
- Fats is the energy store which are used, but mostly in a case of starvation
 - Carbs burn before fats, however, you do not need to go carbs free to burn fats
- Proteins contribute little to energy metabolism, but are used as energy sources in long-term fasting conditions
- Carbohydrates
 - Broken down into glucose
 - Used as energy source
 - Main source of energy in average diet (carbs make up 55-60% of an average adult's daily energy needs)
 - General formula $C_n(H_2O)_n$
 - Includes
 - Grains (wheat, rice, corn)
 - Legumes (beans, peas)
 - Roots and tubers (potatoes, beets)
 - Vegetables & fruits
 - Most abundant organic compound in biosphere
 - Monosaccharides
 - Carbs are made from monosaccharides through covalent bonds called glycosidic links
 - Glycosidic link are bonds between two monosaccharides in a C-O-C pattern
 - Most common monosaccharides found in food
 - Glucose
 - Fructose
 - Galactose
 - In essence monosaccharides are the building blocks of carbs (polysaccharides)
 - Sugars that cannot be divided any further to produce a simpler sugar

	<ul style="list-style-type: none"> - Glucose and galactose raise blood sugar level quickly post-consumption due to high glycemic index - Fructose raises blood sugar mildly and slowly due to lower glycemic index <ul style="list-style-type: none"> - Glucose <ul style="list-style-type: none"> - Most abundant in composition of di and polysaccharides - Hydrolysis results in glucose - Forms starch, glycogen, cellulose - Use by cells as energy source and intermediate in metabolic reactions - Also known as blood sugar - Preferred energy source by all living organisms - Brain is dependant on glucose as energy source <ul style="list-style-type: none"> - If you take a chunk out of your brain, it should taste like candy - All monosaccharides are converted into glucose in liver and stored as glycogen which is used for energy metabolism - Fructose <ul style="list-style-type: none"> - Also known as fruit sugar due to it being found in various fruits - Sweetest monosaccharide - Galactose <ul style="list-style-type: none"> - Energy source - Disaccharides <ul style="list-style-type: none"> - Easily soluble in water - Need to be broken down into mono in order to be absorbed by body through intestine - Broken down by respective enzymes into their constituent monosaccharides - Maltose (glucose + glucose) (malt sugar) - Lactose (glucose + galactose) <ul style="list-style-type: none"> - Milk products - Sucrose (glucose + fructose) <ul style="list-style-type: none"> - Obtained from - Polysaccharides <ul style="list-style-type: none"> - Not very soluble in water
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	<ul style="list-style-type: none"> - Formed as polymer chains or branches from monosaccharide monomers - 3 main for human nutrition <ul style="list-style-type: none"> - Starch (glucose) - Glycogen (glucose) <ul style="list-style-type: none"> - Unavailable part - Stored in liver - Lasts for 12 hour energy requirement - Cellulose (glucose) - Inulin (fructose) found in plants - Digestible polysaccharides <ul style="list-style-type: none"> - Broken down in mouth and small intestine (saliva contains enzymes) - Yield glucose - Starch is most important of digestible polysaccharides - Non-digestible polysaccharides <ul style="list-style-type: none"> - Also known as dietary fibre - Cannot be digested in small intestine as there is no digestive enzyme for cellulose - Fermented in large intestine - Prevents against bowel cancer and cardiovascular diseases, regulates blood sugar level and cholesterol - Inulin promotes growth of beneficial intestinal bacteria
	<ul style="list-style-type: none"> - Fats <ul style="list-style-type: none"> - Broken down into fatty acids - Used as energy source - Cannot dissolve in water as it is non-polar, can dissolve in other non-polar solvents such as benzene - Ingested fat is stored in fat tissues (adipose tissue) - Serve as the structural component of cells and as deposition for metabolic fuel

