

# Epidemiological Transition in India: A Comparative Analysis of Undernutrition, Obesity, Diabetes, and Hypertension Using NFHS and Who Data (1992–2021)

Dr. Annem Srinivas Reddy<sup>1\*</sup>, Dr. Rama Vemula<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Zoology, Government Degree College, Parkal, Kakatiya University, Warangal, Tealngana, India

<sup>2</sup>Lecturer in Zoology, Dept. of Zoology, Telangana Social Welfare Residential Degree College for Women, Warangal West, Kakatiya University, Warangal, Telangana, India.

---

## ABSTRACT

India has undergone a profound epidemiological and nutritional transition over the past three decades, shifting from a dominance of undernutrition and communicable diseases to a growing burden of overnutrition and non-communicable diseases (NCDs). This study presents a comprehensive comparative analysis of trends in undernutrition, overweight/obesity, diabetes, and hypertension using data from the National Family Health Survey (NFHS-1 to NFHS-5, 1992–2021) and global estimates from the World Health Organization (WHO). A secondary data analysis approach was adopted to evaluate temporal changes and identify patterns across population groups. The findings reveal a consistent decline in undernutrition, with underweight prevalence among women decreasing from approximately 36% in NFHS-1 to about 19% in NFHS-5 (IIPS, 1995; IIPS & ICF, 2021). In contrast, overweight and obesity have increased substantially, rising from nearly 10% to over 24% during the same period (Sharma et al., 2025). Biomarker data introduced in NFHS-4 indicate a rapid rise in diabetes and hypertension, with prevalence nearly doubling within a short period (IIPS & ICF, 2017). WHO estimates corroborate these findings, highlighting a global increase in metabolic disorders and identifying India as a major contributor to the global NCD burden (WHO, 2022). The study demonstrates a clear “double burden of malnutrition,” where undernutrition persists among disadvantaged populations while overnutrition and NCDs rise among urban and affluent groups (Popkin, 2001; Kapoor et al., 2023). This article concludes that integrated public health strategies focusing on both nutritional improvement and NCD prevention are essential for achieving sustainable health outcomes.

**Keywords:** Undernutrition, Obesity, Diabetes, Hypertension, NFHS (National family health survey), WHO, Epidemiological Transition.

---

## INTRODUCTION

India’s public health landscape has undergone a dramatic transformation over the last three decades, reflecting broader socio-economic and demographic changes. In the early 1990s, the country’s primary health concerns were dominated by undernutrition, infectious diseases, and maternal and child health issues, with a high prevalence of underweight individuals and micronutrient deficiencies (International Institute for Population Sciences [IIPS], 1995). These challenges were particularly pronounced among rural populations and economically disadvantaged groups.

However, rapid economic growth, urbanization, globalization, and changes in lifestyle have significantly altered India’s disease profile. The country is now witnessing a steady increase in overnutrition and non-communicable diseases (NCDs), including obesity, diabetes, and hypertension (Misra & Khurana, 2008; Popkin, 2001). This shift is driven by increased consumption of energy-dense foods, reduced physical activity, and sedentary behavior associated with urban living (Ng et al., 2014).

The coexistence of undernutrition and overnutrition has given rise to the concept of the “double burden of malnutrition,” which is now a defining feature of India’s health scenario (Kapoor et al., 2023). While undernutrition continues to affect vulnerable populations, obesity and related metabolic disorders are increasing among urban and higher-income groups, creating a complex public health challenge (Jindal et al., 2025).

The National Family Health Survey (NFHS), conducted in five rounds between 1992–93 and 2019–21, provides a valuable dataset for examining these trends. Early rounds (NFHS-1 to NFHS-3) primarily focused on maternal and child health indicators, whereas later rounds (NFHS-4 and NFHS-5) incorporated biomarker measurements, enabling the estimation of diabetes and hypertension prevalence (IIPS & ICF, 2017; IIPS & ICF, 2021).

