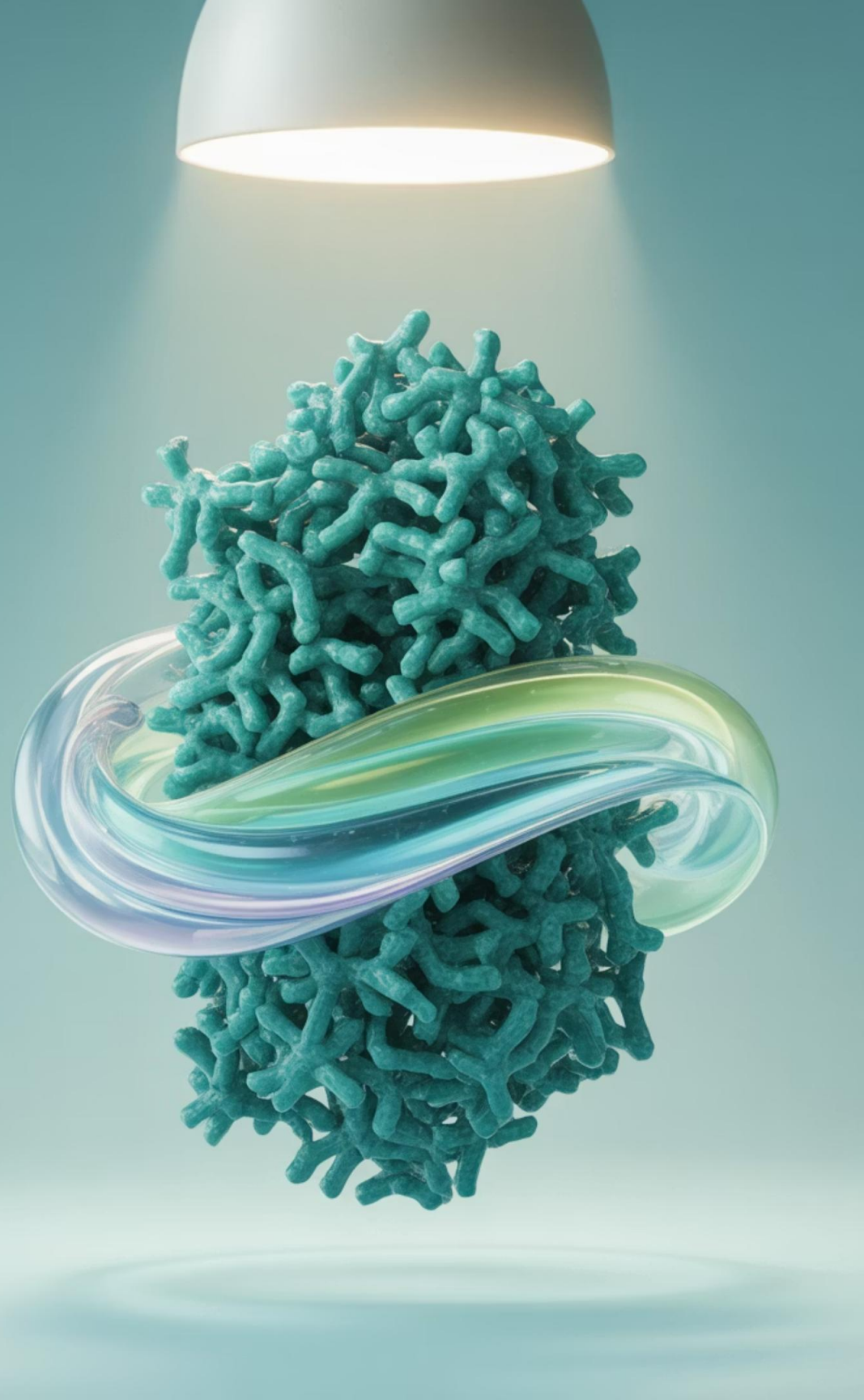




Macronutrients Uncovered: Carbohydrates, Proteins & Fats for Health and Energy

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Understanding macronutrients is fundamental to optimal health and energy. These essential compounds - carbohydrates, proteins, and fats - form the foundation of every meal and fuel every biological process in your body. This comprehensive guide will explore how each macronutrient functions, their unique roles in health, and practical strategies for incorporating them into your daily nutrition plan for sustained energy, tissue repair, and overall wellbeing.