	<ul style="list-style-type: none"> - Unsaturated fatty acids <ul style="list-style-type: none"> - Contains one or more double bond between carbons - Higher number of double bonds, lower melting points, are mostly liquids at room temperature - More common in vegetable oils - Saturated fatty acids <ul style="list-style-type: none"> - Do not contain double bonds between carbons - Lower number of double bonds, higher melting point, are mostly solid at room temperature - More common in animal fats - Essential fatty acids cannot be synthesised by the body and need to be taken from outside diet <ul style="list-style-type: none"> - Polyunsaturated fatty acids containing 2 or more double bonds - Omega oils - Most important is linoleic acid (omega-6) <ul style="list-style-type: none"> - Proteins <ul style="list-style-type: none"> - Proteins are composed of amino acids - Essential for cells and tissue to be constructed (can be used as energy during very long hunger) - Only macronutrient which contains nitrogen - Proteins make up 16% of adult human body - They are separated into amino acids in the digestive tract, get transported to liver by blood and recombine in specific order to make body proteins - Body cannot store large quantities of amino acids <ul style="list-style-type: none"> - Excess protein is broken up and removed from body - Happens in liver - Amino moiety is converted into urea, transported to kidney and then removed from body - Remaining carbon portion of amino acid
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	<p>can be stored by converting it into carbs or oil depending on identity of R group</p> <ul style="list-style-type: none"> - Structure of protein contains 20 standard amino acids and some amino acid derivatives - Essential amino acids: amino acids which the body cannot produce (synthesize) by itself but is vital for survival and therefore needs to be taken in a diet - Histidine and arginine are vital for children and those in their growing ages - Structural proteins <ul style="list-style-type: none"> - Structural elements of tissues (muscle, skin, bone etc.) - Enzymes <ul style="list-style-type: none"> - Some proteins can act as enzymes which are catalysts for digestion and allow carbs to turn into energy - Water <ul style="list-style-type: none"> - Universal solvent <ul style="list-style-type: none"> - As it is very good solvent for polar substances - Required to break down substance and to help them move and interact freely - Body can produce water, but it is needed at a higher rate than that the body can produce - All biochemical reactions occur in water - Helps fill gaps between cells and helps create structures of large molecules (proteins, glycogen) - Digestion, absorption, transportation, dissolution, removal of waste, thermoregulation <p>Micronutrients</p> <ul style="list-style-type: none"> - Vitamins <ul style="list-style-type: none"> - Organic substances necessary for body to fulfil many functions - Only small amount required daily - Cannot be produced by body so must take from outside - Do not enter tissue structure, and do not produce energy - Necessary to bind to enzymes and coenzymes to realise all metabolic reactions - Other than vitamins A (immune system, eyes,
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	<p>ageing, antioxidant) and K (necessary for production of prothrombin; protein made by liver, clotting factor (scab))</p> <ul style="list-style-type: none"> - Rest of vitamins act as coenzymes and cofactors which directly and indirectly act as catalysts for the the enzymes - Water soluble vitamins (polar): B, C - Fat soluble vitamins (non-polar): A, D, E, K <p>- Minerals</p> <ul style="list-style-type: none"> - Most elements found in nature, are also found in the human body - Cells are made up of 99% C, O, N, H <ul style="list-style-type: none"> - Serve as basic building block of organic material - Forms proteins, carbs, fats, and nucleic acids - P and S also in smaller quantities - Na, K, Cl, Ca, Mg as ions in larger quantities in comparison - Cu, Fe, Co, I, Se, Mn, Zn, F (trace elements) in trace amounts in blood - Ca, P, Mg are found in bone structure - Fe, Co for blood production - Zn for immune system - Some elements bond to enzymes, hormones, or vitamins - Electrolytes: Ions found in intracellular or extracellular fluids in living organisms <ul style="list-style-type: none"> - Na^+, K^+, Ca^{2+}, Mg^{2+} - Cl^-, HCO_3^-, HPO_4^{2-} - Minerals highly effective in metabolic events <ul style="list-style-type: none"> - Bind to enzymes as cofactors - Regulate acid-base balance of body - Osmotic pressure settings - Help regulate heart and muscle functions - Help regulate oxidation/reduction events
<p>Should you try the keto diet?</p> <p>(Harvard Medical School,</p>	<ul style="list-style-type: none"> - Low-carb, high-fat diets are referred to as ketogenic diets

<p>2020)</p> <p>(Kathy McManus, director of the Department of Nutrition at Harvard-affiliated Brigham and Women's Hospital.)</p>	<ul style="list-style-type: none"> - Paleo, south beach, atkins diets all fall under keto <ul style="list-style-type: none"> - Diets focus on protein instead of carbs - True keto uses fats instead - Unknown whether it works long-term or whether it is safe (Kathy McManus 2020) <p>The keto diet</p> <ul style="list-style-type: none"> - Body must enter state of ketosis (ketogenesis) in order to consistently produce ketones from fat - Eating too much protein can interfere with ketosis - Unsaturated fats are allowed <ul style="list-style-type: none"> - Nuts, avocados, tofu - Saturated fats are encouraged in high amounts <ul style="list-style-type: none"> - Palm oil, coconut oil, lard, butter <p>Keto Risks (Kathy McManus 2020)</p> <ul style="list-style-type: none"> - Keep saturated fats to no more than 7% of diet due to heart disease links - Due to removal of vegetables, fruits, and grains, there is deficiency of micronutrients (minerals, metals, and vitamins) - Worsen liver conditions due to increased fat needed to be metabolised - Overload kidneys due to increased protein needed to be processed <ul style="list-style-type: none"> - Recommended protein intake is 46g for women and 56g for men - Constipation due to lowered fibrous foods - Confusion and irritability from reduced sugar intake by brain
<p>Ketogenic Diet: Is the ultimate low-carb diet good for you?</p> <p>Marcelo Campos</p>	<ul style="list-style-type: none"> - Keto has been in use for almost 100 years for treating drug-resistant epilepsy (especially in children) - Diet includes meats, eggs, processed meats, sausages, cheeses, fish, nuts, butter, oils, seeds, and fibrous vegetables - Very restrictive so hard to follow over long run <ul style="list-style-type: none"> - Carbs account for at least than 50% of average american diet <p>How does keto work</p> <ul style="list-style-type: none"> - Most cells prefer blood sugar (glucose) as energy source