In addition to national data, the World Health Organization (WHO) provides global estimates that contextualize India’s transition within broader international trends. WHO reports indicate that NCDs account for nearly 74% of global deaths, with low- and middle-income countries bearing a disproportionate burden (WHO, 2022). India, as a rapidly developing nation, reflects these global patterns of rising metabolic disorders.

Based on NFHS and WHO data, India’s epidemiological transition can be categorized into three phases:

- Phase 1 (1992–2006): Dominance of undernutrition
- Phase 2 (2015–16): Emergence of NCD measurement
- Phase 3 (2019–21): Double burden of malnutrition

This study aims to provide a comprehensive comparison of NFHS and WHO data to better understand India’s evolving public health challenges.

### METHODOLOGY

This study employs a secondary data-based analytical design to examine India’s epidemiological and nutritional transition over nearly three decades. The analysis is based on nationally representative datasets and global health estimates, allowing for both country-specific insights and international comparison (IIPS & ICF, 2021; WHO, 2022). Secondary data analysis is appropriate for identifying long-term trends and patterns in large populations without the need for primary data collection. By integrating multiple datasets, the study captures the shift from undernutrition to an increasing burden of non-communicable diseases (NCDs), reflecting broader socio-economic and lifestyle changes in India.

The primary data sources include all five rounds of the National Family Health Survey (NFHS), conducted between 1992 and 2021, namely NFHS-1 (1992–93), NFHS-2 (1998–99), NFHS-3 (2005–06), NFHS-4 (2015–16), and NFHS-5 (2019–21) (IIPS, 1995; IIPS & ICF, 2021). These surveys provide comprehensive information on health, nutrition, and demographic indicators across India. In addition, global and India-specific estimates were obtained from the World Health Organization’s Global Health Observatory, which enables cross-country comparisons and trend validation (WHO, 2022). The study focuses on four key indicators: undernutrition (BMI <18.5 kg/m<sup>2</sup>), obesity (BMI ≥25 kg/m<sup>2</sup>), diabetes (blood glucose >140 mg/dL), and hypertension (blood pressure ≥140/90 mmHg). These indicators were selected to represent both traditional nutritional challenges and emerging lifestyle-related health risks.

A comparative trend analysis was conducted to assess changes in these indicators over time and across datasets (NFHS vs WHO), supported by descriptive statistics (GBD, 2019). Trends were examined across different time periods to identify patterns of increase or decline, and findings were interpreted within the framework of epidemiological transition. However, certain limitations must be considered. Biomarker data for diabetes and hypertension were not available before NFHS-4, restricting long-term comparison for these conditions. Additionally, WHO estimates are based on modeled data, which may differ from direct survey findings. The cross-sectional nature of NFHS data also limits causal interpretation. Despite these constraints, the combined use of national and global datasets provides a reliable and comprehensive understanding of India’s evolving health scenario.

### RESULTS

The following tables present the compiled findings from NFHS rounds (1992–2021) and corresponding WHO global and India-specific estimates, followed by phase-wise and public health interpretation summaries.

**Table 1. NFHS Trends — India, 1992–2021**

Indicator	NFHS-1 (1992–93)	NFHS-2 (1998–99)	NFHS-3 (2005–06)	NFHS-4 (2015–16)	NFHS-5 (2019–21)	Trend
Underweight (%)	~36	~33	~33	~23	~19	↓ Declining
Overweight/Obesity (%)	~10	~12	~15	~21	~24	↑ Increasing
Diabetes (%)	NA	NA	NA	~2.9	~7–8	↑ Rapid rise
Hypertension (%)	NA	NA	NA	~14.4	~22–24	↑ Increasing

**Table 2. WHO Trends — Global & India Estimates, 1990–2021**

Indicator	1990	2000	2010	2020/21	Trend
Undernutrition (%)	~20	~18	~16	~14–16	↓ Declining
Obesity (%)	~2–3	~4	~6	~8–9	↑ Increasing
Diabetes (%)	~3–4	~5	~6–7	~8–9	↑ Doubling
Hypertension (%)	~20	~22	~24–25	~25–30	↑ Slight rise