Chapter 1

Carbohydrates – Fueling Your Body Efficiently

Carbohydrates serve as your body's primary fuel source, providing the energy needed for everything from intense workouts to basic cellular functions. Understanding how different carbohydrates affect your body can transform your energy levels and overall health outcomes.

What Are Carbohydrates?

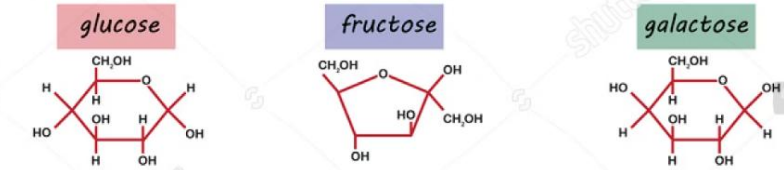
Carbohydrates are organic compounds composed of carbon, hydrogen, and oxygen atoms, typically in a 1:2:1 ratio. They represent the body's preferred energy source, particularly for high-energy organs like the brain, muscles, and kidneys.

Your body efficiently converts carbohydrates into glucose, which cells use immediately for energy or store as glycogen in the liver and muscles. This storage system provides a readily available energy reserve during periods of increased demand or between meals.

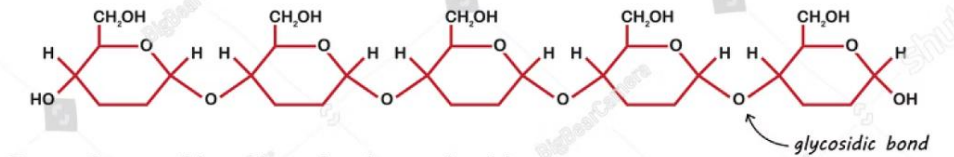
The brain alone consumes approximately 20% of your daily energy intake, relying almost exclusively on glucose for optimal cognitive function.

Biology ●●● Carbohydrate

- Carbohydrate is polymer, made from monosaccharide



- Monosaccharide link together by condensation to form polysaccharide



- Formation and function of polysaccharide



Types of Carbohydrates

Simple Carbohydrates

Monosaccharides and disaccharides including glucose, fructose, and sucrose. These provide quick energy but can cause rapid blood sugar fluctuations.

- Found in fruits, honey, table sugar
- Rapidly absorbed and metabolised
- Best consumed with fiber or protein

Complex Carbohydrates

Polysaccharides like starch and fiber found in whole grains, legumes, and vegetables. These provide sustained energy and essential nutrients.

- Slower digestion and absorption
- Rich in vitamins, minerals, and fiber
- Support digestive health

Refined vs Unrefined

Processing removes fiber, vitamins, and minerals from carbohydrates, creating foods that cause rapid blood sugar spikes and provide fewer nutrients.

- White bread, white rice, sugary snacks
- Quick energy followed by crashes
- Limited nutritional value

