

The interplay of nutrition, human health, and chronic disease: a comprehensive understanding

Dr. Ch. Sudhakar, Dr. Salluri Udaya Laxmi, Dr. Md. Moulana Kareem and Dr. G. Veeranna

Department of Chemistry SR & BGNR Govt. Arts and Science College (A), Khammam, Telangana, India-507002

Email: udayasalluri2@gmail.com

Manuscript details:

Available online on <http://www.ijlsci.in>

ISSN: 2320-964X (Online)

ISSN: 2320-7817 (Print)

Cite this article as:

Dr. Ch. Sudhakar, Dr. Salluri Udaya Laxmi, Dr. Md. Moulana Kareem and Dr. G. Veeranna (2026) The interplay of nutrition, human health, and chronic disease: a comprehensive understanding, *Int. J. of Life Sciences*, Special Issue, A22, 113-116.

<https://doi.org/10.5281/zenodo.21312446>

Article published in the Special Issue of the Two-Day National Seminar on **Emerging Frontiers in Multidisciplinary Research in Life Sciences (EFMRLS-2026)**, held on 25th & 26th March 2026. Organized by the Departments of Zoology and Botany, Nukala Ramachandra Reddy (NRR) Government Degree College (Autonomous), Mahabubabad-506101, TS, India.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International

License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third-party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>

ABSTRACT

Dietary habits are the primary modifiable risk factors for non-communicable diseases (NCDs), which account for approximately 41 million deaths annually. According to the World Health Organization (WHO), the world faces a "double burden" of malnutrition, the coexistence of under nutrition and overweight (obesity). Rapid urbanization and market globalization have transitioned many populations toward diets high in processed foods and added sugars, significantly increasing the prevalence of diabetes, cardiovascular disease (CVD), and stroke etc., A healthy diet is defined by the WHO through four core principles, adequacy, balance, moderation, and diversity. Key components include-Macronutrients Carbohydrates, proteins and fats must be consumed in appropriate proportions to support physiological needs without excess. Micronutrients essential vitamins and minerals like iron, vitamin B12, calcium prevent developmental failure and loss of body functions. Phytochemical compounds in fruits, vegetables, and spices like turmeric and garlic possess antioxidant and anti-inflammatory properties that combat cellular stress. Diet quality impacts health at three critical levels of prevention. Primary Prevention, reducing the risk of developing conditions like heart disease and cancer through fiber-rich plant-based diets. Secondary Prevention, using nutrition literacy to manage existing conditions like hypertension and high cholesterol through informed food choices. Tertiary Prevention, managing complications of chronic diseases and adhering to treatment plans through specialized medical nutrition. A healthy diet remains the cornerstone of longevity and disease prevention. This Review article understands the relationship between nutritional intake and the management of chronic conditions, emphasizing the shift from nutrient-specific studies to holistic dietary patterns. It explores the roles of essential nutrients, phytochemicals, and the gut microbiome in maintaining health and preventing metabolic dysregulation.

Keywords: Dietary habits, non-communicable diseases (NCDs), Macronutrients, Micronutrients, Phytochemicals.

INTRODUCTION

Non-communicable diseases (NCDs) are the leading cause of mortality globally. The World Health Organization (2023) reports (WHO, 2023) that NCDs account for nearly 74% of global deaths. Cardiovascular diseases, diabetes, cancer, and chronic respiratory diseases dominate this burden (Mozaffarian, 2016). Dietary habits are among the most significant modifiable risk factors contributing to NCD development. Industrialization and urbanization have reshaped food systems, promoting increased consumption of processed and energy-dense foods while reducing intake of whole grains, fruits, and vegetables. This nutritional transition has contributed to obesity, insulin resistance, hypertension, and dyslipidemia. Understanding the complex interplay between nutrition and chronic disease is essential for preventive medicine and public health policy.

Components of a Healthy Diet

Macronutrients: Carbohydrates, proteins and fats are macronutrients, provide energy and structural support for bodily functions (Willett et al., 2019).

Carbohydrates: Carbohydrates serve as the primary energy source. Whole grains and complex carbohydrates support glycemic control, whereas excessive intake of refined sugars increases the risk of obesity and type 2 diabetes.

Proteins: Proteins are essential for tissue repair, enzyme synthesis, and immune function. Both plant and animal sources contribute to adequate intake. Protein deficiency can impair immune competence and muscle integrity (Ludwig and Willett, 2019).