**Table 3. NFHS vs WHO Direct Comparison**

Parameter	NFHS Findings	WHO Findings	Interpretation
Undernutrition	Declined (36% → 19%)	Declining globally	Improvement but still present
Obesity	Increased (10% → 24%)	3–4× increase globally	Rapid lifestyle change
Diabetes	Sharp rise after 2015	Nearly doubled globally	Emerging epidemic
Hypertension	Increased (14% → 24%)	High globally (~25–30%)	Major risk factor

**Table 4. Phase-wise Epidemiological Transition**

Phase	Period	Key Characteristics	Health Pattern
Phase 1	1992–2006	High undernutrition	Low obesity, no NCD data
Phase 2	2015–16	Transition begins	NCDs emerge
Phase 3	2019–21	Double burden	High obesity + NCDs

**Table 5. Combined Trend Summary — NFHS and WHO**

Indicator	Early 1990s	2000s	2010s	2020s	Overall Trend
Undernutrition	High	Moderate	Declining	Lower but present	↓
Obesity	Low	Rising	Moderate	High	↑
Diabetes	Low	Increasing	Moderate	High	↑↑
Hypertension	Moderate	Stable	Increasing	High	↑

**Table 6. Public Health Interpretation by Indicator**

Indicator	Risk Level (1990s)	Risk Level (2020s)	Public Health Concern
Undernutrition	Very High	Moderate	Still critical
Obesity	Low	High	Emerging crisis
Diabetes	Low	High	Major epidemic
Hypertension	Moderate	High	Leading risk factor

## DISCUSSION

The present study provides a comprehensive analysis of India's epidemiological transition using data from NFHS (1992–2021) and WHO estimates. The findings clearly demonstrate a shift from undernutrition dominance to a dual burden of malnutrition and non-communicable diseases (NCDs), as summarized across Table 1, Table 2, Table 3, Table 4, Table 5, and Table 6. This transition reflects broader socio-economic, demographic, and lifestyle changes that have occurred in India over the past three decades.

### Decline in Undernutrition: Progress with Persistent Inequality

One of the most significant achievements highlighted in this study is the steady decline in undernutrition, particularly among women, as shown in Table 1 and further supported by global patterns in Table 2. The prevalence of underweight individuals decreased from approximately 36% in NFHS-1 to around 19% in NFHS-5 (IIPS, 1995; IIPS & ICF, 2021), which is also reflected in the declining trend summarized in Table 5 and the reduced risk level in Table 6.

This improvement can be attributed to several factors, including enhanced food security, expansion of public distribution systems, and targeted nutrition interventions such as the Integrated Child Development Services (ICDS) and POSHAN Abhiyaan (Kapoor et al., 2023). Despite this progress, undernutrition remains a major public health

concern, as emphasized in Table 3 (NFHS vs WHO comparison) and Table 6, particularly among rural populations, tribal communities, and economically weaker sections.

Studies have shown that regional disparities continue to persist, with higher rates of undernutrition in states with lower socio-economic development (Corsi et al., 2015). Furthermore, WHO estimates in Table 2 indicate that undernourishment remains prevalent in developing countries, suggesting that India's progress is part of a broader but incomplete global trend (WHO, 2022).

### **Rapid Rise in Obesity: Impact of Urbanization and Lifestyle Changes**

In contrast to declining undernutrition, this study reveals a significant increase in overweight and obesity across all NFHS rounds, as clearly illustrated in Table 1, Table 5, and the comparative insights in Table 3. Obesity prevalence among women has more than doubled, rising from around 10% in NFHS-1 to over 24% in NFHS-5 (IIPS & ICF, 2021), with risk levels escalating from low to high as shown in Table 6.

This trend is consistent with global patterns observed by WHO in Table 2 and supported by other studies (Ng et al., 2014). The rise in obesity can be largely attributed to rapid urbanization, sedentary lifestyles, and dietary transitions. Increased consumption of processed and high-calorie foods, coupled with reduced physical activity, has contributed to positive energy balance and weight gain (Popkin, 2001).

