

MEDICAL SCIENCES

THE ROLE OF PROPER NUTRITION IN THE PHARMACOKINETICS OF THE BODY

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Abstract

Proper nutrition is a fundamental factor in maintaining human health and improving life quality. It affects metabolism, organ functions, mood, work capacity, and the prevention of chronic non-communicable diseases. Nutrient balance, meal timing, and dietary diversity play critical roles in the pharmacokinetics of medications. This article explores the influence of correct nutrition on health, its impact on drug absorption and metabolism, the role of vitamins and minerals, and dietary recommendations for different age groups. Special attention is paid to stress, hydration, and the compatibility of foods for optimal digestion and well-being.

Keywords: Proper nutrition, metabolism, pharmacokinetics, vitamins, minerals, diet

Proper nutrition is one of the fundamental conditions for maintaining health. It is no coincidence that the majority of diseases are associated with metabolic disorders caused by improper nutrition. Proper nutrition ensures quality of life by supporting health, mood, work capacity, metabolism, and the full functioning of various organs and systems, while also helping to prevent many non-communicable diseases (NCDs).[1,2].

As far back as ancient times, Hippocrates said, “You are what you eat,” and also stated, “Let food be thy medicine, and medicine be thy food.” The great scholar Avicenna (Ibn Sina) recommended practices such as warm baths, massaging the body with oil, light exercise, walking, horseback riding, reading, a diet based on plant foods and dairy (especially goat and mare’s milk), red wine in moderation, mild laxatives, and a calm lifestyle as means of prolonging life [4]. Certain cultures, such as the Zerbels and Abkhazians, attributed longevity to specific dietary habits, including consuming eggs, chicken, leafy and wild plants, low-calorie foods, and herbal teas, while Leonardo da Vinci noted that excessive calcium intake could accelerate aging [5;6;7].

The quality of nutrition significantly impacts human health and life. Experience shows that neglecting dietary principles is one of the most common mistakes. Daily food intake should meet the body’s vitamin and mineral needs. Overconsumption of any nutrient can lead to adverse effects. Excessive consumption of high-energy foods, saturated fats, sugar, or salt, combined with insufficient intake of

fruits, vegetables, and whole grains, disrupts metabolism and contributes to chronic non-communicable diseases such as obesity, diabetes, cardiovascular diseases, hypertension, stroke, and certain cancers, reducing work capacity and increasing premature mortality [2;9;10].

A monotonous diet reduces appetite, diminishes the pleasure of eating, and negatively affects dietary habits, ultimately harming the body. Regularly consuming a variety of foods—including fruits, vegetables, meat and dairy products—promotes both physical health and mental well-being. For proper cellular function, the body requires a balanced intake of carbohydrates, fats, proteins, vitamins, and minerals. Periodic rest is also essential, as the intestinal walls can accumulate between 3 and 25 kilograms of waste.[11].

In many cases, when prescribing medications, it is important to choose an appropriate diet to maintain drug bioavailability and avoid undesirable side effects. Improper nutrition during illness can affect treatment outcomes, worsen organ-specific conditions, and lead to relapses. For example, excess sodium in the diet raises blood pressure, animal fats contribute to atherosclerosis, and poorly digestible foods can exacerbate gastrointestinal disorders [9].

An improper diet can inactivate medications, as seen when calcium-rich foods (e.g., curd, kefir, milk) are consumed with tetracyclines, forming indigestible complexes. Meanwhile, consuming vegetables and fruits can regulate bowel function, provide essential macro- and microelements, phytoncides, essential oils, and aromatic compounds, and support digestive

enzyme activity and lactation. Potassium deficiency can be corrected with dried apricots, raisins, beets, apples, pumpkins, and dried fruits. Iron-rich foods (strawberries, apricots, apples, beets, pomegranate) combined with ascorbic acid enhance the effectiveness of anti-anemic drugs. Watermelon is recommended for urinary tract and kidney inflammation, while low-calorie vegetables (cabbage, carrots, radish, cucumber, tomato, eggplant, pumpkin) reduce caloric intake, prevent cholesterol absorption, facilitate its elimination, and regulate bowel movements [2; 11].

Selecting proper therapeutic nutrition can significantly enhance drug bioavailability. Excessive consumption of processed, packaged, refined, fried, high-fat foods and carbonated sweet drinks causes additional strain on the digestive system and other organs. Healthy nutrition requires not only high-quality, ecologically clean foods but also adherence to proper dietary schedules and lifestyle habits. The digestive system aids in nutrient absorption and interacts directly with the excretory system. Eating while standing, rushing, or eating too quickly can cause digestive problems.