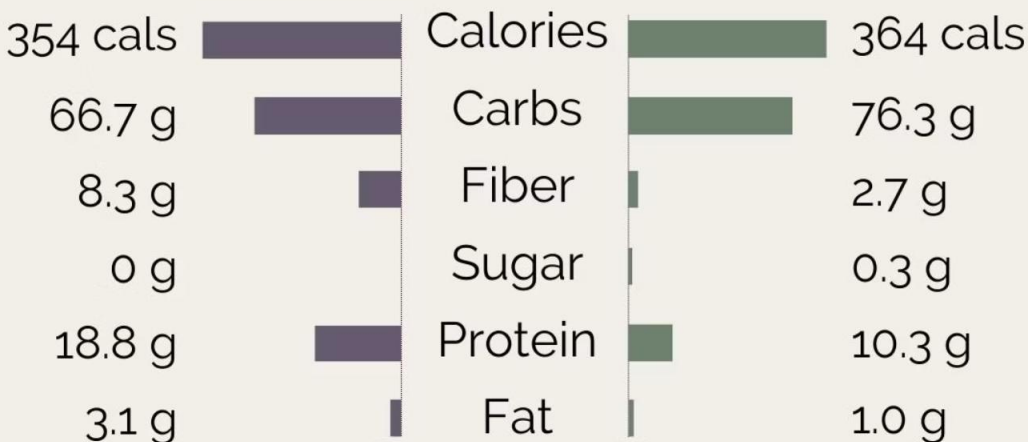
Whole Grains vs. Refined Grains



Wheat Berries
per 100 grams



All-Purpose Flour
per 100 grams



Digestion & Metabolism of Carbohydrates

Understanding how your body processes carbohydrates reveals why food choices significantly impact energy levels and metabolic health.

01

Initial Breakdown

Salivary amylase begins breaking down starch in the mouth, whilst stomach acid temporarily halts the process until food reaches the small intestine.

03

Insulin Response

Rising blood glucose triggers insulin release from the pancreas, enabling cells to absorb glucose for immediate energy or storage as glycogen.

During low-carbohydrate states, the body can produce ketone bodies from fat to fuel the brain, demonstrating metabolic flexibility.

02

Complete Digestion

Pancreatic enzymes complete carbohydrate breakdown into simple sugars, primarily glucose, which are absorbed through the intestinal wall into the bloodstream.

04

Storage & Conversion

Excess glucose is stored as glycogen in liver and muscles, or converted to fat for long-term energy storage when glycogen stores are full.

The Glycemic Index (GI): What It Means for You

The Glycemic Index ranks carbohydrate-containing foods on a scale of 0-100 based on how quickly they raise blood glucose levels compared to pure glucose. This tool helps predict blood sugar responses and guide food choices for sustained energy.

High GI foods (70+) like white bread, instant rice, and sugary drinks cause rapid blood sugar spikes followed by crashes, leading to hunger and energy fluctuations.

Low GI foods (55 or below) such as lentils, steel-cut oats, and most fruits provide gradual glucose release, supporting stable energy levels and reducing type 2 diabetes risk.

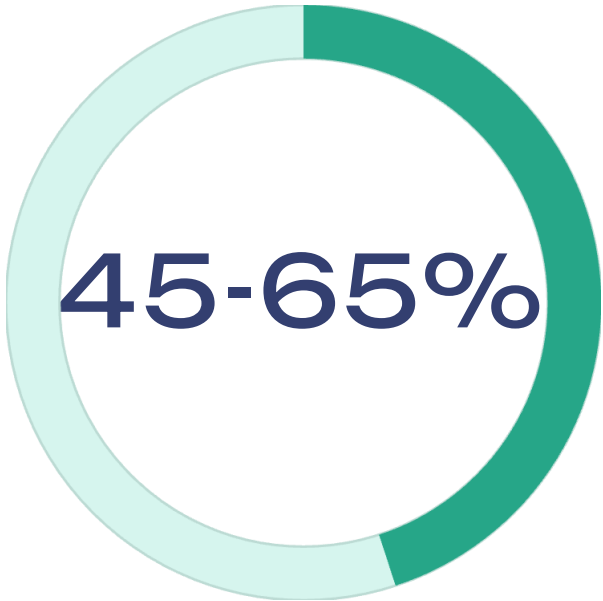
Factors affecting GI include fiber content, food processing, ripeness, cooking methods, and food combinations.

GLYCEMIC INDEX



Calculating Your Daily Carbohydrate Needs

Carbohydrate requirements vary based on activity level, metabolic health, and personal goals, but general guidelines provide a starting point for optimal nutrition.