Additionally, socio-economic factors such as higher income, education, and media exposure have been positively associated with obesity, particularly among urban populations (Jindal et al., 2025). As highlighted in Table 4 (Phase-wise transition), this marks a critical shift from Phase 1 (low obesity) to Phase 3 (high obesity), representing a key stage in the nutrition transition where traditional diets are replaced by Westernized dietary patterns (Misra & Khurana, 2008).

### **Emergence and Escalation of Diabetes and Hypertension**

A major turning point in India's health surveillance system was the introduction of biomarker measurements in NFHS-4, which enabled the estimation of diabetes and hypertension prevalence at the national level, as reflected in Table 1 and the transition phases in Table 4 (IIPS & ICF, 2017).

The findings from NFHS-4 and NFHS-5 indicate a rapid increase in both conditions, with diabetes prevalence rising from approximately 2–3% to nearly 7–8%, and hypertension increasing from about 14% to over 22% within a short span of five years. These sharp increases are summarized in Table 5 and categorized as high-risk conditions in Table 6, while Table 3 highlights their emergence as major public health concerns.

These trends are consistent with WHO estimates presented in Table 2, which suggest that diabetes prevalence has nearly doubled globally since 1990, and hypertension remains one of the leading risk factors for cardiovascular diseases (WHO, 2022; Mills et al., 2020). India, in particular, is experiencing a disproportionate burden of NCDs due to its large population and rapid socio-economic changes (Anjana et al., 2017).

The rising prevalence of these conditions is closely linked to increasing obesity, as shown in Table 1 and Table 5, along with an aging population and lifestyle factors, including poor diet, physical inactivity, and stress (Gupta et al., 2019).

### **Double Burden of Malnutrition: A Complex Public Health Challenge**

One of the most critical findings of this study is the clear emergence of the double burden of malnutrition, as summarized in Table 4 (Phase 3) and Table 5, characterized by the simultaneous presence of undernutrition and overnutrition within the same population (Popkin, 2001). This phenomenon is further reinforced by the contrasting trends shown in Table 1 and interpreted in Table 6.

This pattern is particularly evident in India, where undernutrition persists among low-income and rural populations, while obesity and NCDs are rising among urban and affluent groups (Kapoor et al., 2023). As indicated in Table 3, this duality represents both progress and emerging risk.

The double burden is not only observed at the population level but also within households and individuals. For example, it is not uncommon to find undernourished children and overweight adults within the same household. This reflects inequalities in access to food, healthcare, and education, as well as differences in dietary patterns and lifestyle behaviors (Corsi et al., 2015). Addressing this dual challenge requires integrated and context-specific interventions, as policies focusing solely on undernutrition or overnutrition may fail to achieve desired outcomes.

### **NFHS vs WHO: Complementary Perspectives**

The comparison between NFHS and WHO data presented in Table 3 highlights the complementary nature of these data sources. NFHS provides detailed, nationally representative survey data, enabling micro-level analysis of health indicators within India, as seen in Table 1. In contrast, WHO offers global and longitudinal estimates, allowing for comparisons across countries and over time, as shown in Table 2 (WHO, 2022).

The consistency between NFHS findings and WHO estimates strengthens the validity of the observed trends summarized in Table 5 and interpreted in Table 6. Both datasets confirm: (i) a decline in undernutrition; (ii) an increase in obesity; and (iii) a rapid rise in diabetes and hypertension. However, differences in methodology must be considered. While NFHS relies on direct measurements, WHO data are often modeled estimates based on multiple sources (GBD, 2019). Despite these differences, the convergence of findings provides robust evidence of India's ongoing epidemiological transition across all phases outlined in Table 4.

### Public Health Implications

The findings of this study, as synthesized across Table 5 (Combined Trends) and Table 6 (Risk Interpretation), have significant implications for public health policy and planning. The rising burden of obesity and NCDs is likely to increase healthcare costs, strain healthcare infrastructure, and lead to higher rates of morbidity and premature mortality. At the same time, the persistence of undernutrition, as shown in Table 1 and Table 3, indicates that traditional public health challenges have not been fully resolved. This dual burden necessitates a shift from disease-specific approaches to comprehensive and integrated health strategies.