	<p>which come from carbs</p> <ul style="list-style-type: none"> - In absence of carbs, body starts break down stored fat into molecules called ketone bodies - Once ketosis is reached, cells will use ketone bodies at energy source until carbs are re-introduced - Happens 2-4 days of eating less than 20-50g of carbs - Individualised and some people need more time or a more restricted diet to produce ketones - Could cause fatigue, nausea, vomiting, insomnia, constipation in beginning <p>Keto Benefits</p> <ul style="list-style-type: none"> - Solid proof in treatment of epilepsy in children (reduces seizures) - Due to neuroprotective effects, could also be beneficial to other brain disorders (however, no human studies support keto treatment to these) <ul style="list-style-type: none"> - Parkinson's - Alzheimer's - Multiple sclerosis - Sleep disorders - Autism - Brain cancers
Life in the fasting lane. Jason Fung MD.	
The Diabetes Code Jason Fung MD.	
Fasting: More powerful than any drug on earth (documentary)	
The science of Fasting (Documentary)	
The sugar Film (documentary)	
The fasting method (online resources)	
Low Carb Down Under	<ul style="list-style-type: none"> - Dr. Paul Mason

<p>(Website and Videos)</p> <p>https://lowcarbdownunder.com.au/videos/</p>	<ul style="list-style-type: none"> - Dr. Sarah Halberg - Prof. Robert Lustig - Dr. Ken Berry - Keto in alzheimers
<p>Drugs for Life : How Pharmaceutical Companies Define Our Health Joseph Dumit (book)</p> <p>(https://ebookcentral.proquest.com/lib/ryerson/detail.action?docID=1172262)</p>	
<p>Maintenance Phase</p>	<p>The Keto Diet - https://open.spotify.com/episode/3bSxmddWqtdJWnNce71w7Z?si=2f90dedeb75f4697</p> <p>Sources from Episode</p> <ul style="list-style-type: none"> • https://www.nytimes.com/2020/01/02/style/self-care/keto-diet-explained-benefits.html • https://www.todaysdietitian.com/newarchives/0119p26.shtml • https://www.menshealth.com/nutrition/a25775330/keto-diet-history/ • https://www.health.com/weight-loss/keto-diet-side-effects • https://www.prevention.com/weight-loss/diets/g21764082/keto-diet-side-effects/ • https://www.eurekalert.org/news-releases/514912
<p>The ketogenic Diet for Epilepsy / Seizures</p> <p>https://my.clevelandclinic.org/health/treatments/7156-ketogenic-diet-keto-diet-for-epilepsy</p>	
<p>Not all keto diet talking points backed by science; Benefits shown for childhood epilepsy, Type 2 diabetes, but not for Alzheimer's</p>	<ul style="list-style-type: none"> • “The scenario is a lot more optimistic for Type 2 diabetes, where keto diets can result in greatly improved glucose control and better insulin sensitivity, in some cases even eliminating the need for medication. • At least one study has shown better glucose control in

https://drive.google.com/file/d/1SSJMWbxRRjEG693f5Yg73YwgQdVwHKOv/view?usp=sharing	Type 1 diabetes, along with fewer adverse events.
<p>Limited Evidence for the Health Effects and Safety of Intermittent Fasting Among Patients With Type 2 Diabetes</p> <ul style="list-style-type: none"> - Jama Horne 	
<p>Efficacy of Ketogenic Diets on Type 2 Diabetes: a Systematic Review</p> <ul style="list-style-type: none"> - Delphine Tinguely - Justine Gross - Christophe Kosinski 	
<p>Jason Fung Youtube Channel</p> <p>https://www.youtube.com/channel/UCoyL4iGArWn5Hu0V_sAhK2w</p>	<p><u>Why food Order Matters (2022) Jason Fung</u></p> <ul style="list-style-type: none"> - Total carbs: The total amount of carbs ingested - Net carbs: Total carbs - fibre as body does not process fibres <p>Beginner's Guide to Intermittent Fasting Jason Fung</p> <ul style="list-style-type: none"> - Fasting: The voluntary abstinence of for spiritual, health, or religious reasons - Fasting is not equivalent to starvation - People who shouldn't fast: Fasting reduces nutrients by a lot <ul style="list-style-type: none"> - Pregnant - Children - Breast-feeding - Underweight - Malnourished - Medication that needs to be taken with food - Medication that affects blood sugar - History of eating disorders - Can start and stop fasting whenever - Normal fast: dinner-breakfast 12-14 hours fast - Time restricted eating (16/8) 16hrs fast, 8hrs eating