Daily Calories from Carbs

Recommended percentage for most adults, adjustable based on health goals and activity levels



Daily Carb Intake

Example for 2,000 calorie diet, prioritising whole grains, fruits, and vegetables



Added Sugar Limit

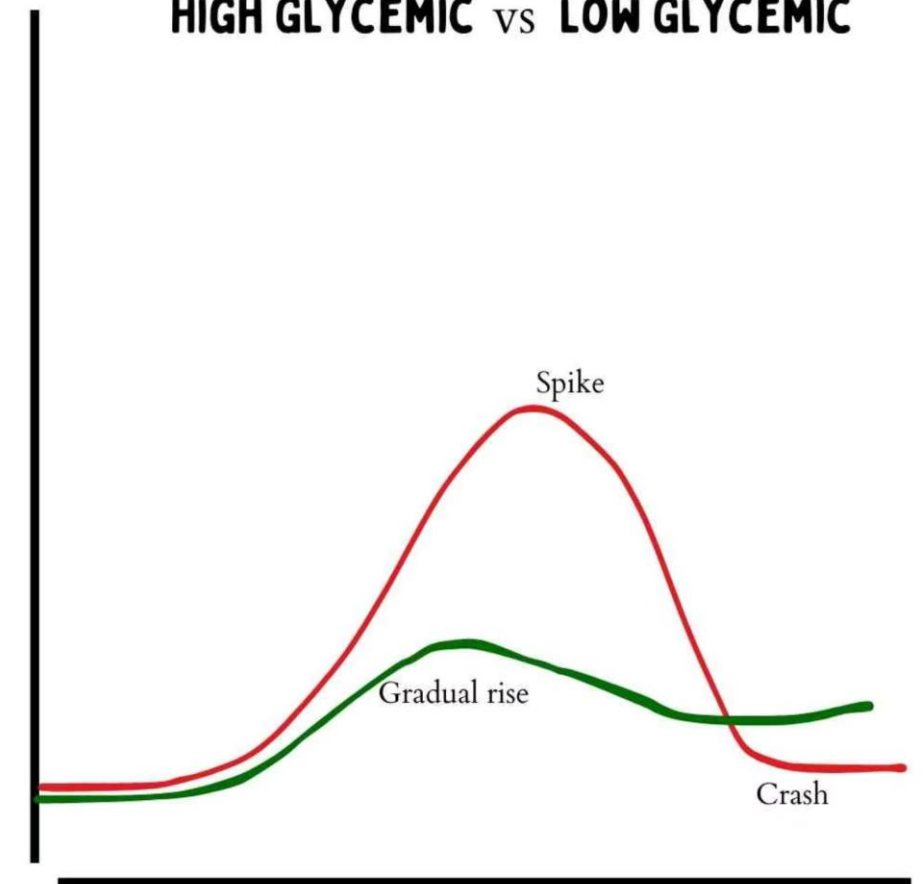
Maximum percentage of daily calories from added sugars for optimal health

Focus on nutrient-dense sources: whole grains, legumes, fruits, and vegetables. These provide not only energy but also essential vitamins, minerals, and fiber that support overall health and digestive function.

Blood Sugar Response: High GI vs Low GI Foods

This visual comparison demonstrates how food choices directly impact blood glucose levels over time. High GI foods create sharp spikes and rapid drops, whilst low GI options provide steady, sustained energy release that supports stable mood, concentration, and hunger management throughout the day.

HIGH GLYCEMIC vs LOW GLYCEMIC





Chapter 2

Proteins – *Building Blocks* for Repair and Growth

Proteins function as the body's construction materials, providing the amino acid building blocks essential for muscle development, tissue repair, enzyme production, and immune function. Understanding protein quality and requirements empowers optimal health outcomes.

What Are Proteins and Amino Acids?

Protein Structure

Proteins consist of long chains of amino acids linked by peptide bonds. During digestion, these chains break down into individual amino acids that serve as building blocks for new proteins throughout your body.

- 20 different amino acids combine to form thousands of proteins
- Each protein has unique functions and structures
- Sequence determines protein's specific role

Beyond muscle building, proteins create enzymes that catalyse biochemical reactions, hormones that regulate body functions, antibodies for immune defence, and transport molecules that carry nutrients throughout your body.

