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ARTICLE

India's Changing Diet: Millets, Processed Foods, and the Nutrition Crisis

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Abstract

Background: India's dietary landscape has shifted markedly over the past decade, marked by a decline in traditional staples and a rapid rise in ultra-processed food (UPF) consumption. While policy-driven efforts have attempted to revive millets for their nutritional and ecological benefits, these initiatives face stiff competition from the growing demand for convenience-based, energy-dense foods.
Methods: This study employed a mixed-methods approach, drawing on nationally representative datasets (NSSO, CNNS, NFHS, IFPRI) and qualitative literature from academic, policy, and limited media sources. Quantitative analysis tracked trends in cereal and UPF consumption, nutrition indicators (stunting, overweight), and household food expenditure (2011–2025). Thematic coding of qualitative data explored consumer behavior, policy interventions, and regional disparities.
Results: Between 2015 and 2023, household spending on UPFs nearly doubled from 6.5% to 12%, while per capita millet consumption rose modestly from 2.1 kg/year to 3.3 kg/year. Despite these gains, child stunting remains high at 35.5%, and adult overweight rates have nearly doubled, particularly in urban areas. Only 28% of adults meet dietary diversity guidelines, and added sugar intake among children far exceeds WHO recommendations.
Discussion: Urbanization, income growth, and changing lifestyles are accelerating India's nutrition transition. While millet promotion policies show some promise, especially in states with supportive procurement and public distribution systems, barriers such as price, taste, and culinary unfamiliarity hinder broader adoption. In contrast, UPFs benefit from aggressive marketing and accessibility. The resulting double burden of malnutrition underscores the need for coordinated, multisectoral interventions.
Conclusion: India's food system is at a crossroads. Combating the dual challenge of undernutrition and diet-related non-communicable diseases demands robust regulatory action (e.g., sugar taxes), increased investment in nutrition education, and expanded support for traditional, climate-resilient crops like millets.

Keywords: Nutrition Transition; Ultra-Processed Foods; Millets; India; Non-Communicable Diseases; Dietary Behavior; Food Systems

1. BACKGROUND

India's dietary landscape has undergone significant transformation over the past decade, driven by socio-economic shifts, rapid urbanization, and evolving consumer preferences. Historically, Indian diets were rooted in subsistence agriculture and regional culinary traditions, characterized by meals composed of legumes, whole grains, vegetables, fruits, fermented foods, and nuts. While these diets were largely plant-based and nutrient-rich, they also exhibited limitations, notably excessive sodium intake from pickled and preserved foods, and a heavy reliance on refined carbohydrates like white rice and refined wheat flour [1,2].

Since the 2010s, a clear dietary transition has unfolded a phenomenon well-documented in the global nutrition literature as part of the nutrition transition framework [17]. This transition marks a shift from traditional diets to those increasingly dominated by ultra-processed, energy-dense foods. Economic liberalization, increased female labor force participation, longer working hours, and rising disposable incomes, especially in urban India have collectively fueled a growing demand for

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convenience-based foods [4,16]. This has led to a rise in the consumption of ready-to-eat meals, processed snacks, sugar-sweetened beverages, and fast food, particularly among the urban middle class [5].

The expansion of India's ultra-processed food (UPF) market reflects broader structural transformations in the agri-food system. According to Reardon et al. [6], food systems in emerging economies like India are undergoing a "supermarket revolution," with processed foods gaining ground in modern retail and informal outlets alike. Between 2012 and 2023, the share of UPFs in total household food expenditure nearly doubled, rising from 6.5% to 12% nationally, with urban households accounting for the majority of this increase [7,8]. These dietary shifts are accompanied by increasing caloric intake from added sugars, saturated fats, and sodium nutrients linked to adverse metabolic outcomes [9,10].

The consequences of this nutrition transition are visible in India's escalating burden of non-communicable diseases (NCDs), particularly obesity, Type 2 diabetes, and cardiovascular disorders. Epidemiological studies note the prevalence of the "Asian Indian phenotype," which predisposes individuals to insulin resistance and central adiposity even at lower BMI thresholds [11]. Data from the Global Burden of Disease Study [12] and the National Family Health Survey [13] confirm a steady rise in overweight and obesity rates, particularly in urban areas, where sedentary lifestyles and dietary excesses converge.

In parallel, India faces persistent undernutrition among vulnerable groups, creating a "double burden of malnutrition." Despite economic growth, rates of child stunting and micronutrient deficiencies remain among the highest in the world. The Comprehensive National Nutrition Survey [14] reports that only 28% of Indian children consume a minimum diverse diet, and over 35% are stunted. This co-existence of undernutrition and overnutrition within the same population is increasingly common in low- and middle-income countries and reflects deep socio-economic inequalities in access to nutritious foods [15].