	<ul style="list-style-type: none"> - 24 hour fasting: 1 meal a day - World record for fasting: 382 days - Why fast <ul style="list-style-type: none"> - Lose weight - Reverse type 2 diabetes <ul style="list-style-type: none"> - Blood sugars fall (no carbs) - Resultant <ul style="list-style-type: none"> - Heart disease - Stroke - Cancer <p>Top Intermittent Fasting Advantages Jason Fung</p> <ul style="list-style-type: none"> - Works with any diets, additive to diets <ul style="list-style-type: none"> - Diets tell you what to eat - Fasting tells you when and how to eat - Makes existing diets more powerful (especially for weight loss) - Infinitely scalable (can do more fasting, but can't do more dieting) - Easy to follow and cheap
<p>PLOS Medicine - Estimating impact of food choices on life expectancy : A modeling study</p> <p>Lars T. Fadnes, Jan-Magnus Økland, Øystein A. Haaland, Kiell Arne Johansson</p>	<ul style="list-style-type: none"> - Impact on risk of premature deaths for various food groups - Measurement of the impact of diet changes on life expectancy - Main food groups noted in paper <ul style="list-style-type: none"> - Fruits - vegetables - Whole grains - refined grains - Nuts - legumes - Fish - Eggs - Dairy - Red meat - Processed meat - Sugar-sweetened beverages

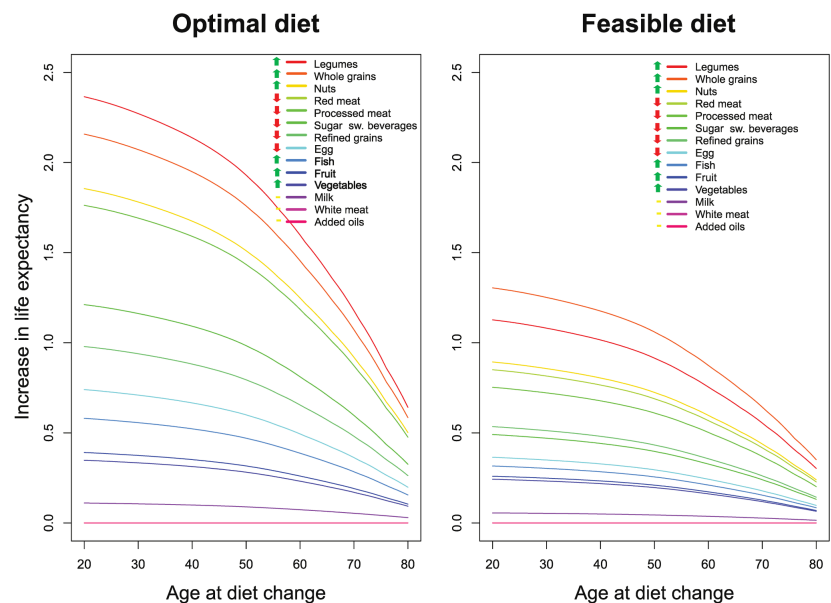
Region	Age	Typical Western		Feasibility approach				Optimized			
		Male		Female		Male		Female		Male	
		LE	LE	LE	Gain	LE	Gain	LE	Gain	LE	Gain
United States	20	57.8	62.5	65.1	7.3	68.7	6.2	70.8	13.0	73.3	10.7
	40	39.4	43.3	46.0	6.5	49.0	5.7	51.1	11.7	53.3	10.0
	60	22.4	25.3	27.2	4.8	29.9	4.5	31.2	8.8	33.3	8.0
	80	9.0	10.3	10.9	1.9	12.3	2.0	12.4	3.4	13.7	3.4
China	20	56.7	61.8	63.7	7.0	67.7	5.9	69.6	12.9	72.4	10.6
	40	37.6	42.2	44.1	6.4	47.8	5.6	49.7	12.0	52.4	10.2
	60	20.1	23.5	25.0	4.9	28.2	4.7	29.4	9.3	32.1	8.6
	80	7.4	8.6	9.1	1.7	10.5	1.9	10.5	3.1	12.0	3.4
Europe	20	56.3	62.9	63.8	7.6	68.8	5.9	69.9	13.7	73.3	10.4
	40	37.7	43.4	44.5	6.8	49.0	5.5	50.0	12.3	53.2	9.8
	60	21.0	25.1	25.9	4.9	29.6	4.5	30.0	9.1	33.2	8.1
	80	8.4	9.8	10.3	1.8	11.7	2.0	11.7	3.3	13.2	3.5

*For the optimal diet and feasibility approach diet, the following intakes were used: 225 g and 137.5 g whole grains (fresh weight), 400 g and 325 g vegetables, 400 g and/ 300 g fruits, 25 g and 12.5 g nuts, 200 g and/ 100 g legumes, 200 g and 100 g fish, 25 g and 37.5 g eggs, 200 g and 250 g milk/dairy, 50 g and 100 g refined grains, 0 g and 50 g red meat, 0 g and 25 g processed meat, 50 g and 62.5 g white meat, 0 g and 250 g sugar-sweetened beverages, and 25 g and 25 g added plant oils.