Essential Amino Acids

Nine amino acids cannot be synthesised by the body and must be obtained through diet. Complete proteins contain all essential amino acids in adequate proportions.

- Histidine, isoleucine, leucine, lysine
- Methionine, phenylalanine, threonine
- Tryptophan, valine

Protein Synthesis & Importance for Skin and Tissue Repair



Digestion & Absorption

Stomach acid and enzymes break proteins into amino acids, which are absorbed in the small intestine and transported via bloodstream to tissues requiring repair or growth.



Protein Synthesis

DNA provides instructions for combining amino acids into specific proteins. Ribosomes act as protein factories, assembling amino acids according to genetic blueprints.



Tissue Repair

New proteins replace damaged tissue, heal wounds, maintain skin elasticity through collagen production, and support muscle recovery after exercise or injury.

Collagen, the most abundant protein in your body, requires vitamin C and specific amino acids for synthesis. This explains why protein intake directly impacts skin health, wound healing, and overall tissue integrity.

Protein-Rich Foods: Demonstration & Evaluation



Animal Sources

Meat, fish, eggs, and dairy provide complete proteins containing all essential amino acids in optimal ratios for human needs.

- High biological value
- Easily digestible
- Rich in B vitamins and minerals

Practical Tip: Combine plant proteins like rice and beans, or hummus and whole grain pita, to create complete amino acid profiles. This strategy maximises protein quality whilst providing diverse nutrients and supporting environmental sustainability.



Plant Sources

Beans, lentils, nuts, seeds, and soy offer excellent protein with additional fiber, antioxidants, and phytonutrients beneficial for health.

- Often incomplete individually
- Combine for complete profiles
- Environmentally sustainable

How Much Protein Do You Need?

Protein requirements vary based on age, activity level, health status, and body composition goals. Understanding these factors helps optimise intake for individual needs.

0.8g

Per Kg Body Weight

Minimum daily requirement for sedentary adults to maintain muscle mass and basic functions

1.2-2.0g

Active Individuals

Athletes and highly active people require increased protein for muscle repair and adaptation

56g

Example: 70kg Person

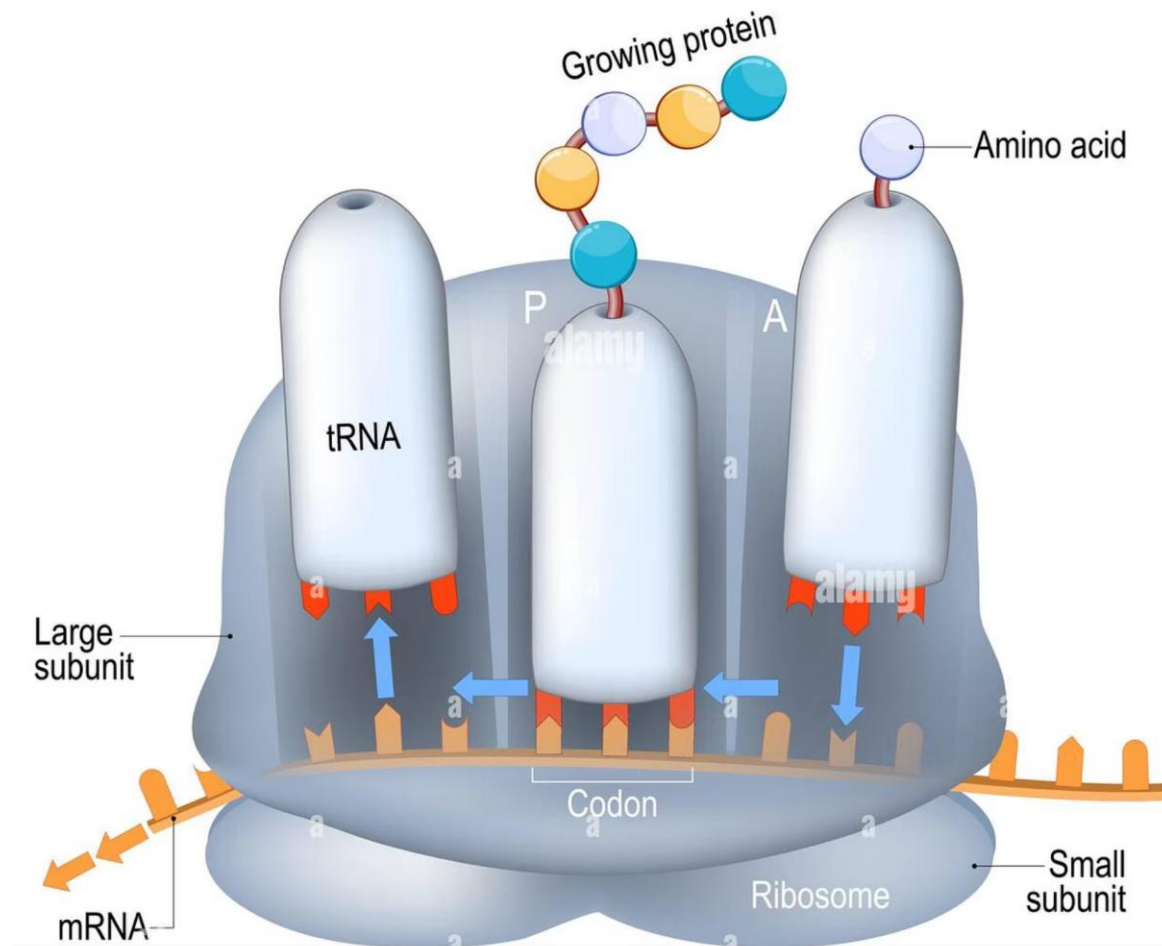
Minimum daily protein requirement, though many benefit from higher intakes