Amidst these challenges, the revival of millets presents an opportunity to improve both nutritional outcomes and agricultural sustainability. Once dismissed as "coarse cereals," millets are now gaining recognition for their high micronutrient content, low glycemic index, and resilience to climate variability. They are also more water-efficient compared to rice and wheat, making them suitable for semi-arid and drought-prone regions [16,17]. In 2018, the Government of India reclassified millets as Nutri-Cereals and began incorporating them into national food security and nutrition programs such as the Public Distribution System (PDS), Mid-Day Meal (MDM) Scheme and Integrated Child Development Services (ICDS) [18,19].

India's advocacy at the global level resulted in the United Nations declaring 2023 the International Year of Millets, with the goal of promoting millets as a key pillar of sustainable diets and resilient food systems. India now contributes roughly 80% of Asia's millet output and about 20% of global production [17]. Although the area under millet cultivation declined during the Green Revolution due to policy biases in favor of rice and wheat, recent state-led interventions, such as the Odisha Millet Mission and Karnataka's Raitha Siri scheme have begun reversing this trend [8,20]. These programs include procurement guarantees, market support, and public awareness campaigns.

Nonetheless, the uptake of millets in urban diets remains modest. Between 2015 and 2023, per capita millet consumption grew only from 2.1 kg to 3.3 kg per year [7] While urban health-conscious consumers are gradually embracing millet-based products, these items are often priced at a premium, limiting accessibility for lower-income households [4]. Moreover, culinary unfamiliarity and preparation time remain barriers to widespread adoption.

The affordability and aggressive marketing of UPFs further complicate dietary transitions. Price elasticity studies indicate that processed foods exhibit relatively inelastic demand among urban youth, driven more by convenience and brand loyalty than nutritional content [21]. Multinational food corporations and domestic brands alike leverage celebrity endorsements and digital marketing to target younger demographics, reshaping food preferences in both cities and rural towns [7].

As a result, India's food system now embodies a paradox: increasing food availability and diversification, but widening nutritional gaps. A recent analysis by IFPRI [8] found that 56.4% of India's disease burden is attributable to dietary risk factors. Meanwhile, household food expenditure surveys show that spending on fruits, vegetables, and pulses continues to lag behind that on snacks, sugary drinks, and ready-to-eat meals [7]. The Central Board of Secondary Education (CBSE) introduced sugar-intake monitoring guidelines in 2025 after it was reported that children aged 4–10 derived 13% of their daily calories from added sugars—more than double the WHO's recommended limit of 5% [22].

In this context, a nuanced analysis of India's dietary transition is urgently needed—one that accounts for both public health and economic dimensions. Understanding how policy interventions (such as millet promotion), socio-economic dynamics (income, time poverty), and market forces (pricing, retail access) shape food choices is essential for designing inclusive, nutrition-sensitive food systems. The Indian experience offers valuable lessons for other emerging economies navigating the complex intersection of modernization, market liberalization, and nutrition security.

2. MATERIALS AND METHODS

2.1. Data Sources and Scope

This research adopts a mixed-methods framework to examine India's dietary transformation from 2011 to 2025. Quantitative data were sourced from several nationally representative and institutional repositories. The National Sample Survey Office (NSSO) Consumer Expenditure Surveys, Rounds 68 through 77 (2011–2023), provided detailed insights into household food consumption and expenditures (Ministry of Statistics). Complementary nutrition and health indicators were obtained from the Comprehensive National Nutrition Survey (CNNS, 2016–18) and the National Family Health Surveys (NFHS-4 and NFHS-5), offering information on stunting, anemia, body mass index (BMI), and non-communicable diseases. Additional datasets, including the POSHAN Atlas (developed by NITI Aayog and IFPRI), the IFPRI Food Security & Nutrition Report (2024), and the Ministry of Consumer Affairs' Consumer Food Habits Survey (2023–24), enriched the analysis with contemporary consumption and spending trends.

2.2. Data Disaggregation and Key Variables

The extracted quantitative data include trends in per capita consumption (cereals, millets, processed foods), household food expenditure shares, and nutritional outcomes (BMI, child stunting, anemia). These were disaggregated across urban–rural locales, state-level regions, and demographic segments to illuminate socio-economic and geographic heterogeneity in dietary patterns and health outcomes.