LE, life expectancy.

<https://doi.org/10.1371/journal.pmed.1003889.t001>

Graph shows sustained usage of certain diet’s impact on life expectancy start from different ages in different regions



Graph shows the increase in life expectancy when partaking in sustained diet change to use of certain foods in an optimal and feasible diet environment

Difference between optimal and feasible diets

Abstract Conclusions:

- “Gains are predicted to be larger the earlier the dietary changes are initiated in life”
- “An optimal diet had substantially higher intake than a typical diet of whole grains, legumes, fish, fruits, vegetables, and included a handful of nuts, while reducing red and processed meats, sugar-sweetened beverages, and refined grains.”

	<p>Discussion</p> <ul style="list-style-type: none"> • “Eating more legumes, whole grains, and nuts, and eating less red meat and processed meats were estimated to be the most effective ways to increase LE [life expectancy] for individuals with a typical diet.
epilepsy.com/treatment/dietary-therapies/ketogenic-diet	
<p>Effect of whey on blood glucose and insulin responses to composite breakfast and lunch meals in type 2 diabetic subjects</p> <p>https://pubmed.ncbi.nlm.nih.gov/16002802/</p>	
<p>The ketogenic diet: 1997</p> <p>Swink TD, Vining EP, Freeman JM (Department of neurology, Johns Hopkins)</p>	<ul style="list-style-type: none"> - For children with difficult to control epilepsy, diet presents alternative method to trying multiple medications - Keto success rate (when properly executed), greatly exceeds that of recent medication (1997) - Side effects (cognitive, allergic) appear less than medication - Cheaper - Do not know how it works, or how medication works - Changes brain fuel from glucose-based energy substrate to ketone-based substrate - Appears to occur without changing brain's normal capabilities - However, changings and limits how the brain handles seizures - If you could figure out how ketone based brain energy would be different from glucose based brain energy, you could theoretically create medication that could cure epilepsy without limiting food choice
<p>Ketogenic Diet</p> <p>Wajeed Masood, Pavan Annamaraju, Kaylan R. Uppaluri</p>	<ul style="list-style-type: none"> - Obesity is a world side health hazard (2.8 million adult mortality cases per year) - Hypertension, diabetes, heart disease related to obesity and product of poor lifestyle and eating habits - Keto has proven effective for rapid weight loss

- Long term compliance is a problem
 - Usually lasts between 2-3 weeks to 6-12 months
 - Monitoring of renal functions is imperative
 - Transition to keto should be gradual and well-controlled
- Generally 10lbs weight loss in 2 weeks or less
- Early weight loss is due to water and some fat
- Lean body muscle is largely spared
- Sustenance in keto result in less hunger pangs and overall less caloric intake
- Macronutrient division
 - 55-60% fats
 - 30-35% proteins
 - 5-10% carbs
- For recommended 200kcal diet, about 20 to 50g of carbs per day
- No limit for calories and fats
- Limit for carbs and proteins
- Random facts brodie
 - In average american diet 55% is carbs (200-350g a day)
 - Greater intake of sugar-laden food associated with 44% increased prevalence in metabolic syndrome and obesity and 26% risk in diabetes
 - Recent systematic review and meta-analysis of randomised controlled trials comparing long-term (more than 1 year) of dietary intervention on weight loss
 - Low-carb diets resulted in much greater weight loss than low-fat diets
 - Low-carb diet shows better retainment of BMR than low-fat diet
 - Quality of calories can affect number of calories burned
 - BMR dropped more than 400kcl/day on low fat diet in comparison to low carb diet

History/Origin

- Russel Wilder first used in 1921 to treat epilepsy and coined the term ketogenic diet

- Used for almost a decade as therapeutic diet for paediatric epilepsy
- Widely used until introduction of antiepileptic agents
- Resurgence of keto for weight loss seems to be effective (only for short term)

