

A Review of Macronutrient Intake Analysis in Diets based on Animal and Plant Source Food in India

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Abstract

Macronutrients like carbohydrates, protein, and fat are essential for body function and energy. Carbohydrates play significant roles in diabetes and obesity. India's calorie intake primarily consists of carbohydrates, with high-fiber diets being more beneficial. Proteins are vital for living cells and muscle tissue, with over half coming from muscle. Adults should limit saturated and trans fats to avoid obesity, diabetes, cardiovascular disease, and cancer. An optimal dietary regimen includes nutritious meals, low-calorie meals enriched with vegetables, fruits, whole nuts, moderate animal foods, and low-fat dairy. One of the popular diet types, the Mediterranean diet offers significant nutritional benefits due to its abundant fiber content and slow digestion rates. Western diets usually lack dietary fiber so that high-fiber foods can benefit health. Sufficient water consumption is recommended for metabolism, cellular homeostasis, temperature regulation, and circulatory function. So, overall, a balanced diet consists of carbohydrates, protein, and fat combined as primary food groups called macronutrients and non-nutrients like fiber, antioxidants, and phytochemicals. This narrative review also emphasized vegetarianism and non-vegetarianism; India's two primary diet types contain plant and animal food that provide proportionate macronutrients. Adherence to the dietary guidelines by dietitians for diet plan preparation and its implementation by patients are two critical aspects that must be practiced strictly.

Keywords: Macronutrients; Animal food; Plant food; Diet planning; Protein; Diet types; Balanced diet.

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INTRODUCTION

Macronutrients, or macros, are essential nutrients for optimal body function, including carbohydrates, protein, and fat. They provide energy and structure, and their intake varies based on personal circumstances, with recommended ranges. A combination of these nutrients is required for optimal health. However, the optimal combination is elusive, and historically, human populations have



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survived on diets with varying proportions of these macronutrients.¹

Carbohydrate

Carbohydrates, constituting 40-85% of the energy consumed by humans, are readily digested in the small intestine. Carbohydrates are categorized as either available or unavailable, and their elevated levels contribute to the risk of obesity.² The need for more reliable research tools has constrained the study of macronutrients' impact on human nutrition, namely dietary carbohydrates. Nevertheless, conventional techniques for estimating the carbohydrate content in food have relied on analyzing other components such as protein, fat, water, alcohol, and ash. This approach incorporates both fiber and non-carbohydrate constituents, such as organic acids. The total carbohydrate content can be determined by directly analyzing the masses of specific carbs and fiber.³

Carbohydrate in the Indian diet

Carbohydrates are necessary for human meals; monosaccharides like glucose and fructose are present in fruits, vegetables, honey, sucrose, lactose, and milk. Cereals, millets, pulses, root vegetables, and animal diets contain complex carbs such as starches and glycogen. Plant foods provide for 70-80% of the total dietary calories in India. High-fiber diets slow down the absorption of carbohydrates, enhance feelings of fullness, lower blood glucose, and lipids, and are more beneficial for health than low-fiber diets.⁴ A study analyzed digestible carbohydrates in the human gastrointestinal tract using enzymes mimicking the human system, focusing on sugars like sucrose, which are crucial components of cereals and sugars. The study employed the modified method of analysis of the Association of Official Analytical Chemists' total dietary technique to ascertain the digestible carbohydrate fractions, such as starches and sugars, in different types of food. Fructose, maltose, and lactose were absent in all rice samples, while the total sugars and starch levels exhibited minor variations attributed to varietal differences.⁵

Source of Carbohydrates

India's calorie intake primarily comprises carbohydrates, comprising 65-70% of the total. The primary sources of carbohydrates in India include rice, wheat, maize, millet, amaranth, barley, starchy vegetables, fruits, and added sweets. Pulses and milk are both sources of carbohydrates. Indian cuisine commonly includes grains, pulses,

vegetables, and dairy products, which offer vital amino acids and minerals.^{6,7}