- ❏ Older adults may require up to 1.2-1.6g per kg body weight to combat age-related muscle loss (sarcopenia). Pregnant and breastfeeding women also have increased protein needs to support fetal development and milk production.

Protein Synthesis: From Amino Acids to Functional Proteins

This diagram illustrates the remarkable process by which individual amino acids combine to form complex, functional proteins. The ribosome reads genetic instructions and assembles amino acids in precise sequences, creating everything from muscle fibers to immune antibodies that keep your body functioning optimally.

BIOLOGICAL PROTEIN SYNTHESIS (mRNA translation)



Types of Fats: Saturated, Unsaturated & Essential Fatty Acids



Saturated Fats

Primarily from animal sources, solid at room temperature. Found in meat, dairy, and tropical oils like coconut oil.

- Linked to increased LDL cholesterol
- May raise heart disease risk
- Limit to <10% of daily calories



Unsaturated Fats

Liquid at room temperature, found in olive oil, nuts, seeds, and fish. Support heart health and reduce inflammation.

- Monounsaturated: olive oil, avocados
- Polyunsaturated: nuts, seeds, fish
- Lower LDL cholesterol levels



Essential Fatty Acids

Omega-3 and Omega-6 fatty acids must be obtained from diet. Crucial for brain function, cell membranes, and inflammation control.

- Omega-3: fish, flaxseeds, walnuts
- Omega-6: vegetable oils, nuts
- Balance ratio for optimal health

Lipid Metabolism: How Your Body Uses Fats

Fat metabolism involves complex processes that provide energy, support cellular function, and enable absorption of fat-soluble vitamins essential for health.

Initial Digestion

Bile salts emulsify fats in the small intestine, creating smaller droplets that enzymes can break down effectively.

Vital Functions

Fats provide insulation, protect organs, form cell membranes, and enable absorption of vitamins A, D, E, and K.



Breakdown & Absorption

Lipases break fats into fatty acids and glycerol, which are absorbed and transported through lymphatic system to bloodstream.

Energy Production

Fatty acids undergo beta-oxidation in mitochondria, producing ATP for cellular energy or storage as triglycerides in adipose tissue.