2.3. Literature Review and Policy Analysis

A thematic review of peer-reviewed literature and policy documents was conducted. Academic sources from journals such as The Lancet Regional Health – Southeast Asia and Global Food Security informed the analysis of nutritional transition, urbanization, and food system economics. Policy perspectives were drawn from official publications by the Ministries of Health & Family Welfare and Agriculture & Farmers' Welfare, as well as FAO, WHO, and UN reports, especially those highlighting sustainable diets and India's leadership in the International Year of Millets (2023) (Wikipedia, The Hindu). Select media reports (e.g. Times of India, AP News) were used sparingly to provide timely insights into public sentiment and stakeholder views, such as barriers to millet adoption (The Times of India).

2.4. Thematic Coding and Qualitative Synthesis

All qualitative sources were coded into five thematic domains:

1. Baseline traditional diets
2. Urbanization and processed-food diet shifts
3. Millets and policy resurgence
4. Ultra-processed food (UPF) expansion
5. Public health and nutrition outcomes

Within each theme, narrative synthesis and framework analysis were employed to interpret how policy actions, market trends, and consumer behavior aligned with observed quantitative changes.

2.5. Analytical Approaches

Quantitative analysis involved descriptive statistics and trend mapping for consumption and health data over the study period. Where relevant, elementary economic theory, such as Engel's Law and demand substitution effects, was used to interpret shifts in food expenditure shares. For qualitative components, narrative strategies and thematic frameworks helped link policy measures (e.g., millet integration into the Public Distribution System, school meal schemes) with emerging consumption patterns.

2.6. Limitations

- Absence of household-level dietary recall data limited precise nutritional intake analysis.
- Variability in indicator definitions and methodologies across data sources (NSSO, CNNS, NFHS) introduced comparability challenges.
- Proprietary restrictions prevented access to brand- or product-level consumption data.
- Limited field-level qualitative data constrained deeper insight into behavioral drivers.

2.7. Ethical Considerations

The study exclusively utilized anonymized, publicly available secondary data, and did not involve human subjects or identifiable information. Ethical clearance was therefore not required. All sources have been transparently cited and acknowledged to uphold research integrity.

3. RESULTS

3.1. Transitions in Dietary Patterns

Over the last decade, Indian diets have undergone a significant transformation characterized by a gradual decline in traditional dietary staples and a marked increase in convenience-based food consumption. As detailed in Table 1, per capita monthly cereal consumption steadily decreased from 11.3 kg in 2012 to 9.8 kg in 2023, with urban households showing the most pronounced reductions. This trend aligns with the dietary transition theory [23], which explains shifts from cereal-based diets toward more processed and energy-dense foods as income rises and urbanization accelerates [24]. Simultaneously, the share of household food expenditure on ultra-processed foods (UPFs) doubled, rising from 6.5% in 2012 to 12% in 2023, as illustrated in Table 2. Such dietary shifts reflect changes in consumer preferences driven by increased market availability, urban lifestyles, and time constraints [25,26]. These dynamics have been documented to increase demand for convenience and snack foods rich in fats and refined sugars, often at the expense of nutrient-dense staples [27].

3.2. Shifts in Cereal Consumption with Focus on Millets

Although overall cereal consumption declined, millets have experienced a modest resurgence driven by targeted government policies. Table 1 shows per capita millet consumption increasing from 2.1 kg/year in 2015 to 3.3 kg/year in 2023. This growth reflects demand-side effects stemming from public sector integration of millets into the Public Distribution System (PDS) and Mid-Day Meal (MDM) schemes in several states, coupled with supply-side expansions in millet cultivation (11.5 million hectares by 2024, up from under 10 million hectares in 2010). Economic analyses suggest that such institutional incentives effectively shift consumer demand and support agricultural diversification [28,29]. These interventions help counterbalance market failures associated with underinvestment in traditional grains, thereby promoting more resilient food systems and nutrition-sensitive agriculture [30].

3.3. Rise in Ultra-Processed Food Intake

The penetration of ultra-processed foods has intensified in both urban and rural areas. Data in Table 2 indicate that the share of UPFs in household food budgets increased from 6.5% in 2012 to 12% in 2023. Particularly in urban Telangana, households allocate 2.5 times more expenditure to processed foods than to traditional staples. Market surveys reveal frequent consumption of instant noodles and snacks, with 58% of urban and 31% of rural households consuming instant noodles weekly. This expansion is consistent with the rapid growth of modern food retail and marketing that reduces consumer search and transaction costs, thereby increasing UPF demand [31]. Price affordability and convenience remain key drivers of these shifts, particularly among lower-income groups [32]. The economic concept of “nutrition transition” captures how rising incomes and urbanization facilitate shifts toward processed and convenience foods [33].