Lente carbohydrates

Lente carbohydrates, found in Indian cuisine, are slow-absorbed due to their high viscous fiber content, delaying gastric emptying time and reducing post-meal blood glucose response.⁸ The Mediterranean diet is characterized by high carbohydrate content, low levels of saturated fats, and frequent inclusion of slow release starch or lente carbohydrate types. The diet has significant implications for health and disease, and certain foods may provide benefits.⁹

Protein

Proteins are vital constituents of living cells, serving as both structural and functional elements. Muscle tissue accounts for over half of these proteins. Proteins are intricate compounds of several amino acids, with indispensable amino acids acquired from food and nonessential amino acids produced within the body. Proteins serve multiple roles and supply energy. Protein needs differ depending on age, physiological condition, and stress levels. Animal and plant meals are abundant in proteins, with animal proteins offering superior essential amino acids in appropriate ratios.^{4,10}

Plant proteins

They are considered lesser quality since they contain fewer crucial amino acids. Including grains, millets, and pulses in one's diet ensures a comprehensive array of amino acids, enhancing the overall quality of proteins consumed.⁴ Protein is an indispensable macronutrient in the diet, necessary to maintain human structures and muscles. Amino acids constitute this substance; the human body needs only 22 macromolecules. Insufficient protein intake can result in problems such as stunted growth, muscle atrophy, weakened immune system, and cardiovascular and respiratory complications.^{4,10}

Animal protein

Animal protein is a comprehensive protein source containing all the necessary amino acids. It is highly absorbable, with a rate of 90%, and has a digestion rate of 85%. Nevertheless, it harbors significant quantities of uremic toxins and proteolytic bacteria, which can lead to the development of renal disease and hinder proper kidney function. Red meat contains iron, Vitamin B12, Vitamin D, DHA, essential omega-3 fatty acids, and zinc. These nutrients are easily absorbable by the human body

and are found in fish, meat, poultry, dairy products, oily fish, eggs, and dairy products.^{4,10}

Fat

Dietary visible fats, such as oils and fats like butter, ghee, and vanaspati, are a highly concentrated energy source, delivering 9 Kcal per gram. They originate from imperceptible lipids in plant and animal-based diets and additional fats and oils such as cooking oil. Fats facilitate the transportation of fat-soluble vitamins and essential polyunsaturated fatty acids. The specific type and amount of fats consumed impact cholesterol and triglyceride levels. Infants and children require sufficient quantities of fat for focused energy. However, adults should restrict their consumption of saturated fat and cholesterol to avoid obesity, diabetes, cardiovascular disease, and cancer.⁴ Insufficient dietary fat intake and inadequate protein and carbohydrates can lead to negative energy balance, weight loss, and poor growth. Classical n-3 and n-6 PUFA deficiencies occur in individuals with severe malnutrition or chronic fat malabsorption.¹¹

Effect of cholesterol

Elevated consumption of dietary cholesterol leads to an increase in blood cholesterol levels, mainly when derived from saturated fats. It is essential to keep cholesterol intake below 200 mg per day. To decrease the intake of saturated fat and cholesterol, it is advisable to restrict the consumption of high-fat animal products and instead choose low-fat milk. Eating eggs three times per week provides a multitude of nutritional advantages. Existing research does not substantiate that consuming cholesterol through diet heightens the risk of heart disease in those in good health. Nevertheless, the consumption of saturated fatty acids and trans-fats can elevate the risk of cardiovascular disease. Eggs are cost-effective, high in protein and vitamins, nutritionally dense, and low in saturated fats. An optimal dietary regimen should consist of meals rich in nutrients, restricted in calories, and a well-balanced combination of essential elements. Additionally, it is vital to incorporate a variety of vibrant vegetables and fruits into the diet. Additional investigation is required about individuals with diabetes.^{4,12}

Source of fat

The importance of fat (visible and invisible) from animal foods is sometimes necessary to achieve optimal health. Low-fat dairy foods, whole nuts,

moderately high-fat, saturated-fat, and cholesterol-rich animal foods are also needed. In contrast, ghee and butter are limited. Consume foods rich in alpha-linolenic acids like legumes, green leafy vegetables, fenugreek, and mustard seeds. Eat fish more frequently, limit egg consumption to 3 eggs per week, and avoid ready-to-eat fast foods, bakery foods, and processed foods made from hydrogenated fat. Use fats and oils in moderation and consume various foods for optimal health benefits.^{4,12}