Physiology and Biochemistry

- When carbs are reduced to less than 50g per day
 - Insulin secretion is greatly decreased and body enters catabolic state
 - Glycogen stores deplete
 - Forces body to go through metabolic changes due to decrease in carb availability
 - Gluconeogenesis
 - Ketogenesis
- Gluconeogenesis
 - Production of glucose within the body
 - In liver with lactic acid, glycerol, alanine, glutamine (amino acids)
 - Limit proteins to 1g/lb body mass (1.5g/lb for those participating in heavy exercise)
 - Prevents internal production of glucose via gluconeogenesis
- Ketogenesis
 - Nutritional ketosis
 - state when body produces ketone bodies in absence of carbs
 - Last for as long as body is deprived of carbs
 - Considered safe as ketone bodies are produced in small concentrations so there are no alterations to blood pH
 - Ketoacidosis
 - Life threatening
 - High concentration of ketone body production
 - Greatly alters blood pH to acidotic state
 - Ketone bodies
 - Easily used by muscle tissue, heart, and kidneys as energy source
 - Also cross blood-brain barrier to provide alternative energy source for brain

- RBCs and liver do not utilise ketone-bodies due to lack of mitochondria and enzyme diaphorase respectively
- Produce more adenosine triphosphate (ATP): source of energy stored at cellular level
 - 100g acetoacetate => 9400g ATP
 - 100g beta-hydroxybutyrate => 10, 500g ATP
 - 100g glucose => 8700g ATP
- Allows body to maintain efficient fuel even during rdeficit
- Decrease free radical damage
- Enhance antioxidant capacity
- Ketone body production
 - Depends on
 - BMR (basal metabolic rate)
 - BMI (body mass index)
 - Body fat percentage
- Glucose generated is unable to keep up with bolidly need without external ingestion
- Body needs alternate source of energy
- Ketone bodies are produced from fat and serve as the alternative main energy source in the body
- Low blood glucose feedback causes
 - Stimulus of insulin secretion to decrease
 - Reduces stimulus for fat and glucose storage
 - Causes increased breakdown of fats into fatty acids
- How fats are broken down
 - Fats broken down into fatty acids
 - Fatty acids metabolised into acetoacetate
 - Acetoacetate is later converted to basic ketone bodies: beta-hydroxybutyrate and acetone

Effects

- Short-term side effects (keto flu)

	<ul style="list-style-type: none"> - Nausea - Vomiting - Headache - Fatigue - Dizziness - Insomnia - Difficulty in exercise tolerance - Constipation - Symptoms resolve in few days to few weeks - Adequate fluid and electrolyte intake and help with symptoms - Long-term adverse effects <ul style="list-style-type: none"> - Not well researched (limited literature) - Hepatic steatosis - Hypoproteinemia - Kidney stones - Vitamin and mineral deficiencies <p>Contradictions</p> <ul style="list-style-type: none"> - Diabetes, insulin intake, oral hypoglycemic agents can get severe hypoglycemia if not adjusted before diet - Pancreatitis - Liver failure - Fat metabolism disorders - Porphyrias - Pyruvate kinase deficiency <p>Other</p> <ul style="list-style-type: none"> - High fat diets do not have correlation with obesity, diabetes, coronary heart disease, cancer (recent epidemiological studies) - Studies in feeding animal high fat diets show no correlation or causation between ingested fat and weight gain - High fat, low carb diets actually show weight loss
<p>Ketogenic Diets: Boon or bane?</p> <p>Joshi Shilpa, Viswanathan Mohan</p>	<p>Types of keto diets:</p> <ul style="list-style-type: none"> - SKF and HPKD are used extensively - SKD and TKD are used by bodybuilders and athletes - SKD: Standard keto diet <ul style="list-style-type: none"> - 70% fat - 20% protein - 10% carbs - CKD: Cyclical keto diet

	<ul style="list-style-type: none"> - High carb intake between keto cycles - (5 keto days, followed by 2 high carb days) - TKD: Targeted keto diet <ul style="list-style-type: none"> - Allows carbs around times if intensive workout - HPKD: High protein keto diet <ul style="list-style-type: none"> - 60% fat - 35% protein - 5% carbs <p>Physiology</p> <ul style="list-style-type: none"> - Glucose becomes insufficient - Fatty acids cannot be used as fuel by CNS - CNS is forced to find alternative fuel source - Starts production of ketone bodies - Ketosis breaks down fats, and is most reliable indicator of weight loss - Ketosis is a completely psychological mechanism - Hans Krebs first to differentiate between psychological (nutritional) ketosis from pathological ketoacidosis (type 1 diabetes) - Nutritional keto: ketonaemia reaches maximum of 7-8 mmol/L (CNS uses ketones efficiently and does not go higher) - Ketoacidosis: ketonaemia exceeds 20mmol/L and causes body pH to drop
<p>Beyond weight loss: a review of the therapeutic uses of very-low-carbohydrate (ketogenic) diets</p> <p>A Paoli, A Rubini, J S Volek, K A Grimaldi</p>	<ul style="list-style-type: none"> - Since 1920 for epilepsy - After 1960s, most common methods for obesity treatment - Diets eliminate the usage of pharmaceutical solutions which are often life long and cause side-effects - Atkins diet - VLCKD (very low carb keto diet)
<p>Intermittent Fasting: What is it, and how does it work?</p>	<ul style="list-style-type: none"> - Dictates time of eating instead of what is being consumed - Dieting times can range by a lot (many dietary schedules) <ul style="list-style-type: none"> - Complete days without food - Parts of day without food