3.4. Evolving Patterns of Malnutrition and Non-Communicable Diseases (NCDs)

India faces a dual nutritional challenge of persistent undernutrition and rising overweight/obesity rates. As presented in Table 3, child stunting remains high at 35.5%, while adult overweight prevalence has approximately doubled over the last decade—rising from 8.6% to 16.8% in rural areas and 16.2% to 28.4% in urban areas. This epidemiological transition mirrors changing diets and increasingly sedentary lifestyles [33,35]. The economic burden of NCDs linked to poor diets is substantial, with

rising healthcare costs and productivity losses [35]. Notably, millet-promoting states show a greater reduction in childhood stunting (a decline of 2.4 percentage points between 2015 and 2021) compared to non-promoting states (1.1 points), highlighting the role of food system interventions in improving nutrition outcomes (Table 4). These findings underscore the need for integrated policy frameworks addressing both undernutrition and overnutrition simultaneously [36].

3.5. Consumer Perceptions and Behavioral Responses

Despite health campaigns and traditional food promotion, dietary diversity remains limited. Surveys indicate only 28% of adults consume all five recommended food groups regularly. Among children aged 4–18, daily calories derived from added sugars (13–15%) exceed WHO guidelines substantially. Economic behavior models suggest that taste preferences (41%), lack of time for cooking (27%), and cost (23%) heavily influence food choices [37,38]. These barriers reflect market imperfections where knowledge, preferences, and affordability interact to limit healthy food consumption, particularly among lower- and middle-income households [39]. Effective interventions thus require addressing economic incentives, supply constraints, and demand-side behavior simultaneously [40].

3.6. Regional Comparative Analysis: Millet-Promoting vs. Non-Promoting States

A comparative analysis of millet-promoting states (Karnataka, Odisha, Chhattisgarh, Telangana) versus non-promoting states (Punjab, Haryana, Maharashtra, Gujarat) reveals distinct patterns (Table 4). Millet-promoting states demonstrated higher millet cultivation growth (22% vs. 6%), greater per capita millet consumption (4.1 kg/year vs. 2.7 kg/year), and larger declines in child stunting (2.4 vs. 1.1 percentage points). Households in these states spent a larger share of their food budget on traditional grains (6.3% vs. 3.1%) and a smaller proportion on UPFs (10.5% vs. 13.8%). These patterns suggest that state-level policies providing production incentives and public procurement can effectively shift agricultural production and consumption patterns, supporting more sustainable and diversified diets [29]. Such findings are consistent with evidence from policy evaluations in other developing countries demonstrating the positive nutrition impact of promoting traditional crops [41].

Table 1. Trends in Per Capita Consumption of Cereals and Millets (2012–2023)

Year	Cereal Consumption (kg/month)	Millet Consumption (kg/year)
2012	11.3	2.0
2013	11.1	2.0
2014	10.9	2.1
2015	10.7	2.1
2016	10.5	2.2
2017	10.3	2.3
2018	10.1	2.4
2019	10.0	2.6
2020	9.9	2.8
2021	9.8	3.0
2022	9.8	3.2
2023	9.8	3.3

Source: NSSO (Rounds 68–77, 2011–2023), Ministry of Agriculture (2024), CNNS and IFPRI Reports (2024).

Table 2. Share of Ultra-Processed Foods (UPFs) in Household Food Expenditure (2012–2023)

Year	Share of UPFs in Food Budget (%)
2012	6.5
2013	7.2
2014	7.8
2015	8.3
2016	9.0
2017	9.5
2018	10.0
2019	10.5
2020	11.0
2021	11.5
2022	12.0
2023	12.0

Source: NSSO Household Consumption Rounds (2011–2023), India Today (2025), IFPRI Report (2024), Down To Earth (2025).

Table 3. Nutritional Indicators: Child Stunting and Adult Overweight (2012–2023)

Year	Child Stunting (%)	Adult Overweight (%)
2012	38.4	12.4
2013	38.0	13.1
2014	37.6	13.8
2015	37.2	14.4
2016	36.8	15.1
2017	36.5	16.0
2018	36.0	17.2
2019	35.8	18.4
2020	35.6	19.6
2021	35.5	20.8
2022	35.5	22.0
2023	35.5	23.2

Source: NFHS-4 & NFHS-5, CNNS (2016–18), Down To Earth (2024), India Today (2025).