Fiber

The Mediterranean diet is anticipated to provide substantial nutritional advantages because of its abundant fiber content, especially soluble fiber, and its slow rates of digestion, which aid in reducing increases in blood glucose levels and insulin release. These meals can also assist in the maintenance of low blood lipids and potentially slow down the progression of non-insulin-dependent diabetes in elderly people. Although extensive data for many years shows the positive effects of dietary fiber on health, Western diets remain deficient in this essential component. The responsibility for this issue rests not only with food firms that process food products lacking in fiber but also with the choices made by customers. A nutritious diet generally carries a price tag of 25-30% higher than an unhealthy diet centered around heavily processed foods. Nevertheless, the accessibility, ease, and affordability of processed foods should not compel us to make detrimental decisions for our health. Opting for high-fiber foods instead of ultra-processed ones as customers can benefit our health and well-being, potentially influencing the strategy of food companies. In our capitalist culture, it is essential to express our preferences through our choices and appreciate preparing meals using fresh products rich in dietary fiber.^{13,14}

Water

Water is crucial for metabolism, cellular homeostasis, temperature regulation, and circulatory function. There has yet to be a consensus on human water requirements for different demographic groups due to the complexity of the human water regulatory network. A novel approach focuses on the intensity of a neuroendocrine response, like plasma arginine vasopressin, used by the brain to regulate body water volume and concentration. This method defines hydration and distinguishes it from hypohydration. Consuming less than 24 hours of water adequate intake may

increase the risk of dysfunctional metabolism and chronic diseases.¹⁵

Balanced Diet

A balanced diet provides all necessary nutrients in appropriate amounts and proportions, blending the four primary food groups. The food needed varies with demographic factors, exercise, and physiological aspects. A balanced diet ideally includes 55%-60% carbohydrates, proteins per

kilogram bodyweight or approximately 15-20%, and visible cum invisible fat up to 30% that are variable from person to person. Non-nutrients like dietary fiber, antioxidants, and phytochemicals also benefit health. Antioxidants like vitamins C and E, beta-carotene, riboflavin, and selenium protect the body from free radical damage. Spices rich in antioxidants are also beneficial.^{4,16} Fig. 1 shows the as-usual need of food groups to prepare a balanced diet. A balanced diet means consuming maximum staple foods such as cereals and minimizing oils/fats.¹⁶

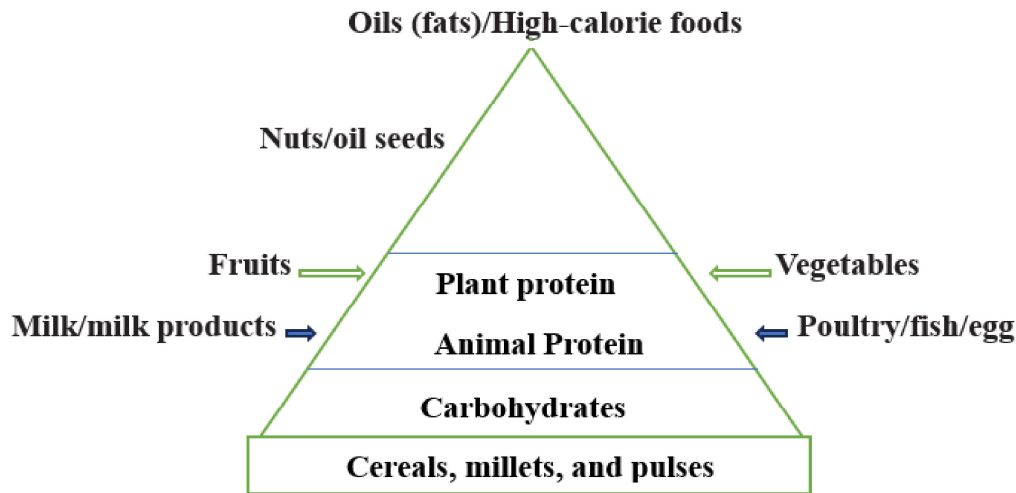


Fig. 1: Food group at a glance for a balanced diet

Table 1 shows the essential food groups and their sources for both sexes by serving sizes and numbers needed for Indians based on sedentary to heavy activities. Cereals, millets, pulses, roots, tubers, and fruits are plant sourced. On the other hand, Meat, fish, eggs, milk and milk products, butter, and ghee are animal-sourced. As per ICMR-NIN guidelines, serving sizes have been multiplied by the serving numbers as needed