Proper chewing and mastication are essential in a healthy diet. Thoroughly chewing and moistening food with saliva aids digestion and reduces energy expenditure for the digestive process. Proper chewing increases saliva production, which supports stomach enzyme activity. Consuming cold foods and drinks can weaken enzyme function, while excessively hot foods and beverages can stop enzyme secretion and damage the stomach. A proper diet supports healthy digestion, mental well-being, and physical vigor. Eating too quickly disrupts digestion and may lead to overeating, as satiety is controlled by the brain rather than the stomach. Reducing food portion size by 1.5–2 times can improve health outcomes. Daily meals should be divided into 3–6 small portions, with adjustments for longer daylight in summer.

Caloric intake is critical. Consuming more calories than needed leads to fat accumulation, obesity, and the development of related diseases. Nutritional requirements should be adjusted according to lifestyle: physically active individuals burn more calories, while sedentary individuals require carefully planned meals with controlled energy content to maintain optimal health [10].

When planning the daily diet of individuals engaged in mental work, the following guidelines are followed. Physical labor requires a higher food intake. If an adolescent is experiencing rapid growth in height and body weight, the quantity of food should be increased accordingly. Maintaining balance and appropriate portion sizes is impossible without adhering to a structured eating schedule. From a physiological perspective, consuming meals four times a day is considered optimal. Dinner should be taken at least two hours before sleep [11].

In terms of energy distribution, the daily intake should be divided as follows: breakfast – 25%, lunch – 35%, snack – 15%, and dinner – 25%. The total daily energy intake is approximately 2400–2500 kcal, with 1200–1400 kcal from carbohydrates, 720–810 kcal from fats, and 400–460 kcal from proteins. In a moderately restricted diet, the average daily intake is: protein 70–80 g, fat 80–90 g, and carbohydrates 300–350 g. Animal protein should account for at least 50%

of total protein intake, with half of this amount coming from dairy protein. One-fourth of the daily fat intake should come from butter, one-fourth from vegetable oils, and the remaining half from fats naturally present in foods and culinary fats (e.g., margarine). Sugar should constitute approximately 15% of total carbohydrate intake, and at least 25% of carbohydrate consumption should come from potatoes, vegetables, and fruits (about 80–100 g). Additionally, the daily intake should include 2 g of essential fatty acids and 25 g of dietary fiber.

Regarding meal composition, breakfast should avoid processed meats (sausage, salami, ham), canned foods, fruit juices (especially sour orange or grapefruit), coffee, overly sweet foods, and cold products, as these are not compatible with a healthy diet. Optimal breakfast foods include plenty of water, hot tea, cheese, a small amount of butter, honey, milk-based cereals (oatmeal, buckwheat, etc.), eggs (boiled, scrambled, omelet, etc.), and whole-grain bread. Lunch should include soups and main dishes made from meat, fish, poultry (occasionally), mushrooms, and vegetables. Dinner should consist of light snacks, salads, yogurt, and milk products. Meals consumed after 6 p.m. or late at night are poorly digested during sleep and can lead to bloating, fatigue, weakness, and nausea the next day.

One of the major factors disrupting proper nutrition is stress. Stress causes significant metabolic changes. For instance, during fat metabolism, mobilization of fat from adipose tissue occurs, increasing triglycerides and free fatty acids in the blood, which are then burned for energy. Cholesterol synthesis in the liver increases 2.5-fold, and excessive fatty acids accumulate in organs, leading to hepatic fat infiltration. Carbohydrate metabolism is also affected: glycolysis and glycogenolysis accelerate, insulin secretion from pancreatic β -cells decreases (hypoinsulinemia), blood glucose increases, and conversion of glucose to fatty acids accelerates, resulting in fat deposition.

Stress increases the body's demand for vitamins 2–3 times, particularly B-complex vitamins. Vitamin B1 participates in acetylation of choline in cell phosphatides. Vitamin B2 prevents adrenal hyperplasia caused by stress [10]. Vitamin B6 deficiency impairs myelin lipid synthesis, and the requirement for vitamin E increases. Stress also increases the need for minerals, especially potassium and copper. During stress, consumption of meat and meat products, sugar, and grain-based foods (various types of bread, pastries, excluding buckwheat and oats, cakes, biscuits, chocolates) negatively affects overall health. ****Antistress nutrients**** include amino acids (methionine, tryptophan, tyrosine, glutamine), dietary fiber (cellulose, pectin), vitamins (B1, B2, B6, PP, E), and minerals (Ca, K, Fe, Cu, Mn) [11; 12].