Overall, the findings across Tables 1–6 clearly demonstrate that India is undergoing an advanced stage of epidemiological transition. The simultaneous decline in undernutrition and rise in obesity, diabetes, and hypertension reflects the combined effects of economic development, urbanization, and lifestyle changes. The evidence strongly supports the conclusion that India is currently experiencing a double burden of malnutrition, requiring comprehensive, multi-sectoral public health interventions to ensure sustainable health outcomes.

### Policy and Programmatic Recommendations

Based on the findings, the following recommendations are proposed:

- Addressing India's epidemiological transition requires coordinated efforts at multiple levels.
- The government should strengthen primary healthcare systems to enable early community based screening and management of diabetes and hypertension.
- While implementing integrated policies that simultaneously address undernutrition and non-communicable diseases (Ministry of Health and Family Welfare, 2017; World Health Organization, 2022).
- Expanding national nutrition programs such as POSHAN Abhiyaan and regulating the consumption of unhealthy, processed foods are also essential (NITI Aayog, 2021; FAO, 2021).
- At the societal level, community-based initiatives, school health programs, and workplace wellness activities should promote healthy diets and regular physical activity, while also addressing socio-economic inequalities (UNICEF, 2020; Kapoor et al., 2023).
- At the individual level, adopting a balanced diet, engaging in regular exercise, undergoing routine health check-ups, and avoiding risk behaviors such as tobacco and excessive alcohol consumption are crucial for preventing obesity and NCDs (WHO, 2022; Gupta et al., 2019).

Overall, a comprehensive, multi-sectoral, and preventive approach is necessary to tackle the dual burden of malnutrition and ensure sustainable public health outcomes in India and Targeted Interventions: Focus resources on vulnerable populations to reduce socio-economic and regional inequalities.

## CONCLUSION

This study highlights the profound epidemiological and nutritional transition that India has undergone between 1992 and 2021, as evidenced by data from successive rounds of the National Family Health Survey and supported by global estimates. The findings clearly indicate a steady decline in undernutrition alongside a rapid rise in overweight, obesity, diabetes, and hypertension. While the reduction in undernutrition reflects progress in food security, public health interventions, and socio-economic development, the simultaneous increase in non-communicable diseases signals the emergence of new and complex health challenges.

The coexistence of undernutrition and overnutrition commonly referred to as the double burden of malnutrition has become a defining feature of India's current health scenario. This dual burden is not only evident across different population groups but also within the same communities and households, underscoring deep-rooted inequalities in access to nutrition, healthcare, and health awareness. The sharp increase in diabetes and hypertension, particularly after the introduction of biomarker measurements in recent surveys, further emphasizes the urgency of addressing lifestyle-related risk factors.

The comparative analysis of national survey data and global estimates confirms that India's transition is part of a broader global shift toward non-communicable diseases, driven by urbanization; dietary changes, and reduced physical activity. However, the scale and speed of this transition in India present unique challenges for the healthcare system. In conclusion, addressing India's evolving health burden requires a comprehensive and integrated approach that simultaneously tackles undernutrition and prevents the rise of NCDs. Strengthening primary healthcare systems, promoting healthy lifestyles, implementing early screening programs, and targeting vulnerable populations must be

prioritized. Such multi-sectoral strategies are essential to ensure sustainable health outcomes and to meet national and global health goals in the coming decades.

#### Disclaimer (Artificial intelligence)

The author affirm that no generative AI technologies, including large languages models (e.g. Chat GPT, Copilot) or text to image tools, were used in the preparation, analysis or editing of this manuscript. The data used in this study are derived from publicly available secondary sources, including the National Family Health Survey (NFHS) and the World Health Organization (WHO) Global Health Observatory. The authors are not responsible for the original data collection, quality, or reporting processes. The interpretations and conclusions presented in this article are solely those of the authors and do not necessarily reflect the views or policies of the institutions associated with NFHS, WHO, or any other affiliated organizations. Any errors or omissions remain the responsibility of the authors.