based on activity type (sedentary to heavy). Table. 2 also shows essential food groups and their sources for Indian women with pregnancy and Indian lactating mothers. As per ICMR-NIN guidelines, serving sizes have been multiplied by the serving numbers as needed based on activity type (sedentary to heavy), and there is an extra need for serving sizes for cereals, pulses, fruits, milk, and milk products, and fat.^{4,17}

Table 1: Food groups and their sources needed for Indians as per the serving size and numbers

Food Group	Sources	Male (Sedentary-Heavy)			Female (Sedentary-Heavy)		
Indian perspective	Common	*Size (g)	*No.	Total Quantity(g)	*Size(g)	*No.	Total Quantity(g)
Cereals/Millets	Plant	30	12.5-20	375-600	30	11-16	330-480
Pulses	Plant	30	2.5-4.0	75-120	30	2-3	60-90
Roots/Tubers	Plant	100	2	200	100	2	200
All Vegetables	Plant	200	3	600	200	3	600
Fruits	Plant	100	1	300	100	1	100
Meat, fish, egg	Animal	100	1	100	100	1	100
Milk and milk products	Animal	100	3	300	100	3	300
Cooking oil	Plant	5	5-6	25-30	5	4-6	20-30
Butter/Ghee	Animal	5	1-2	5-10	5	1	5

*Serving (size/numbers)

Table 2: Food groups and their sources needed for Indian mothers during pregnancy and lactation as per the serving size and numbers

Food Group	Sources	Pregnancy			Lactation		
Indian perspective	Common	*Size(g)	*No.	Total Quantity(g)	*Size(g)	*No.	Total Quantity(g)
Cereals/Millet	Plant	30	12.5-20 +1	375-600+30	30	11-16	330-480
Pulses	Plant	30	2.5-4.0+2	75-120+60	30	2-3	60-90
Roots/Tubers	Plant	100	2	200	100	2	200
All Vegetables	Plant	200	3+0.5	600+10	200	3+0.5	600+10
Fruits	Plant	100	1+1	100+100	100	1+1	100+100
Meat, fish, egg	Animal	100	1	100	100	1	100
Milk and milk products	Animal	100	1+2	100+200	100	1+2	100+200
Cooking oil	Plant	5	1+1	5+5	5	1+1	5+5
Butter/Ghee	Animal	5	1+1	5+5	5	1+1	5+5

*Serving (size/numbers)

A study examined the impact of vegan and non-vegan diets on hypothyroidism, kidney diseases, and poor bone health in older adults in Southeast Asia. A total of 95 patients were included in the study, and the results showed no significant difference in TSH, creatinine, bone mass, or calcium levels between vegan and non-vegan diets. However, the food habits group was associated with decreased outcomes. The study pointed out that improper diets can affect these health issues. Southeast Asians are prone to various health issues, including hypothyroidism, chronic kidney disease, and bone health issues, mainly due to poor dietary habits and exercise. Improper vegan or non-vegan diets can affect both male and female older adults, but a healthy diet can reduce disease risks.¹⁸

CONCLUSIONS

Macronutrients like carbohydrates, protein, and fat are crucial for body function and energy. India's calorie intake is primarily carbohydrates, with high-fiber diets being more beneficial. Proteins are vital for living cells and muscle tissue. Fat is essential to a certain extent, but adults should limit saturated and trans fats to avoid obesity, diabetes, cardiovascular disease, and cancer. An optimal dietary regimen includes nutritious, low-calorie meals and high-fiber foods. Overall, a balanced diet combines primary food groups and macronutrients.

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