	<ul style="list-style-type: none"> - Fasting also makes meals more happy and supports good health <p>During fasting</p> <ul style="list-style-type: none"> - Water, black coffee and similar 0-calorie drinks are permitted <p>Mark Mattson</p> <ul style="list-style-type: none"> - Bodies have evolved to survive long periods (days) without food - In prehistoric times, long periods of energy output were needed to obtain food - After hours of starving, body runs out of carbs and starts burning fats - Takes 2-4 weeks for body to be accustomed to intermittent fasting <p>Christie Williams</p> <ul style="list-style-type: none"> - 50 years ago <ul style="list-style-type: none"> - Electric entertainment was minimal, so people stopped eating and went to bed - Portions were also smaller - Exercise was more prominent <p>Popular Approaches</p> <ul style="list-style-type: none"> - 16/8 fasting: fast for 16 hours, eat during 8 hours of day - 5:2 fasting: eat normally for 5 days of week, consume 500-600 calories on other 2 days - Longer fasting intervals may actually not be as good, as it can encourage body to store more fat
<p>Intermittent fasting: is there a role in the treatment of diabetes? A review of the literature and guide for primary care physicians</p> <p>Michael Albosta, Jesse Bakke</p>	<ul style="list-style-type: none"> - Type 2 diabetes: metabolic disorder characterised by hyperglycemia <ul style="list-style-type: none"> - Disorder due to insulin resistance: Cells in body is not responsive to insulin and cannot take glucose from blood - Decreased glucose usage -
<p>History of dietary treatment: Guelpa & Marie first report of intermittent fasting for epilepsy in 1911</p>	<ul style="list-style-type: none"> - Ketogenic diet to mimic fasting - Intermittent fasting as treatment for epilepsy <ul style="list-style-type: none"> - 15 patients did not properly follow diet - 2 improved temporarily

<p>SophieHöhnBlandineDozières-PuyravelStéphaneAuvin</p>	<ul style="list-style-type: none"> - 4 presented improvement
<p>https://www.webmd.com/cholesterol-management/cholesterol-liver-disease</p>	<ul style="list-style-type: none"> - Cholesterol is a type of lipid or fat that is produced by liver or is ingested - Eating too many fats can result in fatty liver disease and other conditions - Fatty liver disease: <ul style="list-style-type: none"> - Eating too many fats - Liver cannot handle and stores fats - Causes blockage and liver failure, liver blockage, liver cancer - High cholesterol and high fat concentrations causes material (calcium, cholesterol, fat) buildup in arteries - Calcium forms hard covering around material over time - Entire material is called atheroma - Shrinking of lumen (arteries get smaller) - High blood pressure => blood clots <ul style="list-style-type: none"> - Heart attacks and strokes - Atherosclerosis <ul style="list-style-type: none"> - Causes arteries to harden which in turn messes up the blood pressure
<p>https://www.healthline.com/nutrition/will-a-keto-diet-affect-my-already-high-cholesterol</p>	<ul style="list-style-type: none"> - LDL (low density lipids) <ul style="list-style-type: none"> - Takes cholesterol to your arteries - HDL (high density lipids) <ul style="list-style-type: none"> - Helps get rid of excess cholesterol in your arteries - Lipids: lipoprotein - Keto can raise LDL and triglycerides in short term, but in long term LDL drops and HDL increases <ul style="list-style-type: none"> - LDL and triglyceride increase in short term (few months) does not do much for cardiovascular disease, but if it persists for longer duration, not good (months to years)
<p>Ketogenic Diet and Epilepsy: What We Know So Far</p> <p>Isabella D'Andrea</p>	<ul style="list-style-type: none"> - Keto used since 1920s for epilepsy - MAD (modified atkins diet) <ul style="list-style-type: none"> - 1:1 fat to protein - Low-glycemic index diet

[Meira,1,2,*](#) [Tayla Taynan Romão,2](#) [Henrique Jannuzzelli Pires do Prado,1,2](#) [Lia Theophilo Krüger,1](#) [Maria Elisa Paiva Pires,1](#) and [Priscila Oliveira da Conceição](#)³

- Metabolic epilepsy

How keto works against epilepsy

- Changes fuel source of brain from glucose to ketone bodies
- Modifies neuro-metabolism and excitability of brain
- Reduces seizures
- There is no definitive known reason why, however, it is likely due to the difference in

In 1970, Robert C. Atkins developed a weight-loss diet that restricted the intake of carbohydrates ([Sharma and Jain, 2014](#)), and this diet was later evaluated for seizure treatment. The first patient was a 7-year-old girl with intractable epilepsy due to a left parietal cortical dysplasia, who used the Atkins diet for a week in order to acclimate to the CKD. After 3 days, her seizures stopped, and she remained seizure-free for 3 years