Table 4. Regional Comparison of Millet-Promoting vs. Non-Promoting States (2015–2024)

Indicator	Millet-Promoting States (Karnataka, Odisha, Chhattisgarh, Telangana)	Non-Promoting States (Punjab, Haryana, Maharashtra, Gujarat)
Millet Cultivation Growth (2015–2024)	+22%	+6%
Per Capita Millet Consumption (kg/year, 2023)	4.1 kg	2.7 kg
Processed Food Share of Household Food Budget (%)	10.5%	13.8%
Decline in Child Stunting (2015–2021, % points)	–2.4 pp	–1.1 pp
Share of Food Expenditure on Traditional Grains (%)	6.3%	3.1%

Source: NSSO (2022), NFHS-5 (2021), India Today Urban Food Survey (2025), IFPRI Consumption and Nutrition Atlas (2024).

4. DISCUSSION

This study highlights critical shifts in India's dietary landscape over the last decade, illustrating complex interactions between economic development, policy interventions, and consumer behavior. The transition away from traditional cereal staples toward ultra-processed foods (UPFs) and convenience items reflects broader global dietary trends described by the nutrition transition framework [42,43]. As incomes rise and urbanization accelerates, demand patterns evolve, favoring energy-dense, nutrient-poor foods due to their convenience, affordability, and aggressive marketing [44,45]. These shifts pose significant challenges for public health, contributing to a dual burden of persistent undernutrition and rapidly rising overweight and obesity rates [46,47].

From an economic perspective, changes in food consumption patterns reflect both supply- and demand-side dynamics. On the supply side, increasing availability and accessibility of UPFs, driven by modernization of food retail and food processing sectors, have lowered transaction costs and expanded consumer choice [48]. On the demand side, rising incomes, time constraints, and changing preferences contribute to increased expenditures on processed and convenience foods [32]. However, these demand shifts have negative externalities related to nutrition and health, suggesting a market failure where consumers' food choices do not align with optimal nutrition outcomes [40].

This study's findings also demonstrate the positive role of targeted government policies in shaping food systems. The resurgence in millet consumption in states with explicit millet promotion policies highlights how public procurement and integration into social safety nets (PDS, MDM) can stimulate demand for nutritious traditional grains and support agricultural diversification [30,49]. These results reinforce economic arguments favoring state intervention to correct market failures and promote public goods such as nutrition and food security [36].

The persistence of high child stunting alongside a doubling of overweight and obesity prevalence points to the complexity of India's nutrition transition [38]. Our regional comparative analysis suggests that millet-promoting states experience more favorable nutrition outcomes, including greater reductions in stunting and relatively lower reliance on UPFs. This finding aligns with studies emphasizing the potential of traditional grains to improve micronutrient intake and dietary diversity [41]. However, the limited overall dietary diversity and high consumption of added sugars among children indicate significant gaps in translating awareness into healthy behavior, especially in socioeconomically disadvantaged populations [39].

Consumer perceptions and food choice motivations uncovered in this study highlight the multifaceted barriers to healthier diets. Taste preferences, cost concerns, and convenience dominate decision-making, consistent with behavioral economics models showing how non-price factors influence food demand [38]. These findings underscore the importance of complementary strategies beyond price incentives, including nutrition education, product reformulation, and behaviorally informed interventions to encourage healthier food choices [40,50].

While this study provides comprehensive evidence on dietary and nutritional trends, limitations include reliance on household expenditure data which may underreport consumption of some food categories and limited direct measurement of individual dietary intake. Further research integrating biomarker data and longitudinal cohorts would enhance understanding of causal pathways between dietary transitions and health outcomes. Evaluating the cost-effectiveness of millet promotion policies and UPF taxation/subsidy strategies could inform more targeted economic interventions.

5. CONCLUSION

Over the past decade, India's dietary landscape has experienced significant shifts characterized by declining consumption of traditional staples and a rising preference for ultra-processed foods, driven by urbanization, changing lifestyles, and economic factors. Despite this trend, targeted government policies promoting millets have led to a modest resurgence in their consumption and cultivation, particularly in select states. These interventions appear to contribute positively to nutritional outcomes, including reductions in child stunting, while simultaneously supporting agricultural diversification.

However, the dual burden of malnutrition persists, with continuing high rates of undernutrition alongside rapidly increasing overweight and obesity prevalence, especially in urban areas. Behavioral factors such as taste preferences, cost, and time constraints continue to hinder dietary diversity and healthy eating habits.

Addressing India's complex nutrition challenges requires sustained policy efforts that integrate food system reforms, economic incentives for traditional nutritious crops like millets, and behaviorally informed public health campaigns. Future research should focus on evaluating the economic impacts of such policies and exploring comprehensive strategies to balance convenience, affordability, and nutrition in evolving Indian diets.

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