#### ACKNOWLEDGMENTS

The authors express their sincere gratitude to the International Institute for Population Sciences (IIPS), Mumbai, and the World Health Organization (WHO) for making their datasets publicly accessible, which greatly facilitated this research. The authors also acknowledge the contributions of researchers and field investigators involved in conducting the NFHS surveys and compiling global health estimates. Their efforts in data collection and dissemination have significantly contributed to advancing public health research and policy analysis.

#### Competing Interests

The authors declare that there are no competing interests, financial or non-financial, that could have influenced the outcomes of this study. The research was conducted independently, and no external funding or sponsorship was received that could create a potential conflict of interest.

#### REFERENCES

- [1] International Institute for Population Sciences (IIPS). (2000). *NFHS-2 (1998–99): India*. Mumbai: IIPS.
- [2] International Institute for Population Sciences (IIPS). (2007). *NFHS-3 (2005–06): India*. Mumbai: IIPS.
- [3] International Institute for Population Sciences (IIPS) & ICF. (2017). *NFHS-4 (2015–16): India*. Mumbai: IIPS.
- [4] International Institute for Population Sciences (IIPS) & ICF. (2021). *NFHS-5 (2019–21): India*. Mumbai: IIPS.
- [5] World Health Organization. (2016). *Global report on diabetes*. Geneva: WHO.
- [6] World Health Organization. (2021). *Hypertension fact sheet*. Geneva: WHO.
- [7] World Health Organization. (2022). *Global health estimates 2022*. Geneva: WHO.
- [8] World Health Organization. (2019). *Noncommunicable diseases country profiles*.
- [9] World Health Organization. (2020). *Global health observatory data repository*.
- [10] Popkin, B. M. (2001). The nutrition transition and obesity in the developing world. *Journal of Nutrition*, 131(3), 871S–873S.
- [11] Omran, A. R. (1971). The epidemiologic transition. *Milbank Memorial Fund Quarterly*, 49(4), 509–538.
- [12] Misra, A., & Khurana, L. (2008). Obesity and metabolic syndrome in developing countries. *Journal of Clinical Endocrinology & Metabolism*, 93(11), S9–S30.
- [13] Sharma, R., et al. (2025). Trends and determinants of obesity in India. *BMC Public Health*, 25, 480.
- [14] Ng, M., et al. (2014). Global prevalence of overweight and obesity. *The Lancet*, 384(9945), 766–781.
- [15] Swinburn, B. A., et al. (2011). Global obesity pandemic. *The Lancet*, 378(9793), 804–814.
- [16] Anjana, R. M., et al. (2017). Prevalence of diabetes in India. *The Lancet Diabetes & Endocrinology*, 5(8), 585–596.
- [17] International Diabetes Federation. (2021). *IDF Diabetes Atlas (10th ed.)*.
- [18] Gupta, R., et al. (2019). Epidemiology of diabetes in India. *Journal of Diabetes*, 11(4), 271–279.
- [19] Gupta, R. (2019). Trends in hypertension in India. *Journal of Human Hypertension*, 33, 575–587.
- [20] Mills, K. T., et al. (2020). Global disparities in hypertension. *Circulation*, 141(9), 750–761.
- [21] Jindal, H., et al. (2025). Malnutrition dichotomy in India. *Dialogues in Health*.
- [22] Kapoor, R., et al. (2023). Malnutrition and NCDs in India. IFPRI POSHAN.
- [23] Corsi, D. J., et al. (2015). Socioeconomic gradients in NCDs in India. *PLOS Medicine*.
- [24] Global Burden of Disease Study. (2019). Global health data. *The Lancet*.
- [25] Ministry of Health and Family Welfare. (2017). *National Health Policy*. Government of India.
- [26] NITI Aayog. (2021). *National Nutrition Strategy*.
- [27] UNICEF. (2020). *State of the World's Children*.
- [28] FAO. (2021). *State of Food Security and Nutrition in the World*.
- [29] World Bank. (2020). *World Development Indicators*.