Fats: Dietary fats are crucial for hormone production and cellular function. Unsaturated fats, particularly omega-3 fatty acids, support cardiovascular health. In contrast, high intake of saturated and trans fats promotes atherosclerosis and inflammation (Afshin et al., 2019).

Micronutrients: Micronutrients, though required in small quantities, are essential for metabolic regulation and disease prevention.

Iron deficiency leads to anemia, vitamin B12 deficiency contributes to neurological impairment, and inadequate calcium and vitamin D intake predisposes individuals to osteoporosis. Despite food abundance in many regions, micronutrient deficiencies remain prevalent due to poor diet quality.

Phytochemicals: Phytochemicals are bioactive compounds present in plant-based foods. They act as scavengers, neutralizing free radicals (unstable molecules) before they can damage our DNA or cell membranes. This cellular protection is why diets high in plants are consistently linked to lower rates of heart disease and cancer. Curcumin in turmeric and allicin in garlic exhibit antioxidant and anti-inflammatory properties (Satija and Hu, 2018). These compounds mitigate oxidative stress, a key contributor to chronic disease progression (Schwingshackl et al. 2017).

Nutrition and Levels of Disease Prevention

Primary Prevention: Primary prevention aims to reduce disease risk before onset. Diets rich in fiber, fruits, vegetables, and whole grains have been shown to lower cardiovascular and cancer risk (Slavin, 2013). The Mediterranean dietary pattern demonstrates significant cardio protective benefits (Estruch et al., 2013).

Healthy Diet → Improved Metabolism → Reduced Risk Factors → Disease Prevention

Secondary Prevention: Secondary prevention focuses on managing existing conditions to prevent progression. Nutritional interventions such as the DASH diet for hypertension and glycemic control strategies for diabetes improve clinical outcomes. The DASH diet (Dietary Approaches to Stop Hypertension) is a balanced eating plan designed to lower high blood pressure and reduce the risk of several chronic diseases. It emphasizes whole foods rich in nutrients that naturally regulate blood pressure, such as potassium, calcium, magnesium and fiber. Glycemic control strategies for diabetes focus on maintaining blood glucose levels within a target range to prevent long-term complications like nerve, kidney and eye damage.

Disease Diagnosis → Nutrition Intervention → Slowed Disease Progression

Tertiary Prevention: Tertiary prevention minimizes complications in advanced disease states. Medical nutrition therapy is essential for chronic kidney disease, advanced diabetes, and post-cardiac event recovery. Chronic Disease → Specialized Nutrition Therapy → Improved Quality of Life

The Role of the Gut Micro biome

Dysbiosis is a condition where the natural balance of microorganisms collectively known as the micro biome within or on our body is disrupted. It most commonly refers to an imbalance in the gastrointestinal tract, where beneficial "good" bacteria are outnumbered or overshadowed by harmful "bad" bacteria. Dysbiosis can be triggered by external "stressors" such as antibiotic use, high-sugar diets, chronic stress, or excessive alcohol consumption. When the microbiome is out of sync, it can weaken the immune system and damage the intestinal barrier, leading to "leaky gut" and systemic inflammation. Common symptoms include bloating, gas, diarrhea, and fatigue. If left untreated, chronic dysbiosis is linked to several long-term conditions, including irritable bowel syndrome (IBS) and Inflammatory Bowel Disease (IBD), Obesity and Type 2 diabetes, Skin problems (acne, eczema), autoimmune diseases, and even mental health challenges like anxiety or depression (Turnbaugh et al., 2006). Emerging evidence highlights the importance of the gut micro biome in regulating immune and metabolic processes. Dietary fiber promotes beneficial gut bacteria that produce short-chain fatty acids (SCFAs), which reduce systemic inflammation and enhance insulin sensitivity.

Shift Toward Holistic Dietary Patterns

Modern nutrition science increasingly emphasizes dietary patterns rather than isolated nutrients. Evidence supports plant-based, Mediterranean, and DASH dietary approaches for reducing chronic diseases risk (Hu, 2002; Tilman and Clark, 2014). These patterns incorporate diversity, balance, and moderation consistent with global dietary guidelines.