Identifying Good vs. Bad Fats in Dietary Plans

Fats to Avoid

- **Trans fats:** Found in hydrogenated oils, processed foods, and some margarines
- Increase LDL cholesterol and inflammation
- Banned in many countries due to health risks
- Check labels for "partially hydrogenated oils"

Fats to Limit

- **Saturated fats:** Less than 10% of daily calories
- Choose lean cuts of meat
- Opt for low-fat dairy products
- Use tropical oils sparingly

Fats to Emphasise

- **Monounsaturated:** Olive oil, avocados, nuts, seeds
- **Omega-3 fatty acids:** Fatty fish, flaxseeds, chia seeds, walnuts
- Support heart and brain health
- Reduce inflammation markers

Optimal fat intake: 20-35% of daily calories from healthy fats, emphasising unsaturated sources whilst limiting saturated and eliminating trans fats completely.

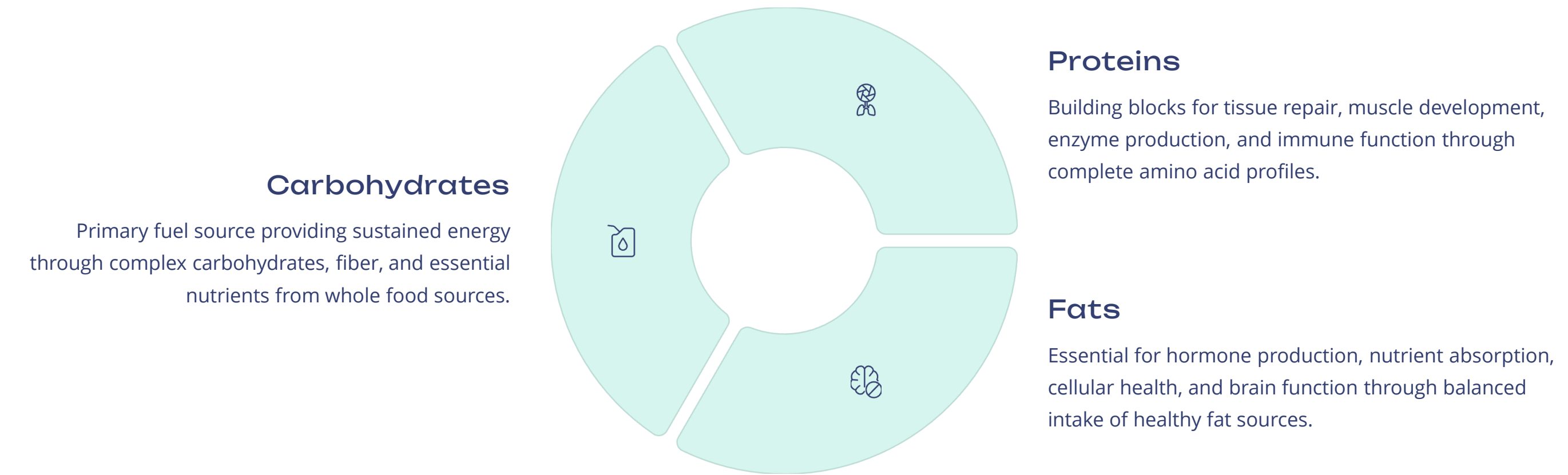


Food Sources: Saturated vs. Unsaturated Fats and Heart Health Impact

This visual guide helps identify beneficial and potentially harmful fat sources in your diet. The heart health icons indicate the cardiovascular impact of different fat types, empowering you to make informed choices that support long-term wellness and reduce chronic disease risk.

Balanced Macronutrients for Optimal Health

Achieving optimal health requires understanding how carbohydrates, proteins, and fats work synergistically to fuel your body, support repair processes, and maintain vital functions.



Choose whole, minimally processed foods that provide complex carbohydrates, high-quality proteins, and beneficial fats. Personalise your macronutrient ratios based on individual lifestyle, health goals, and any underlying medical conditions.

Empower your nutrition journey: Use this knowledge to make informed food choices that support sustained energy, effective tissue repair, and long-term wellbeing. Remember that optimal nutrition is highly individual—work with healthcare providers to tailor recommendations to your specific needs and goals.