Several studies have shown that the MAD, besides being more palatable, is as effective as the KD in the treatment of drug-resistant epilepsy in children ([Miranda et al., 2011](#); [Martin et al., 2016](#)). A study performed using 20 children receiving 10 g of carbohydrates daily showed that 65% of the children had a >50% seizure reduction, 35% of the children had >90% improvement, and four children were seizure-free at 6 months ([Kossoff et al., 2006](#)). In a study in South Korea, 36% of 14 children treated with the MAD showed improvement of >50% in seizures and 12% were seizure-free ([Kang et al., 2007](#)). A recent meta-analysis performed using 70 studies concluded that the MAD and classical KD do not differ in reduction of seizure frequency at month 3 and month 6, with $\geq 50\%$ and $\geq 90\%$ reductions, respectively ([Rezaci et al., 2017](#)). A retrospective study showed >50% of seizure reduction in 65% of the 10 children who remained on the diet for up to 6 months, and 20% of them were seizure-free ([Park et al., 2018](#)).

In a recent meta-analysis, eight studies were identified that used the MAD in adult patients with refractory epilepsy, aged between 15 and 86 years, with treatment times ranging from 3 to 36 months. In these studies, the proportion of patients who showed >50% seizure reduction ranged from 20 to 70% and the rate of seizure freedom ranged from 7 to 30%. The rate of abandonment of the diet varied between 12.5 and 82% of the patients ([Liu et al., 2018](#)).

Parisian physicians, G Guelpa, and A Marie, recorded the first modern use of starvation as a treatment for epilepsy in 1911 ([Wheless, 2008](#)). The modern use of this form of therapy began in the early 1920s ([Lima et al., 2014](#); [Yuen and Sander, 2014](#)), when Drs. Stanley Cobb and W.G. Lennox of Harvard at Harvard Medical School observed the effects of starvation as a treatment for epilepsy, noting that seizure improvement typically occurred after 2–3 days ([Wheless, 2008](#)). In the same period, Dr. Russel M. Wilder

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<https://pubmed.ncbi.nlm.nih.gov/30803508/>

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<https://www.healthline.com/nutrition/will-a-keto-diet-affect-my-already-high-cholesterol>

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Chennai India:

<https://www.cambridge.org/core/journals/british-journal-of-nutrition/article/dietary-carbohydrate-s-glycaemic-load-food-groups-and-newly-detected-type-2-diabetes-among-urban-asian-indian-population-in-chennai-india-chennai-urban-rural-epidemiology-study-59/4D774219CC0A39C49D5E5C748B094901>

Is epilepsy a metabolic disease

<https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf>

https://www.healthline.com/nutrition/15-conditions-benefit-ketogenic-diet#TOC_TITLE_HDR_4

<https://clindiabetesendo.biomedcentral.com/articles/10.1186/s40842-020-00116-1>

Should i put website or online database for citations

Maybe include breakfast word originations

Fasting and keto can help with type 2 diabetes because body uses up blood sugar as there are no carbs being put in

Fasting increase production of orexin-A, a neurotransmitter linked to alertness

Insulin: Beta cells in pancreas produces insulin which allows glucose to enter cells

Insulin resistance

IFIC: More than 10% of americans 18-80, 1000 people, participate in intermittent fasting

Diabetes: Insulin resistance causes body to be unable to consume glucose

- Glucose buildup in blood can result in death
- Why insulin needs to be injected to be able to properly break down the glucose at a good rate
- If you stop eating carbs (keto or inter-fasting)
- The inefficient insulin can break down and consume the rest of the glucose
- Body will turn to fat reserved after after there is no glucose energy left

[Vegan diet](#): Reduces cholesterol and promotes weight loss through a different method

Non-medical usage of keto and inter-fasting

- Both diets have a lot of cons and negative effects towards certain people, so it is not recommended for everyone, and medical consultation should take place first before application of diets
- Both can result in weight loss
- Reduce appetite
- Reduce triglycerides
- [Keto](#) is not recommended for long term usage if there are no medical conditions as it does not do much more for you than that a normal healthy diet can, and also leaves you with less options for food
- Inter-fasting is good practice even without conditions
- Allows you to prepare better for situations where food is not available
- Prolongs your ability to withstand hunger
- Makes you feel more mentally and physically active in the long term
- Save more money
- Does not limit food choice, however limits food consumption
- Can help attain a better life-style
- In an eight-week study in 34 resistance-trained men, those who practised the 16/8 method of intermittent fasting lost nearly 14% more body fat than those following a normal eating pattern
- Similarly, a review of 28 studies noted that people who used intermittent fasting lost an average of 7.3 pounds (3.3 kg) more fat mass than those following very low-calorie diets

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