DISCUSSION

Globalization has accelerated a "nutrition transition" where traditional, fiber-rich diets are replaced by affordable, energy-dense, and ultra-processed foods. This shift, combined with rapid urbanization and sedentary

lifestyles, is a primary driver of the global rise in non-communicable diseases (NCDs) like type 2 diabetes, cardiovascular conditions, and certain cancers etc., Addressing these risks requires a multi-layered approach involving policy, regulation, and education. Implementing taxes on sugar-sweetened beverages and tobacco has proven highly cost-effective in reducing consumption. Creating "health-in-all-policies" to improve the availability and affordability of nutritious foods like fruits, vegetables, and whole grains. Simplified, color-coded systems (e.g., traffic light labels) help consumers quickly identify healthier options at the point of purchase. Mandating clear declarations of salt, sugar, and trans fats helps curb deceptive marketing and empowers informed decision-making. Embedding nutrition education in school curricula and workplace programs builds lifelong healthy habits. Strengthening "critical nutrition literacy" enables individuals to navigate complex food environments and resist misleading health claims.

Targeting dietary quality through these interventions is often "cost-saving" rather than just cost-effective. For instance, reducing salt content in manufactured foods can significantly lower population blood pressure at a minimal cost per person. By shifting the focus from high-cost clinical treatments to upstream primary prevention, governments can reduce long-term healthcare expenditures, minimize productivity losses, and substantially improve overall population longevity.

CONCLUSION

Nutrition plays a central role in chronic disease prevention and management. Macronutrients, micronutrients, phytochemicals, and gut microbiota collectively influence metabolic health. A holistic dietary approach grounded in adequacy, balance, moderation, and diversity remains fundamental to reducing the global burden of NCDs. Preventive nutrition should be prioritized within healthcare systems to promote longevity and sustainable public health outcomes.

Conflict of Interest: The authors declare no conflict of interest in relation to this research.

Data Availability Statement: Not applicable.

Correspondence and requests for materials should be addressed to **Dr. Ch. Sudhakar**

Peer review information

IJLSCI thanks the anonymous reviewers for their contribution to the peer review of this work. A peer review file is available.

World Health Organization (2023) Noncommunicable diseases.

Available at: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>

Reprints and permissions information is available at <https://www.ijlsci.in/reprints>

© The Author(s) 2026

REFERENCES

- Afshin A, et al (2019) Health effects of dietary risks in 195 countries, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet* 393(10184): 1958–1972. doi:10.1016/S0140-6736(19)30041-8
- Estruch R, Ros E, Salas-Salvadó J, et al (2013) Primary prevention of cardiovascular disease with a Mediterranean diet. *New England Journal of Medicine* 368(14): 1279–1290. doi:10.1056/NEJMoa1200303
- Hu FB (2002) Dietary pattern analysis: A new direction in nutritional epidemiology. *Current Opinion in Lipidology* 13(1): 3–9. doi:10.1097/00041433-200202000-00002
- Ludwig DS, Willett WC (2019) Three daily servings of reduced-fat milk: An evidence-based recommendation? *New England Journal of Medicine* 381(21): 2034–2036.
- Mozaffarian D (2016) Dietary and policy priorities for cardiovascular disease, diabetes, and obesity: A comprehensive review. *Circulation* 133(2): 187–225. doi:10.1161/CIRCULATIONAHA.115.018585
- Satija A, Hu FB (2018) Plant-based diets and cardiovascular health. *Trends in Cardiovascular Medicine* 28(7): 437–441. doi:10.1016/j.tcm.2018.02.004
- Schwingshackl L, Hoffmann G, et al (2017) Adherence to Mediterranean diet and risk of cancer. *Nutrients* 9(10): 1063. doi:10.3390/nu9101063
- Slavin J (2013) Fiber and prebiotics: Mechanisms and health benefits. *Nutrients* 5(4): 1417–1435. doi:10.3390/nu5041417
- Tilman D, Clark M (2014) Global diets link environmental sustainability and human health. *Nature* 515(7528): 518–522. doi:10.1038/nature13959
- Turnbaugh PJ, Ley RE, et al (2006) An obesity-associated gut microbiome with increased capacity for energy harvest. *Nature* 444(7122): 1027–1031. doi:10.1038/nature05414
- Willett W, et al (2019) Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet* 393(10170): 447–492. doi:10.1016/S0140-6736(18)31788-4

Publisher's Note

IJLSCI remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.