When selecting a diet, it is essential to consider a person's age. Improper nutrition can accelerate premature aging, making it particularly important to carefully plan the diets of elderly individuals. Older adults should take into account potential digestive difficulties, maintain consistent meal times, and regulate portion sizes and caloric intake—especially fats, carbohydrates, sweets, and other high-starch foods [13].

It is recommended to increase the intake of biologically active substances, such as vitamins, trace elements, phosphatides, and amino acids, and to enrich meals with natural anti-sclerotic compounds. Long gaps between meals should be avoided. Elderly individuals should minimize consumption of rice, pasta, legumes, cream, sour cream, salty fatty cheeses, egg yolks, sorrel, spinach, sugar, confectionery, fatty ice cream, chocolate, and creamy desserts. Conversely, to maintain health, they should prioritize breads and baked goods (wheat and rye bread, bran porridge, cookies with soy flour or seaweed), low-fat dairy products, lean meats, poultry, and fish, as well as 2–4 lightly cooked eggs per week.

Among all foods, water is the most essential for health. Water is vital for life and as important as the air we breathe. Rich in minerals, water plays a crucial role in the body's biochemical reactions. It helps regulate body temperature, supports digestion, and facilitates the elimination of harmful substances. Daily fluid intake should be at least 2–3 liters. Drinking a glass of water upon waking is beneficial. Water should be consumed about 30 minutes before meals, but not during or immediately after eating. Developing the habit of drinking 2–3 liters of plain water daily—initially sipping 30 grams every half hour during the first month—is considered an effective therapeutic approach. In cases of fever, pain, mental or physical fatigue, or stress, one should refrain from eating, consume food only when hungry, and drink a glass of lukewarm water 10–15 minutes before meals as a regular practice [14].

Drinking water during meals or immediately afterward is not recommended, as water leaves the stomach within 10–15 minutes, washing away gastric juices and disrupting digestion. It is better to drink water 30 minutes after fruits, 2 hours after starchy foods, and 4 hours after protein-rich foods.

Salt intake should be reduced in the diet, and completely avoided in cardiovascular diseases. Table salt contains only two trace elements—sodium and chloride—whereas sea salt contains 64 trace elements beneficial to the body. Onion, garlic, sorrel, and radish can serve as alternatives to table salt.

Proper digestion occurs only when the diet is correctly structured, making it essential to understand which foods can be combined. Professor Herbert Shelton identified incompatible food combinations to prevent digestive conflicts. He recommended that protein-rich foods—such as nuts, meat, eggs, and other protein sources—should not be eaten simultaneously with carbohydrate-rich foods like bread, potatoes, pastries, or sweet fruits. For example, eggs, fish, milk, and cheese can be consumed at one time, while bread, porridge, or noodles can be eaten at another [15].

Carbohydrate-rich foods should not be eaten with acidic foods; for example, bread, potatoes, legumes, bananas, and dates should not be combined with tomatoes, lemons, oranges, kiwis, tangerines, feijoa, pineapple, and other acidic fruits. Fats should not be consumed together with proteins—such as cream, butter, sour cream, or vegetable oils with meat, eggs, cheese, or nuts—because such combinations inhibit gastric secretion. Similarly, acidic fruits like oranges, lemons, tangerines, feijoa, kiwis, sour apples, sour

plums, tomatoes, pineapples, and cherries should not be eaten with protein-rich foods like meat, cheese, nuts, or eggs.

Starchy foods should not be combined with sugars—such as jam, fruit, buttered sugar, syrup, porridge, or potatoes—as this leads to fermentation in the intestines. Starch-rich foods should be eaten separately, as combining two types of starchy foods (e.g., potatoes or porridge with bread) interferes with digestion. Fats should not be eaten simultaneously with proteins, as they slow gastric juice secretion. Milk is an exception: after being transformed into yogurt, curd, ayran, whey, or cheese, it can be consumed more safely, since the fat in milk temporarily inhibits gastric juice but is digested in the duodenum rather than the stomach. Foods consumed simultaneously with milk are not properly digested, as the stomach does not secrete enzymes in response to milk.

Therefore, for proper nutrition, it is crucial to avoid monotonous, incompatible, or repetitive combinations. Meal planning should be done in advance, taking into account which foods, vegetables, and fruits will be consumed throughout the week. Proper nutrition also plays a vital role alongside pharmacotherapy in preventing and treating diseases. Improper nutrition contributes to the development of many pathologies and can significantly influence the course of treatment. Consequently, ensuring a diet that is ecologically clean, high-quality, and properly scheduled is one of the most important aspects of modern health preservation and disease prevention.

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